

# ***ECONseries Specifications***

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# Analog Input Specifications

This section lists the specifications for each of the ECONseries modules.

## DT9810 Specifications

Table 1 lists the analog input specifications for the DT9810 module.

**Table 1: DT9810 Analog Input Specifications**

Feature	DT9810 Specifications
Number of analog input channels	8 single-ended
Number of gains	–
Resolution	10-bit
Data encoding	binary
System accuracy, to % of FSR (gain = 1) (Averaged over 50 readings)	0.1%
Range	0 to 2.44 V
Nonlinearity	0.1%
Differential nonlinearity	$\pm 1/2$ LSB
Inherent quantizing error	1 LSB
Drift Zero: Gain:	$\pm 20$ $\mu$ V $\pm 50$ ppm
Differential linearity:	monotonic
Input impedance <sup>a</sup> Off channel: On channel:	10 M $\Omega$ , 10 pf 10 M $\Omega$ , 100 pf

**Table 1: DT9810 Analog Input Specifications (cont.)**

Feature	DT9810 Specifications
Input bias current	±10 nA
Maximum input voltage (without damage)	
Power on:	±35 V
Power off:	±20 V
A/D conversion time	40 µs
Channel acquisition time (±½ LSB)	40 µs
Sample-and-hold	
Aperture uncertainty:	2 ns
Aperture delay:	200 ns
Throughput	25 kHz
ESD protection (per spec)	
Arc:	8 kV
Contact:	4 kV
Reference	2.44 V
Monotonicity	Yes

a. Very high input impedance minimizes any source error.

## DT9812, DT9813, and DT9814 Series Specifications

Table 1 lists the analog input specifications for the DT9812, DT9813, and DT9814 Series modules.

**Table 2: DT9812, DT9813, and DT9814 Series  
Analog Input Specifications**

Feature	DT9812-2.5V Specifications	DT9812-10V, DT9812-10V-OEM DT9813-10V, DT9814-10V Specifications
Number of analog input channels	8 single-ended	DT9812-10V: 8 single-ended DT9812-10V-OEM: 8 single-ended DT9813-10V: 16 single-ended DT9814-10V: 24 single-ended
Number of gains	5 (1, 2, 4, 8, 16)	4 (1, 2, 4, 8)
Resolution	12-bit	12-bit
Data encoding	binary	twos complement
System accuracy, to % of FSR (Averaged over 50 readings)		
Gain = 1:	0.04%	0.04%
Gain = 2:	0.06%	0.06%
Gain = 4:	0.08%	0.08%
Gain = 8:	0.10%	0.10%
Gain = 16:	0.15%	–
Input Range		
Gain = 1:	0 to 2.44 V,	±10 V,
Gain = 2:	0 to 1.22 V,	±5 V,
Gain = 4:	0 to 0.610 V,	±2.5 V,
Gain = 8:	0 to 0.305 V	±1.25 V
Gain = 16:	0 to 0.1525 V	–
Nonlinearity	0.05%	0.05%
Differential nonlinearity	±1/2 LSB	±1/2 LSB

**Table 2: DT9812, DT9813, and DT9814 Series  
Analog Input Specifications (cont.)**

Feature	DT9812-2.5V Specifications	DT9812-10V, DT9812-10V-OEM DT9813-10V, DT9814-10V Specifications
Inherent quantizing error	1 LSB	1 LSB
Drift		
Zero:	±50 µV	±100 µV
Gain:	±100 ppm	±100 ppm
Differential linearity:	monotonic	monotonic
Input impedance <sup>a</sup>		
Off channel:	10 MΩ, 10 pf	10 MΩ, 10 pf
On channel:	10 MΩ, 100 pf	10 MΩ, 100 pf
Input bias current	±10 nA	±10 nA
Maximum input voltage (without damage)		
Power on:	±35 V	±35 V
Power off:	±20 V	±20 V
A/D conversion time	8 µs	8 µs
Channel acquisition time (±½ LSB)	20 µs	20 µs
Sample-and-hold		
Aperture uncertainty:	2 ns	2 ns
Aperture delay:	200 ns	200 ns
Throughput	50 kHz	50 kHz
ESD protection (per spec)		
Arc:	8 kV	8 kV
Contact:	4 kV	4 kV
Reference	2.44 V	2.5 V
Monotonicity	Yes	Yes

**Table 2: DT9812, DT9813, and DT9814 Series  
Analog Input Specifications (cont.)**

<b>Feature</b>	<b>DT9812-2.5V Specifications</b>	<b>DT9812-10V, DT9812-10V-OEM DT9813-10V, DT9814-10V Specifications</b>
Sample Clock Internal: External:	Yes Yes	Yes Yes
Trigger Source Internal: External:	Yes Yes	Yes Yes
A/D Converter Noise	0.6 LSB rms	0.6 LSB rms
Channel-to-Channel Offset	0.1 mV	0.1 mV
Effective Number of Bits at 50 kHz with a 1 kHz sine wave:	10.5 bits	10.5 bits
Total Harmonic Distortion	< -70 db @ 1 kHz	< -70 db @ 1 kHz
Channel Crosstalk	-74 db @ 1 kHz	-74 db @ 1 kHz
Maximum A/D Pacer Clock Single Analog Input Throughput: Multiple Analog Input Throughput:	50 kHz  50 kHz	50 kHz  50 kHz

a. Very high input impedance minimizes any source error.

