MD-171

High Stability GNSS (GPS and GLONASS) Disciplined Oscillator Module



The MD-171 is a Vectron GNSS disciplined module. It is a fully integrated GNSS disciplined oscillator module in a compact surface mount 40 x 50 mm footprint. The module has an embedded 34 channel receiver that is both GPS and GLONASS compatible and provides a sinewave or CMOS 10 MHz, and HCMOS 1 pps output. An onboard precision OCXO provides stabilities in the unlocked mode enabling extremely low holdover. The module operates from -40 °C to +85 °C.

Features

- **Embedded GNSS Receiver - GPS and Glonass Compatible**
- **Field upgradeable for Galileo in 2017**
- **1pps HCMOS output signal standard**
- **10MHz sinewave or CMOS output**
- **Modified NMEA (VSIP)**
- **Evaluation kit with software available**
- **4µs holdover for 24 hours**

Applications

- **Radar systems**
- **Digital Video Broadcast**
- **E911 Location Systems**
- **General Timing and Synchronization**
- **Military Radio**

Block Diagram

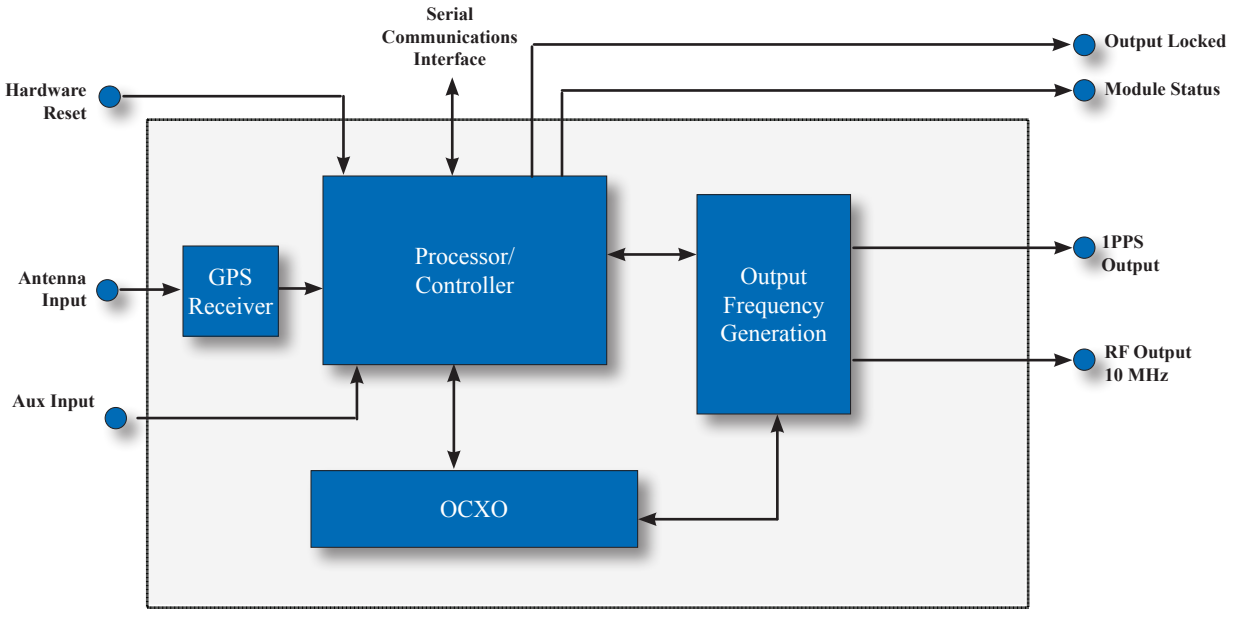


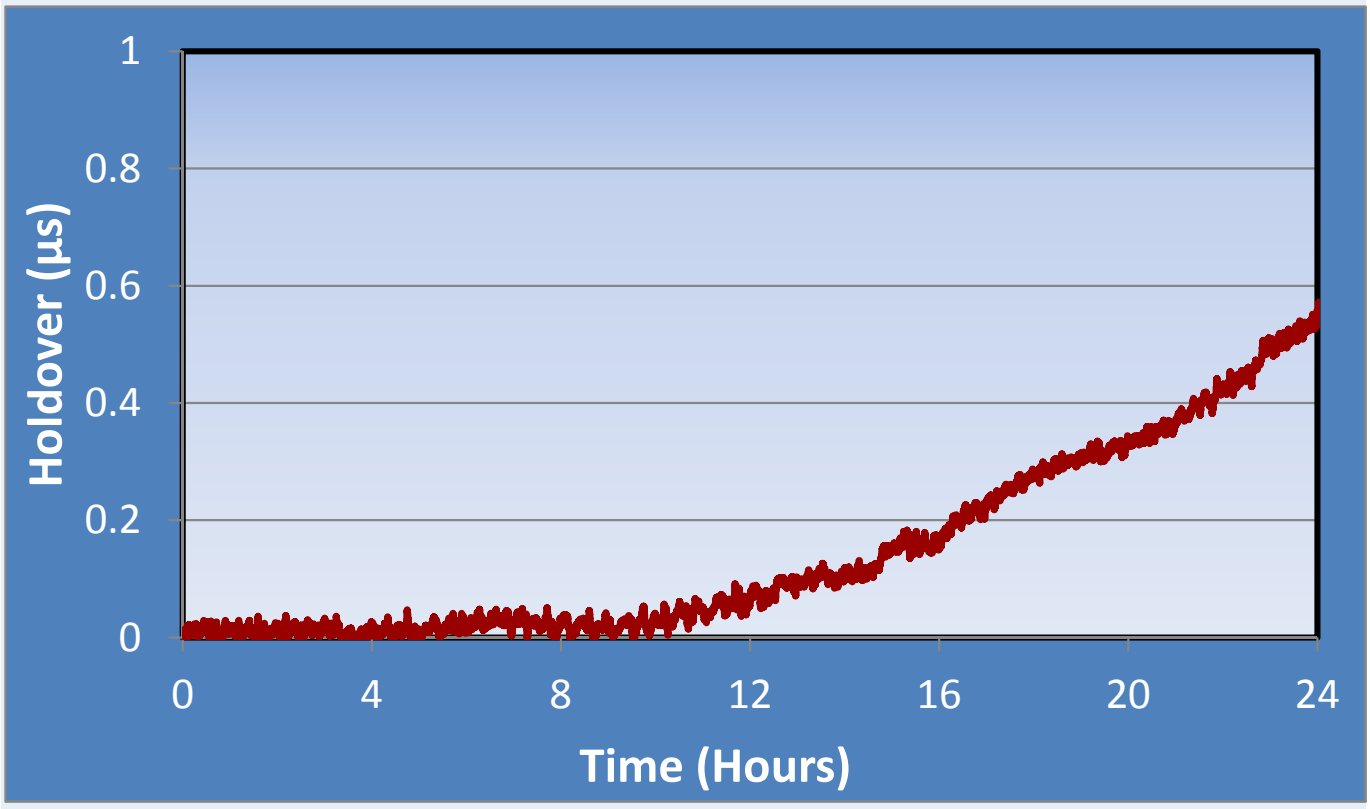
Figure 1. *Functional Block Diagram*

Summary Specifications

Hold Over Performance [1]								
Hold Over Time	**10 min**		**1 hr**	**1 hr**	**4 hr**	**4 hr**	**24hr**	**24 hr**
Hold Over Temperature Change	**ΔT= 2 °C**		**ΔT= 2 °C**	**ΔT= 10 °C**	**ΔT= 2 °C**	**ΔT= 10 °C**	**ΔT= 2 °C**	**ΔT= 10 °C**
Model			**Maximum Accumulated Hold Over in us**					
MD-1710-DAE-DAOC-10M0000000	0.1		0.15	4	0.6	10	4	15

Summary Performance Characteristics									
Model	**Warm Up Time (min-utes)**	**Aging / day (ppb)[1]**	**Temper-ature Stabil-ity (ppb)**	**Module Height (mm)**	**Accuracy to UTC (+/-1σ) (ns)[2]**	**Accuracy (+/-) [3]**	**Warm up Power @ 25 °C (W)**	**Steady State Power @ 25 °C (W)**	**Voltage (V)**
MD-1710-DAE-DAOC-10M0000000	5	0.06	0.4	25	20	1E-12	4.5	2.8	5.0 V analog/ 3.3V digital

Phase Noise/ ADEV									
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	ADEV τ=1s	ADEV τ=10s		
at 10 MHz	-125	-140	-145	-145	-145	5e-12	5E-11		



