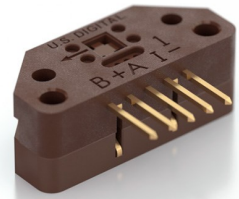




EM2 Features

- Two-channel quadrature with index
- High-resolution version of EM1
- Single 5V supply
- Rotary versions up to 10,000 CPR
- Linear versions up to 2,000 CPI
- Internal decoupling capacitor
- Outputs source/sink 5 mA



EM2 Product Description

The **EM2** is a transmissive optical encoder module designed to offer 2x or 4x higher resolution than the **EM1** encoder module. This module is designed to detect rotary position when used with a US Digital encoder disk. The **EM2** consists of a lensed LED source and a monolithic detector IC enclosed in a small polymer package identical to the **EM1**. The **EM2** uses phased array detector technology to provide superior performance and greater tolerances over traditional aperture mask-type encoders.

The **EM2** provides digital A & B quadrature outputs with a third output index channel. Each **EM2** module is resolution-specific and is matched to the resolution of an encoder disk. The **EM2** operates with a single 5V supply and provides single-ended outputs capable of sinking and sourcing 5mA. An internal 0.1 μ F decoupling capacitor is designed into the **EM2** to provide enhanced noise immunity.

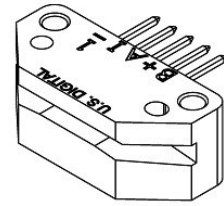
For open collector and higher voltage applications, add the PC3 (<https://www.usdigital.com/products/accessories/interfaces/cable-drivers/pc3/>) cable driver, or for differential cable driver outputs, add the PC4 (<https://www.usdigital.com/products/accessories/interfaces/cable-drivers/pc4/>) cable driver. Encoder disks, quadrature decoder chips, counter chips, computer interface boards, mating connectors, and cables are also available.

Download (<https://www.usdigital.com/media/4tvlnrwp/em2-em1-comparison.pdf>) the EM2/EM1 comparison chart.

