

Helping Customers Innovate, Improve & Grow



MD-010

The MD010 is a Vectron standard platform module that provides 1 pps TTL, 10 MHz sine wave and 10 MHz square wave outputs that are disciplined to an external 1 pps reference. Internal to the module is a Vectron digitally corrected OCXO.

Features

- 1 pps TTL output signals standard
- 10 MHz sinewave and square wave outputs standard
- Other output frequencies available
- Embedded oscillator dependent upon holdover requirements
- Serial communications interface standard

Applications

- 3G Basestations (WCDMA, CDMA2000)
- LTE
- WiMAX Basestations
- Digital Video Broadcast
- E911 Location Systems
- General Timing and Synchronization
- Military Radio

Block Diagram

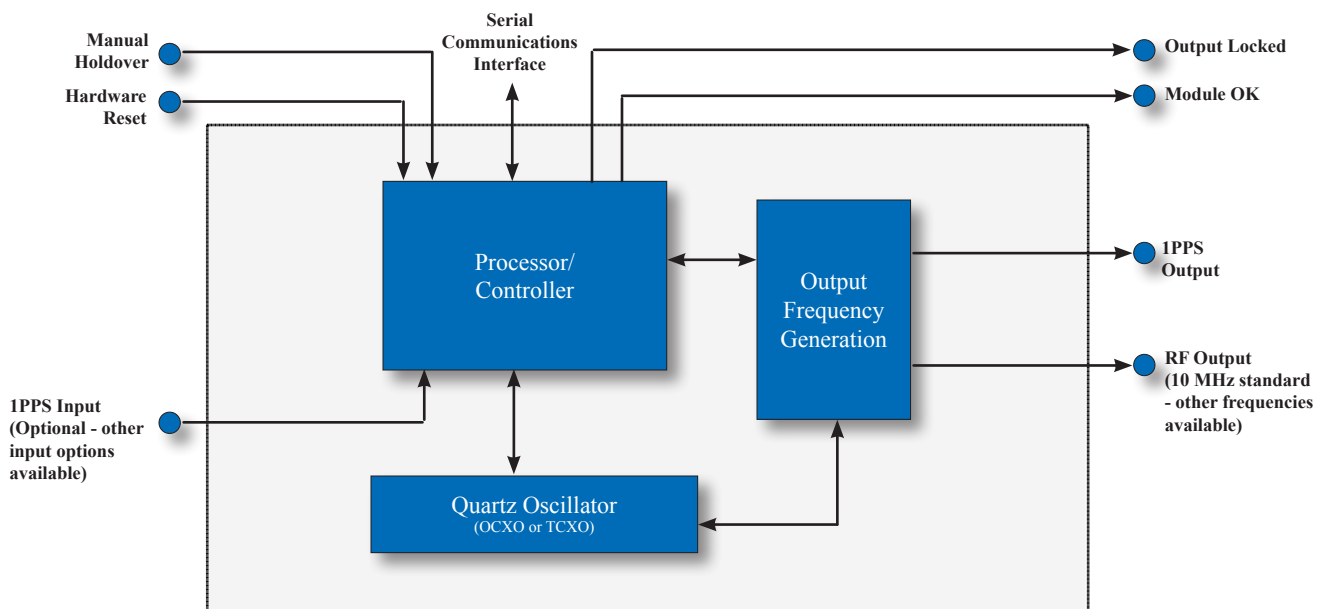


Figure 1. Functional Block Diagram

Summary Specifications

Comparitive Performance of Standard Modules									
Model	Embedded Oscillator		Typical Uses						
MD-0103-BXJ-DAOC-10M0000000	Digitally Assisted OCXO		Applications requiring 24 hour hold over on the order of 20 us						
Hold Over Performance (detailed performance on page 5) ¹									
Hold Over Time	10 min		1 hr	1 hr	8 hr	8 hr	24hr	24 hr	
Hold Over Temperature Change	$\Delta T = 2^{\circ}C$		$\Delta T = 2^{\circ}C$	$\Delta T = 10^{\circ}C$	$\Delta T = 2^{\circ}C$	$\Delta T = 10^{\circ}C$	$\Delta T = 2^{\circ}C$	$\Delta T = 10^{\circ}C$	
Model	Maximum Accumulated Hold Over in us								
MD-0103-BXJ-DAOC-10M0000000	0.05		0.24	0.4	2.8	3.7	18	21	
Summary Performance Characteristics									
Model	Warm Up Time (min-utes)	Aging / day (ppb) ¹	Temperature Stability (ppb) ²	Module Height (mm)	Accuracy to UTC (+/-1sigma)	Accuracy (+/-) ³	Warm up Power @ 25 °C (W)	Steady State Power @ 25 °C (W)	Voltage (V)
MD-0103-BXJ-DAOC-10M0000000	18	0.2	0.5	19.5	50 ns	1E-12	4.2	3	12
Phase Noise/ AVAR									
	-10 Hz		-100 Hz	-1 kHz	-10 kHz	-100 kHz	AVAR ($\tau=1s$)	AVAR ($\tau=10s$)	
MD-0103-BXJ-DAOC-10M0000000	-120		-135	-145	-145	-145	1E-11	2E-11	
RF Output Waveform Characteristics (via sma)									
Parameter	Min	Typical	Max	Units	Condition				
Waveform	Sinewave								
Output Power	+3.0	+9.0	+11.0	dBm	50 Ohms				