Specifications

Internal Receiver Characteristics					
Parameter					**Condition**
Type	Timimg w/ Auto Position Lock				
Number of channels	34				
Frequency band	GPS L1 C/A				
	SBAS L1 C/A				WAAS, MSAS, EGNOS, GAGAN
	GLONASS L1 OF				
	Galileo				Firmware update will be required
Tracking capability	12 satellites				
sensitivity tracking	-161 dBm				
sensitivitiy acquisition	-147 dBm				
Position Accuracy	< 2.5 m CEP				Open sky. 24 hours
TTFF	<5 seconds				HOT (currrent almanac, position, time and ephemeris)
	<35 seconds				Warm (current almanac, position, time)
	< 35 seconds				Cold (no data)
GPS Antenna					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Antenna Input Voltage[4]	2.6	3.1	3.4	V_{DC}	
Antenna Current		20	100	mA	see protocol for under current flag and short circuit protection
RF Output Waveform Characteristics					
Waveform	Sinewave				
Load		50		Ω	
Output Power	+3	+5	+7	dBm	
Harmonics			-30	dBc	
Spurious			-80	dBc	
Waveform	LVCMOS				
Load		15		pF	
High-level output voltage (V_{OH})	2.4			VDC	15 pF ll 10k Ohm
Low-level output voltage (V_{OL})			0.4	VDC	15 pF ll 10k Ohm
Duty Cycle	45		55	%	15 pF ll 10k Ohm
1pps Output Characteristics					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Waveform	LVCMOS				
High-level output voltage (V_{OH})	3.0		3.4	V_{DC}	> 100 Ohms
Low-level output voltage (V_{OL})		0.0	0.4	V_{DC}	> 100 Ohms
Pulse Width		10		us	
Aux 1pps input Characteristics					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Waveform	LVCMOS, TTL				
High-level input voltage (V_{iH})	2.4		5	VDC	15 pFll10kOhm
Low-level input voltage (V_{IL})		0.0	0.3	VDC	15 pFll10kOhm

Specifications

Lock Status Indicator					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Module Locked	90		100	$\%V_{cc}$	
Module Not Locked	0		20	$\%V_{cc}$	
Module Hardware OK Indicator					
Module Hardware OK	90		100	%Vcc	
Module Hardware Failure	0		20	%Vcc	
Module Hardware Reset					
Reset Module	0		0.5	V_{DC}	2 kOhm internal pullup
Serial Communications Interface					
Rx high-level input voltage (V_{IH})	2.8			V_{DC}	
Rx low-level input voltage (V_{IL})	-0.5	0.0	0.5	V_{DC}	
Tx high-level output voltage (V_{OH})	3.15	3.3		V_{DC}	
Tx low-level output voltage (V_{OL})	-0.2	0.0	0.2	V_{DC}	
Update rate		1		Hz	
Communications Protocol	Vectron Binary/NMEA 0183				See VSIP Command List for Full Details
Pulse width[7]	10			uSec	
Supply Voltage					
Supply voltage (Vcc)	+4.75	+5.0	+5.25	V_{DC}	
Supply voltage (Dig Vcc)	+3.0	+3.3	+3.4	V_{DC}	
Absolute Maximum Ratings					
Supply voltage (Vcc)			6	V_{DC}	
Dc voltage on any I/O pin			3.9	V_{DC}	
Output load	100			Ohms	
AC ripple			50	mVpk-pk	10Hz to 1MHz

Environmental Conditions					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Operating temperature	see ordering information for avaialble ranges				
Humidity @ 40˚C			90	%	
Storage Temperature	-55		+125	˚C	
Physical Characteristics					
Weight			120	g	
g-sensitivity		1		ppb/g	10 to 1000 Hz