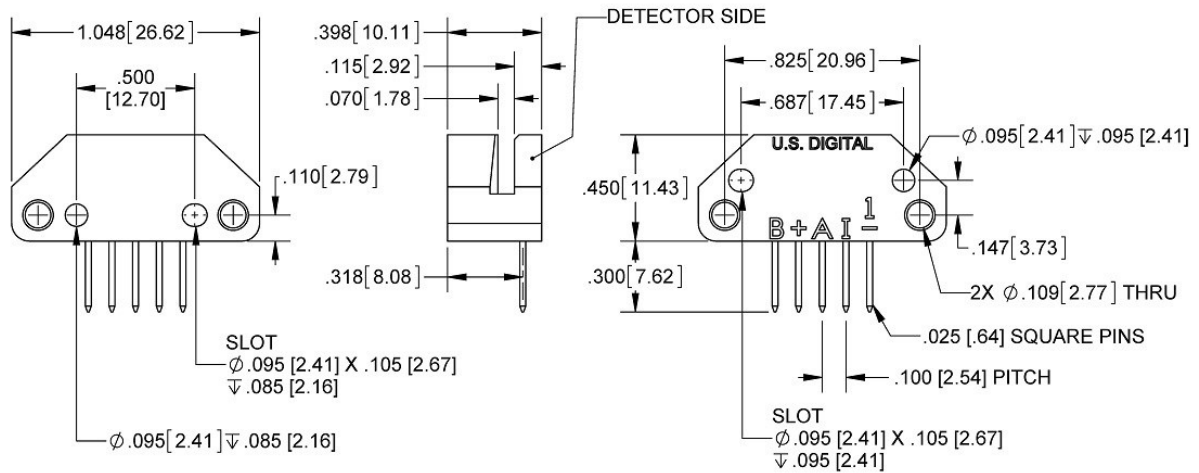
Mechanical Drawings

EM2 TRANSMISSIVE OPTICAL ENCODER MODULE

EM2 Transmissive Optical Encoder Module



RELEASE DATE: 10/17/2013



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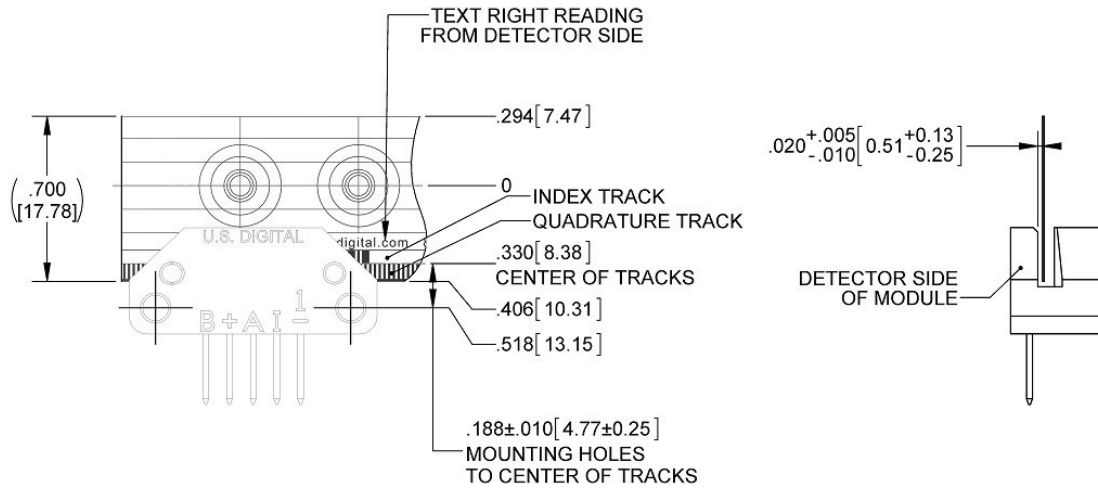
UNITS: INCHES (MM)
 METRIC SHOWN FOR REFERENCE ONLY



EM2 TRANSMISSIVE OPTICAL ENCODER MODULE

EM2 Transmissive Optical Encoder Module Linear Strip Alignment

RELEASE DATE: 04/07/2015



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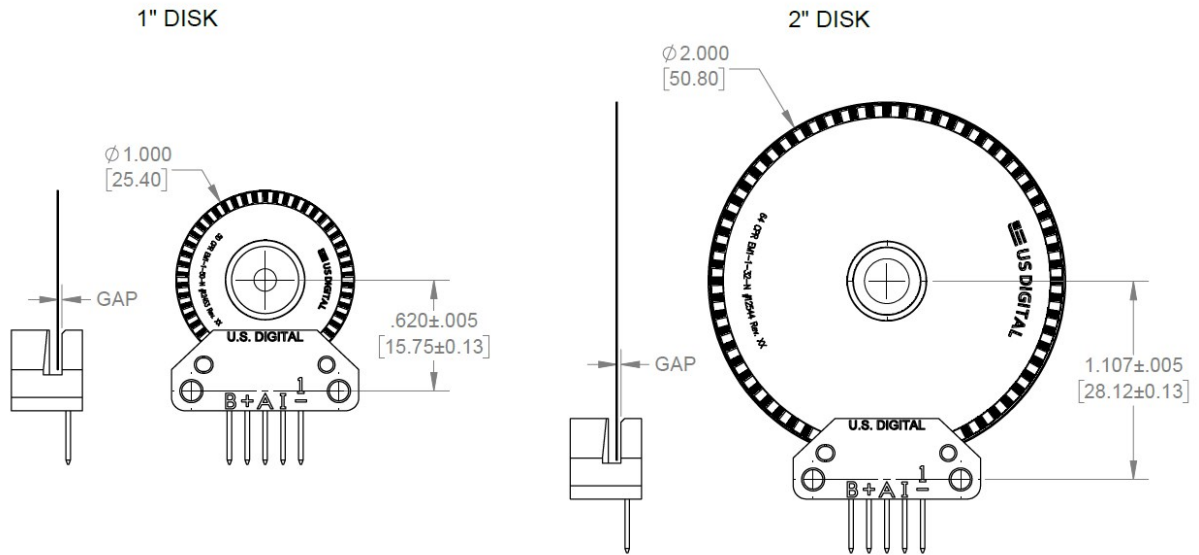
UNITS: INCHES [MM]
 METRIC SHOWN FOR REFERENCE ONLY



EM2 TRANSMISSIVE OPTICAL ENCODER MODULE

EM2 Transmissive Optical Encoder Module Disk Alignment

RELEASE DATE: 12/21/2016



RECOMMENDED DISK GAP: $.020 \pm .005$ [0.51 \pm 0.13]