## DT9816 Specifications

Table 1 lists the analog input specifications for the DT9816 module.

**Table 3: DT9816 Analog Input Specifications**

Feature	DT9816 Specifications
Number of analog input channels	6 single-ended
Number of gains	2 (1, 2)
Resolution	16-bit
Data encoding	offset binary
System accuracy, to % of FSR (Averaged over 50 readings)	±0.08% typical
Range	±5 V, ±10 V
Nonlinearity	0.015%
Differential nonlinearity	0.003%
Inherent quantizing error	±½ LSB
Drift Zero: Gain:	±25 µV/°C ±50 ppm/°C
Differential linearity:	monotonic to 14 bits
Input impedance <sup>a</sup> Off channel: On channel:	— 10 MΩ 10 pf
Input bias current	±10 nA
Maximum input voltage (without damage) Power on: Power off:	±35 V ±20 V

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**Table 3: DT9816 Analog Input Specifications (cont.)**

<b>Feature</b>	<b>DT9816 Specifications</b>
A/D conversion time	4 $\mu$ s (DT9816-A) 8 $\mu$ s (DT9816)
Channel acquisition time ( $\pm 1/2$ LSB)	1 $\mu$ s
Sample-and-hold Aperture uncertainty: Aperture delay: Aperture match: Gain match: Zero match:	1 ns 35 ns 5 ns 0.05% $\pm 3.0$ mV
Throughput	50 kHz per channel (DT9816) 150 kHz per channel (DT9816-A)
ESD protection (per spec) Arc: Contact:	8 kV 4 kV
Reference	2.5 V
Monotonicity	Yes

a. Very high input impedance minimizes any source error.

## DT9812, DT9813, and DT9814 Series Analog Output Specifications

Table 4 lists the analog output specifications for the DT9812, DT9813, and DT9814 Series modules.

**Table 4: DT9812, DT9813, and DT9814 Series  
Analog Output Specifications**

Feature	DT9812-2.5V Specifications	DT9812-10V, DT9812-10V-OEM, DT9813-10V, DT9814-10V Specifications
Number of waveform analog output channels	2	2
Resolution	12-bit	12-bit
Data encoding	Binary	Twos Complement
Nonlinearity	0.05%	0.05%
Differential nonlinearity	± LSB	±1 LSB
Inherent quantizing error	1 LSB	1 LSB
Output range	0 to 2.44 V	±10 V
Error		
Zero:	±1 mV	±4 mV
Gain:	±0.1%	±0.2%
Drift		
Zero (bipolar):	±20 $\mu\text{V} / ^\circ\text{C}$	±100 $\mu\text{V} / ^\circ\text{C}$
Gain:	±100 ppm	±100 ppm
Throughput)		
Continuously paced analog output mode:	50 kHz	50 kHz

**Table 4: DT9812, DT9813, and DT9814 Series  
Analog Output Specifications (cont.)**

<b>Feature</b>	<b>DT9812-2.5V Specifications</b>	<b>DT9812-10V, DT9812-10V-OEM, DT9813-10V, DT9814-10V Specifications</b>
Current output	±2 mA	±2 mA
Output impedance	<200 Ω	<0.2 Ω
Capacitive driver capability	1000 pF minimum	1000 pF minimum
Protection	Short to ground	Short to ground
Power-on voltage	0 V ±5 mV	0 V ±10 mV
Settling time to 0.01% of FSR	20 μs	20 μs
Slew rate	2 V / μs	2 V / μs
Glitch energy	1 μV -sec	1 μV -sec
ESD protection (per spec) Arc: Contact:	8 kV 4 kV	8 kV 4 kV
Monotonicity	Yes	Yes
Output Clock Internal: External:	Yes No	Yes No
Trigger Source Internal: External:	Yes No	Yes No

## Digital I/O Specifications

This section lists the digital I/O specifications for each of the ECONseries modules.

### DT9810, DT9817, and DT9817-H Specifications

Table 5 lists the digital I/O specifications for the DT9810, DT9817, and DT9817-H modules.

