

Electrical Specifications

- Specifications apply over entire operating temperature range.
- Typical values are specified at Vcc = 5.0V and 25C.

Parameter	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	4.5	5.0	5.5	V	Ripple < 100 mVpp
Supply Current, EM1-0- (linear strip)		27	33	mA	LPI < 300, no load
		54	65	mA	LPI ≥ 300, no load
Supply Current, EM1-1- (1" disk)		27	33	mA	CPR < 500, no load
		54	65	mA	CPR ≥ 500, no load
Supply Current, EM1-2- (2" disk)		27	33	mA	CPR < 1000, no load
		54	65	mA	CPR ≥ 1000, no load
Low-level Output			0.5	V	IOL = 8mA max.
		0.05		V	No load
High-level Output	2.0			V	IOH = -8mA max.
		4.8		V	No load
Output Current Per Channel	-8		8	mA	
Load Capacitance			100	pF	
Output Rise Time		110		nS	
Output Fall Time		100		nS	
Electrostatic Discharge			± 4	kV	IEC 61000-4-2

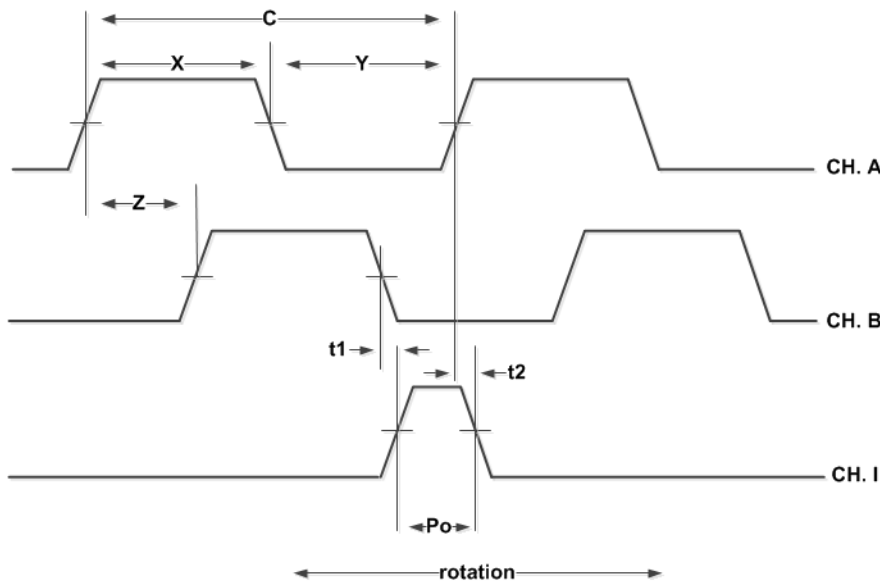
Timing Characteristics

Encoding Characteristics:

- Specifications apply over entire operating temperature range.
- Values are for the worst error over full rotation.
- Refer to timing diagram below.

Parameter	Symbol	Min.	Typ.	Max.	Units
Cycle Error	C		3.0	5.5	° e
Symmetry	X, Y	150	180	210	° e
Quadrature	Z	60	90	120	° e
Index Pulse Width	Po	60	90	120	° e
Ch. I Rise After Ch. B or Ch. A Fall	t1	50	100	200	ns
Ch. I Fall After Ch. B or Ch. A Rise	t2	-10	15	25	ns

Timing Diagram:



CPR: The number of Cycles (C) of the A or B outputs Per Revolution.

Cycle Error: An indication of cycle uniformity. The difference between an observed shaft angle which gives rise to one electrical cycle, and the nominal angular increment of $1/CPR$ of a revolution.

Index (I): The index output goes high once per revolution, coincident with the low states of channels A and B, nominally $1/4$ of one cycle ($90^\circ e$).

LPI: Lines Per Inch. The number of Cycles (C) of the A or B output per inch of linear strip movement.

One Shaft Rotation: 360 mechanical degrees.

One Electrical Degree ($^\circ e$): $1/360$ th of one cycle.

One Cycle (C): 360 electrical degrees ($^\circ e$). Each cycle can be decoded into 1 or 4 states, referred to as X1 or X4 resolution multiplication.

PPR: The number of resolvable Positions Per Revolution of the encoder disk with x4 quadrature decoding.

Quadrature (Z): The phase lag or lead between channels A and B in electrical degrees, nominally $90^\circ e$.

Symmetry: A measure of the relationship between (X) and (Y) in electrical degrees, nominally $180^\circ e$.

Installation Torque

Parameter	Torque
Mounting Screws	3.5-4 in-lbs

EM1 / HEDS Comparison

US Digital is the designer and manufacturer of the **EM1** transmissive optical encoder module. The design of the **EM1** provides electrical and mechanical compatibility with **HEDS-9000**, **HEDS-9100**, **HEDS-9200**, **HEDS-9040**, and **HEDS-9140** series modules.

The process of switching from the **HEDS** to the **EM1** module should not require any mechanical or electrical changes. Simply use the **EM1** and matching codewheel in place of the **HEDS** module and codewheel. The **EM1** has a built-in index channel available on most resolutions, for both rotary disks and linear strips. The **EM1** uses a US Digital designed codewheel with 2 tracks rather than 3 tracks for index versions. The **EM1** offers improved output drive capability and will source and sink 8mA at TTL levels.

Physically, the **EM1** has no external wire loops which can interfere when mounting. The connector pins are 0.051" shorter than **HEDS** modules, while still providing .30" insertion depth. US Digital's **EM1** offers custom resolutions.

Pin-outs

Pin	Description
1	Ground
2	Index
3	A channel
4	+5VDC power
5	B channel

Ordering Information

EM1 - - -

Native OD	Native LPI/CPR	Index
0Linear	32 =	I =Index
1 =1in	50 =	N =No Index
2 =2in	100 =	
	120 =	
	127 =	
	200 =	
	250 =	
	300 =	
	360 =	
	400 =	
	500 =	
	512 =	
	720 =	
	900 =	
	1000 =	
	1024 =	
	1250 =	
	1800 =	
	2000 =	
	2048 =	
	2500 =	

Notes

- US Digital® warrants its products against defects in materials and workmanship for two years. See complete warranty for details.