Harmonics			-30	dBc	50 Ohm				
Spurious			-70	dBc	50 Ohm				
RF Output Waveform Characteristics (via pin 8)									
Waveform	HCMOS								
High Level Output Voltage (V_{OH})	4.5		5.0	V_{DC}	<0.5mA Loads				
Low Level Output Voltage (V_{OL})		0.0	0.4	V_{DC}	<0.5mA Loads				
Rise/Fall Time		3	5	nSec	15 pF				
Duty Cycle	40	50	60	%	15 pF				
1 pps Output Characteristics (via SMA and pin 2)									
Parameter	Min	Typical	Max	Units	Condition				
Waveform	TTL								
High-level output voltage (V_{OH})	4.0		5.0	V_{DC}	50 Ohms				
Low-level output voltage (V_{OL})		0.0	0.4	V_{DC}	50 Ohms				
Pulse Width		10		us	default value user programmable 100 ns to 999.9999 ms				
External 1PPS Reference Input (Pin 1)									
Waveform	TTL								
High-Level Output Voltage (V_{OH})	2.4		5.0	V_{DC}	50 Ohms input impedance				
Low-Level Output Voltage (V_{OL})		0.0	0.4	V_{DC}					
Pulse width ⁷	10			uSec					

Specifications

Lock Status Indicator (Pin 9) ⁴					
Parameter	Min	Typical	Max	Units	Condition
Module Locked	4.5		5.0	V _{DC}	<5mA Load
Module Not Locked	0		0.5	V _{DC}	<5mA Load
Module Hardware OK Indicator (Pin 10) ⁵					
Module Hardware OK	4.5		5.0	V _{DC}	<5mA Load
Module Hardware Failure	0		0.5	V _{DC}	<5mA Load
Module Hardware Reset (Pin 12) ⁶					
Reset Module			0.5	V _{DC}	2 kOhm internal pull up resistance
Manual Holdover Set (Pin 11) ⁷					
Enter Manual Holdover	0		0.5	V _{DC}	2 kOhm internal pull up resistance
Serial Communications Interface ⁸					
Rx high-level input voltage (V _{IH})	4.5		5.5	V _{DC}	
Rx low-level input voltage (V _{IL})	-0.5	0.0	0.5	V _{DC}	
Tx high-level output voltage (V _{OH})	4.5	5.0		V _{DC}	
Tx low-level output voltage (V _{OL})	-0.5	0.0	0.5	V _{DC}	
Update rate		1		Hz	User configurable from 0 to 255 seconds
Communications Protocol	Vectron Binary/NMEA 0183				See MD-010/MD-010 Command List for Full Details
Pulse width ⁷	10			uSec	
Supply Voltage (Pin 7,15,16)					
Supply voltage	+11.4	+12	+12.6	V _{DC}	
Absolute Maximum Ratings					
Supply voltage (V _S)			15	V _{DC}	
Dc voltage on any I/O pin			5.5	V	
Output load	10			Ohms	
AC ripple			50	mVpk-pk	10Hz to 1MHz