Specifications



AVAILABLE RESOLUTIONS

CPR/CPI	EM2	HUBDISK-1	HUBDISK-2	LIN
1000	EM2-0-1000-*	-	-	LIN-1000-*.*
2000	EM2-1-2000-I (1") / EM2-0-2000-*. (LIN)	HUBDISK-1-2000-*.IE	-	LIN-2000-*.*
2048	EM2-1-2048-I	HUBDISK-1-2048-*.IE	-	-
2500	EM2-1-2500-I	HUBDISK-1-2500-*.IE	-	-
3600	EM2-2-3600-I	-	HUBDISK-2-3600-*.IE	-
4000	EM2-1-4000-I (1") / EM2-2-4000-I (2")	HUBDISK-1-4000-*.IE	HUBDISK-2-4000-*.IE	-
4096	EM2-1-4096-I (1") / EM2-2-4096-I (2")	HUBDISK-1-4096-*.IE	HUBDISK-2-4096-*.IE	-
5000	EM2-1-5000-I (1") / EM2-2-5000-I (2")	HUBDISK-1-5000-*.IE	HUBDISK-2-5000-*.IE	-
7200	EM2-2-7200-I	-	HUBDISK-2-7200-*.IE	-
8000	EM2-2-8000-I	-	HUBDISK-2-8000-*.IE	-
8192	EM2-2-8192-I	-	HUBDISK-2-8192-*.IE	-
10000	EM2-2-10000-I	-	HUBDISK-2-10000-*.IE	-

OPERATING CONDITIONS

PARAMETER	MIN.	MAX.	UNITS	NOTES
Temperature	-25	100	C	
A/B Output Frequency	0	360	kHz	2000, 2048, 2500 CPR (1") 3600, 4000, 4096, 5000 CPR (2") 1000 CPI (Linear)
	0	720	kHz	4000, 4096, 5000 CPR (1") 7200, 8000, 8192, 10000 CPR (2") 2000 CPI (Linear)
Disk RPM	0	$(21.6 \times 10^6) / \text{CPR}$	RPM	2000, 2048, 2500 CPR (1") 3600, 4000, 4096, 5000 CPR (2")
	0	$(43.2 \times 10^6) / \text{CPR}$	RPM	4000, 4096, 5000 CPR (1") 7200, 8000, 8192, 10000 CPR (2")
Linear Strip Speed	0	360	in./sec.	1000, 2000 CPI (Linear)
Disk/Linear Strip Radial Position Tolerance	± .005		inch	



ELECTRICAL SPECIFICATIONS

- Specifications apply over the entire operating temperature/voltage range.
- Typical values are specified at $V_{cc} = 5.0V$ and $25C$.

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	4.5	5.0	5.5	V	Ripple < 100 mVpp
Supply Current		72	85	mA	no load
Low-level Output			0.5	V	$I_{OL} = 5 \text{ mA}$
		0.25		V	no load
High-level Output	2.0			V	$I_{OH} = -5 \text{ mA}$
		4.0		V	no load
Output Current Per Channel	-5		5	mA	
Load Capacitance			100	pF	
Output Rise Time		50		nS	$\pm 5 \text{ mA load}$
Output Fall Time		50		nS	$\pm 5 \text{ mA load}$
Electrostatic Discharge			± 4	kV	IEC 61000-4-2