Reliability

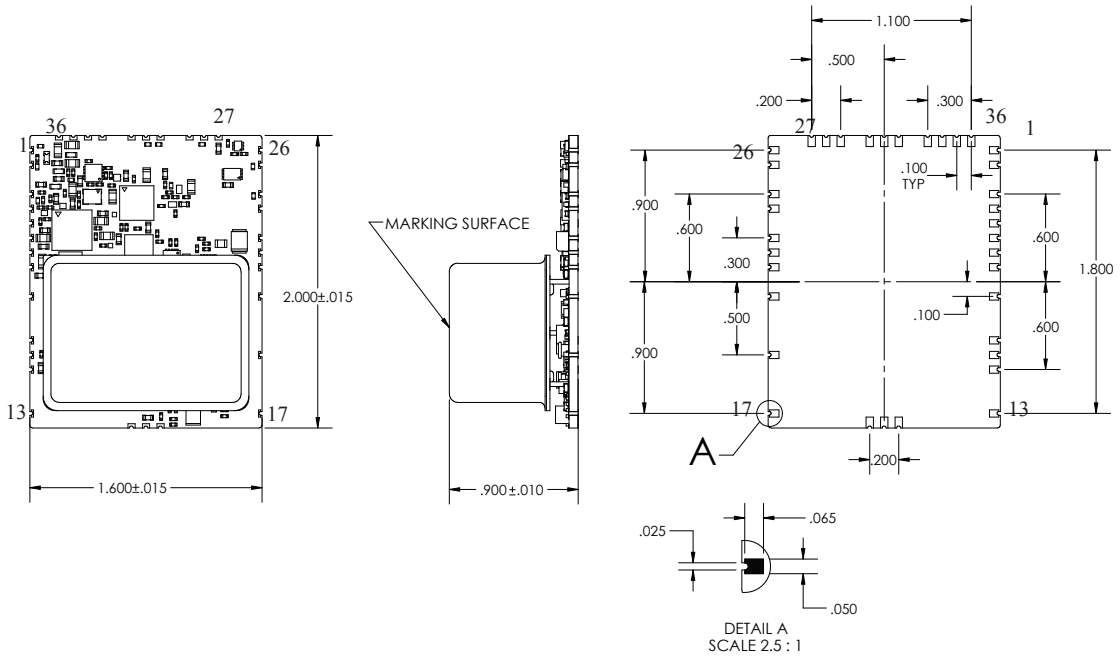
VI qualification includes aging various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The MD-171 family is capable of meeting the following qualification tests:

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

Although ESD protection circuitry has been designed into the MD-171 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-833, Method 3015
Charged device model	1000 V	JEDEC, JESD22-C101

Package Outline



WARNING, this is a sketch and is not under revision control. An item documented in this manner must not be used in processes where using the wrong version could adversely affect the fit, form, or function of Vectron Product.

Pin Configuration

36 Pin I/O Connections		
Number	**Name**	**Description/comment**
1	PPS_OUT	1 pps output
2	REF_IN	Reference input
3,5,7,20,26,36	D_GND	Digital Ground
4	ANT_IN	Antenna
6	VCC_ANT	Antenna Supply
8,27	D_VCC	Digital 3.3V supply
9,12,13,14,16,17,18,19	A_GND	Analog Ground
10,11	A_VCC	Analog 5.0V supply
15	RF_OUT	Sinewave or CMOS (see ordering code)
21,22,29,32,33,34,35	N/C	Do not connect - leave floating
23	RX_IN	Data in - internal pull up
24	TX_OUT	data out
25	AUXIO	
28	MOD_RST	Pull up - active low
30	STATUS	pull down
31	LOCK	pull down

Ordering Information

MD - 171 0 - DA E - DAOC - 10M0000000

Product Family
MD: Precision Modules

Package
40 x 50mm

Height
0: 23 mm

Supply Voltage
D: +5V

RF Output Code
A: CMOS
E: Sinewave

Temperature Range
D: -40°C to +70°C
E: -40°C to +85°C
J: -20°C to +70°C
T: 0°C to +70°C

Embedded Oscillator
DAOC (Digitally Assisted OCXO)

Frequency

Notes

1) Holdover and aging performance is after 7 days of power-on time. Temperature and aging rates are when device is not locked. Performance measured in still air. 1
2) After customer applies offset corrected using cable delay command while locked, after 24 hours of locked operation
3) Allan Variance at τ=86400s while locked, after 24 hours of locked operation
4) Antenna supply pin at pin 21 is an input voltage from customer. Vectron couples the DC input voltage to the rf signal of the GPS signal. The customer does not need to provide any additional blocking or coupling circuitry.

For Additional Information, Please Contact

USA:
Vectron International
267 Lowell Road, Unit 102
Hudson, NH 03051
Tel: 1.888.328.7661
Fax: 1.888.329.8328

Europe:
Vectron International
Landstrasse, D-74924
Neckarbischofsheim, Germany
Tel: +49 (0) 7268.801.100
Fax: +49 (0) 7268.801.282

Asia:
Vectron International
1F-2F, No 8 Workshop, No 308 Fenju Road
WaiGaoQiao Free Trade Zone
Pudong, Shanghai, China 200131
Tel: 86.21.5048.0777
Fax: 86.21.5048.1881

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