**Table 5: DT9810, DT9817, and DT9817-H  
Digital I/O Specifications**

Feature	DT9810	DT9817	DT9817-H
Number of digital I/O lines	20	28	28
Number of ports	2, 8-bit & 1, 4-bit	3, 8-bit & 1, 4-bit	3, 8-bit & 1, 4-bit
Input termination	No	No	No
Logic family	TTL	TTL	TTL
Logic sense	Positive true	Positive true	Positive true
Inputs			
Input type:	Level sensitive	Level sensitive	Level sensitive
Input logic load:	1 TTL Load	1 TTL Load	1 TTL Load
High input voltage:	2.4V min	2.4 V min	2.4 V min
Low input voltage:	0.8 V max	0.8 V max	0.8 V max
Low input current:	-0.4 mA max	-0.4 mA max	-0.4 mA max

**Table 5: DT9810, DT9817, and DT9817-H  
Digital I/O Specifications (cont.)**

<b>Feature</b>	<b>DT9810</b>	<b>DT9817</b>	<b>DT9817-H</b>
<b>Outputs</b>			
High output:	2.8 V min	2.8 V min	2.8 V min
Low output:	0.6 V max	0.6 V max	0.6 V max
High output current (source), typical:	4.5 mA	4.5 mA	15 mA
Low output current (sink), typical:	10 mA	10 mA	64 mA
<b>Software I/O selectable</b>	Yes	Yes	Yes
<b>ESD protection (per spec)</b>			
Arc:	8 kV	8 kV	8 kV
Contact:	4 kV	4 kV	4 kV

## DT9817-R Specifications

Table 6 lists the digital I/O specifications of the DT9817-R module.

**Table 6: DT9817-R Digital I/O Specifications**

Feature	DT9817-R
Number of digital I/O lines	16 (8 In, 8 Out)
Number of ports	2, 8-bit (1 In, 1 Out)
Inputs Input type: High input voltage: Low input voltage: High input current: Low input current: Termination	AC or DC $\pm 3$ to 32 V $< \pm 1.5$ V 2.2 k $\Omega$ resistor to 1.2 V 2.2 k $\Omega$ resistor to 1.2 V Series 2.2 k $\Omega$
Outputs Output type: Output driver: High output: Low output: Breakdown voltage: Contact impedance:	Solid-state Relay CMOS $\pm 30$ V 0.4 V @ 400 mA $\pm 60$ V 1 $\Omega$
Isolation voltage To computer ground: Input within pairs 0&1, 2&3, etc. Input across pairs Output channel to channel	500 V 250 V ( $\pm 125$ V) 500 V ( $\pm 250$ V) 500 V
Software I/O selectable	Yes
ESD protection (per spec) Arc: Contact:	8 kV 4 kV

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## DT9812 and DT9813 Series Specifications

Table 5 lists the digital I/O specifications for the DT9812 and DT9813 Series modules. The DT9814-10V module does not support digital I/O operations.

**Table 7: DT9812 and DT9813 Series  
Digital I/O Specifications**

Feature	DT9812-2.5V, DT9812-10V DT9812-10V-OEM, DT9813-10V Specifications
Number of digital I/O lines	DT9812 Series: 16 (8 in/8 out) DT9813-10V: 8 (4 in/4 out)
Number of ports	DT9812 Series: 2, 8-bit DT9813-10V: 2, 4-bit
Input termination	No
Logic family	TTL
Logic sense	Positive true
Inputs Input type: Input logic load: High input voltage: Low input voltage: Low input current:	Level sensitive 1 TTL Load 2.4 V min 0.8 V max −0.4 mA max

**Table 7: DT9812 and DT9813 Series  
Digital I/O Specifications (cont.)**

<b>Feature</b>	<b>DT9812-2.5V, DT9812-10V DT9812-10V-OEM, DT9813-10V Specifications</b>
Outputs High output: Low output: High output current (source): Low output current (sink):	2.8 V min 0.6 V max 2 mA 10 mA
Software I/O selectable	No
ESD protection (per spec) Arc: Contact:	8 kV 4 kV

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## DT9816 Specifications

Table 5 lists the digital I/O specifications for DT9816 module.

**Table 8: DT9816 Digital I/O Specifications**

Feature	DT9816 Specifications
Number of digital I/O lines	16 (8 each; dedicated)
Number of ports	2, 8-bit
Input termination	Series 1 k $\Omega$ ; Series 33.2 $\Omega$
Logic family	TTL
Logic sense	Positive true
Inputs Input type: Input logic load: High input voltage: Low input voltage: Low input current:	Level sensitive 1 TTL Load 2.4 V min 0.8 V max -0.4 mA max
Outputs High output: Low output: High output current (source): Low output current (sink):	2.8 V min 0.6 V max 4.5 mA 10 mA
Software I/O selectable	Yes
ESD protection (per spec) Arc: Contact:	8 kV 4 kV

## Counter/Timer Specifications

Table 9 lists the counter/timer specifications for all ECONseries modules.