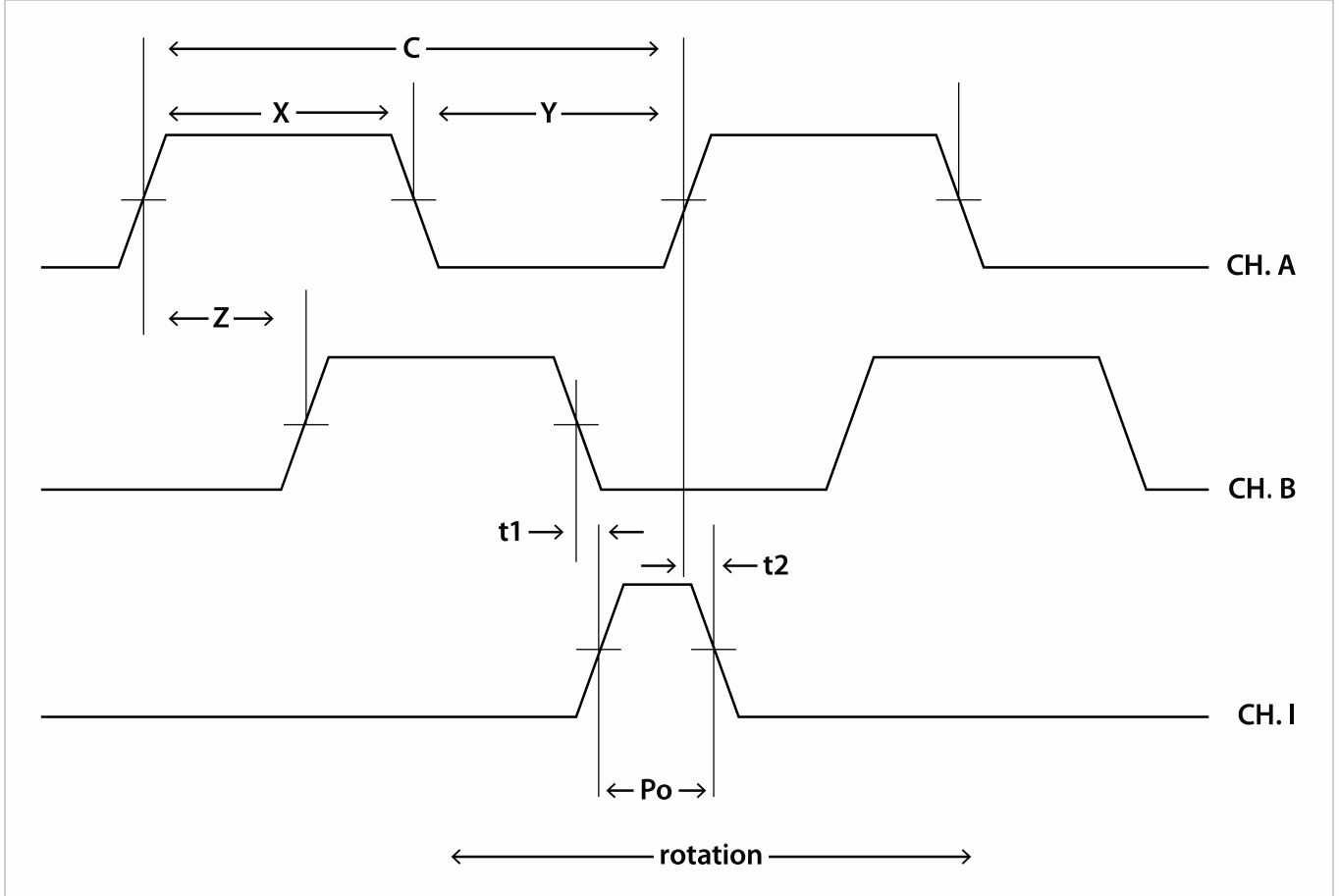
TIMING CHARACTERISTICS

ENCODING CHARACTERISTICS:

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

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Symmetry	X, Y	108	190	252	$^{\circ}e$ (https://www.usdigital.com/support/resources/glossary/#glossary_e)
Quadrature	Z	45	90	135	$^{\circ}e$ (https://www.usdigital.com/support/resources/glossary/#glossary_e)
Index Pulse Width	Po	45	90	135	$^{\circ}e$ (https://www.usdigital.com/support/resources/glossary/#glossary_e)
Ch. I Rise After Ch. B or Ch. A Fall	t1		-40		ns
Ch. I Fall After Ch. B or Ch. A Rise	t2		25		ns

TIMING DIAGRAM:



CPI: The number of Cycles (C) of the A or B output Per Inch of linear strip movement.

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

One Shaft Rotation: 360 mechanical degrees.

One Electrical Degree (°e): 1/360th of one cycle.

One Cycle: 360 electrical degrees (°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 °e.

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

INSTALLATION TORQUE

PARAMETER	TORQUE
Mounting Screws	3.5-4 in-lbs



PIN-OUTS

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

PRODUCT CHANGE NOTIFICATIONS

Title	Date	Description	Download
EM1 & EM2 Update - PCN 4199	1/14/2014	Based on our continuous process improvement program, US Digital is changing the current marking method for our EM1 and EM2 encoder modules to a serialization method. This change will allow for each module to have a unique code; the current marking method is based on a date code system that includes all encoder modules produced within a specific week / year. The serialization system will be based on a hexadecimal system.	Download (https://www.usdigital.com/support/resources/product-change-notifications/pcn-4199-em1-em2-update/)

Notes

- US Digital® warrants its products against defects in materials and workmanship for two years. See complete warranty (<https://www.usdigital.com/company/warranty>) for details.