Detailed Hold Over Specifications (us)

Holdover Capability - MD-0103-BXJ-DAOC-10M0000000					
Holdover Time	ΔT=2 °C	ΔT=10 °C	ΔT=20 °C	ΔT=30 °C	ΔT=45 °C ⁹
30 minutes	0.12	0.2	0.3	0.35	0.5
1 hour	.24	0.4	0.5	1	1
4 hours	1	1.6	2.3	3	3.9
8 hours	2.8	3.7	5	6.4	8.2
24 hours	18	21	23	25	32

Specifications

Environmental Conditions

Parameter	Min	Typical	Max	Units	Condition
Operating temperature	see ordering information for available ranges				
Humidity @ 40°C			90	%	
Storage Temperature	-55		+125	°C	

Reliability

VI qualification includes aging various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The MD-010 family is capable of meeting the following qualification tests:

Environmental Compliance

Parameter	Conditions
Mechanical shock	MIL-STD-202, Method 213 condition B
Mechanical vibration	MIL-STD-202, Method 204 condition A
Resistance to solvents	MIL-STD-202, Method 215

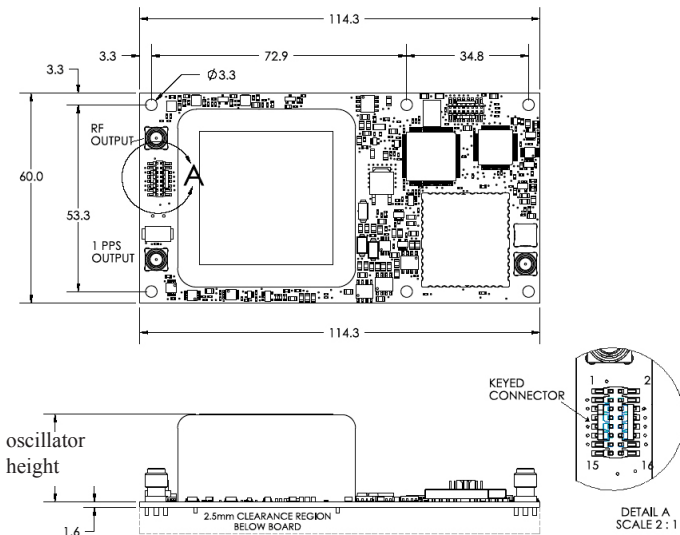
Handling Precautions

Although ESD protection circuitry has been designed into the MD-010 proper precautions should be taken when handling and mounting. VI employs a human body model (HBM) and a charged-device model (CDM) for ESD susceptibility testing and design protection evaluation.

ESD Ratings

Model	Minimum	Conditions
Human body model	1500 V	MIL-STD-883C, Method 3015
Charged device model	1000 V	JEDEC, JESD22-C101

Package Outline



16 Pin I/O Connections

Number	Name	Description
1	PPS In	External 1 PPS Input
2	PPS Out	1 PPS Output
3	Ground	Ground
4	Ground	Ground
5	Rx	Serial Communications Receive
6	Tx	Serial Communications Transmit
7	Vcc	Power Supply
8	RF Out	RF HCMOS Output
9	Locked	Logic-high = Output locked to PPS
10	Module OK	Logic low = Failure with module operation
11	ManHold	Manual Holdover Input
12	Reset	Hardware reset
13	Ground	Ground
14	Ground	Ground
15	Vcc	Power Supply
16	Vcc	Power Supply

Notes:

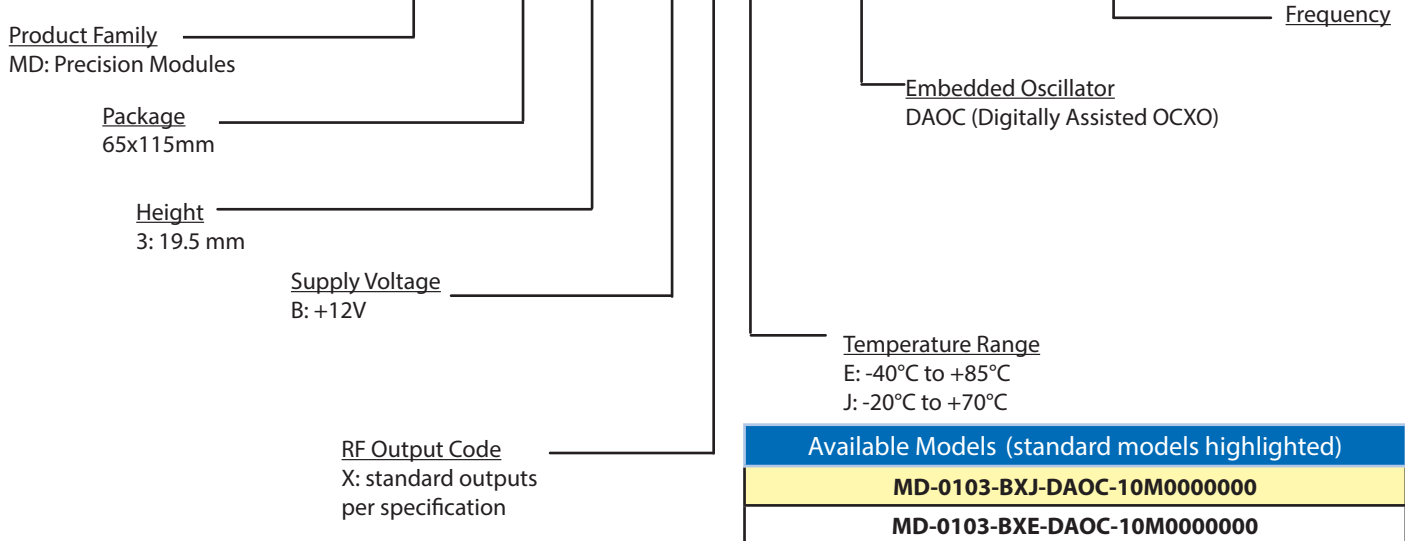
- RF and 1pps input and output connectors are MCX type (SMA, SMB, MMCX connectors require additional part numbers).
- Keyed connector is Samtec FTSH-108-01LDVK type.
- Dimensions: mm
- Module height in part number is the sum of oscillator height, board, and clearance

Accessories

Vectron Partnumber	Description
MD-010-EK	MD-010X-XXX-XXXX Module with Evaluation Kit

Ordering Information

MD - 010 3 - B X J - OCXO - 10M0000000



Notes

- 1) Holdover and aging performance is after 7 days of power-on time.
- 2) Temperature stabilities apply to -20 to +70 °C modules. For other temperatures the temperature stability will vary, however the hold over values over defined temperature ranges remain constant.
- 3) 24 hour average when locked to external 1PPS
- 4) The status locked indicator is intended to indicate when the module is fully locked to external 1 pps.
- 5) The Hardware OK indicator is intended to indicate when the module is operating properly without any failures including hardware, software or parameter out of range, see protocol.
- 6) Open collector input bit.
- 7) If the minimum supply current is not exceeded, the Antenna Open Flag will be set. Over current will be set if maximum is exceeded. Circuit has overcurrent protection.
- 8) The Rx pin is the serial interface input and the Tx pin is the serial interface output. The serial interface shall operate at 9600 baud with eight (8) data bits, one (1) stop bit and no parity.
- 9) This holdover performance also applies to the temperature deviation over the entire operating range of -20 to +70°C.

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