**Table 9: ECONseries Counter/Timer Specifications**

Feature	Specifications
Number of counter/timers	1
Counter/timer modes	Event counting, frequency measurement, edge-to-edge measurement, rate generation
Resolution	16-bit (DT9816) 32-bit (all other modules)
Minimum pulse width: (minimum amount of time it takes a C/T to recognize an input pulse)	25 ns (DT9816) 200 $\mu$ s (DT9817-R) 200 ns (all other modules)
Logic family	TTL
Inputs Input logic load: High input voltage: Low input voltage: Low input current:	Level sensitive 1 TTL Load 2.4 V min 0.8 V max -0.4 mA max
Outputs High output :  Low output :	3.0 V min @ 0.1 mA Source (DT9817-R) 2.8 V min @ 2 mA Source (all other modules)  0.4 V max @ 2 mA Sink (DT9817-R) 0.6 V max @ 12 mA Sink (all other modules)
Isolation voltage	500 V to computer ground (DT9817-R only)

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**Table 9: ECONseries Counter/Timer Specifications (cont.)**

<b>Feature</b>	<b>Specifications</b>
ESD protection (per spec) Arc: Contact:	8 kV 4 kV
Internal clock frequency:	15 Hz to 12 MHz (DT9812/13,/14 Series) 60 Hz to 6 MHz (DT9816) 4 Hz to 2.5 kHz (DT9817-R) 4 Hz to 12 MHz (other modules)
External clock divider:	2 to 65536 (DT9812/13/14 Series) 2 to 65534 (DT9816) 9600 to 130050 (DT9817-R) 2 to 130050 (all other modules)

## External Trigger Specifications

Table 10 lists the external trigger specifications for the DT9812, DT9813, and DT9814 Series modules.

**Table 10: DT9812, DT9813, and DT9814 Series  
External Trigger Specifications**

Feature	DT9812, DT9813, and DT9814 Series Specifications
Input type	Low-level or falling edge sensitive
Logic family	TTL
Inputs Input logic load: High input voltage: Low input voltage: Low input current:	Level sensitive 1 TTL Load 2.4 V min 0.8 V max -0.4 mA max
Minimum pulse width High: Low:	200 ns 200 ns
Triggering modes Single scan: Continuous scan:	Yes Yes

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# External Clock Specifications

Table 11 lists the external clock specifications for the DT9812, DT9813, and DT9814 Series modules.

**Table 11: DT9812, DT9813, and DT9814 Series  
External Clock Specifications**

Feature	DT9812, DT9813, and DT9814 Series Specifications
Input type	Rising-edge sensitive
Logic family	TTL
Inputs Input logic load: Input termination: High input voltage: Low input voltage: Low input current:	Level sensitive 1 TTL Load 2.4 V min 0.8 V max -0.4 mA max
Oscillator frequency	40 kHz maximum
Minimum pulse width High: Low:	200 ns 200 ns

## Power, Physical, and Environmental Specifications

Table 12 lists the power, physical, and environmental specifications for the ECONseries modules.

**Table 12: ECONseries Power, Physical, and Environmental Specifications**

Feature	Specifications
DT9812/13/14 Series only: USB +5 V out (pin 20)	100 mA maximum
Power +5 V Enumeration: Operation:	< 100 mA <175 mA (DT9812/13/14 Series) < 150 mA (DT9817-H) < 100 mA (DT9810, DT9817, and DT9817-R) <250 mA (DT9816)
Physical Dimensions (board):  Dimensions (box with screw terminals and feet):  Weight (board):  Weight (box with screw terminals and feet):	100 mm (L) x 100 mm (W) x 15.5 mm (H)  107.7 mm (L) x 100 mm (W) x 33.5 mm (H)  60.3 g 65.8 g (DT9816)  133.4 g 138.8 g (DT9816)
Environmental Operating temperature range: Storage temperature range: Relative humidity: Altitude:	0 to 55° C –40 to 85° C to 95% non-condensing 10,000 feet

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# Regulatory Specifications

Table 13 lists the regulatory specifications for all ECONseries modules.

**Table 13: Regulatory Specifications**

Feature	Specifications
Emissions (EMI)	FCC Part 15, EN55022:1994 + A1:1995 + A2:1997 VCCI, AS/NZS 3548 Class A
Immunity	EN61000-6-1:2001
RoHS (EU Directive 2002/95/EG)	Compliant (as of July 1st, 2006)

## Mating Connector Specifications

Table 14 lists the mating connector specifications for the DT9812-10V-OEM module.

**Table 14: Mating Connector Specifications for the DT9812-10V-OEM Module**

Connector on Module	Mating Connector Specifications
USB Connector	Bulgin part#14193 USB cable
Analog I/O Connector (J3)	Tyco part# 1658622-4
Digital I/O Connector (J4)	Tyco part# 1658622-4

