Generic Spec & Operating Instructions: OSP **VibroView-200** Laser Vibration Testing Station





OmniSensing Photonics, LLC

Contents

1.	Introduction	3
	1.1 Core Technology	3
	1.2. Typical Applications	4
2. F	Product Description & Specifications	6
	2.1 Product descriptions	6
	2.2 Optical measurement specifications	7
	2.3 Mechanical specification for VibroView-200	8
3. (Communications & Application Software	9
	3.1 Ethernet connection and TCP/IP setting:	9
	3.2 GUI quick introduction	9
Ap	pendix: Operation of VibroView-200 Testing GUI1	.1

1. Introduction

Taking the advantage of photonic integrated circuit (PIC) technology and its proprietary all-in-one packaging design, OmniSensing Photonics (OSP) has developed a series of compact laser vibrometer solutions. The latest generation carries the model series OSP-MV-H-XX for various applications. Based on the MV-H laser vibrometer modules, OSP designed and developed a turn-key solution, called VibroView, which is a vibration characterization station for small size components such as MEMS. The lastest model is VibroView-200, which has following unique features:

- Integrated System w/ Small Footprint: Integrated laser vibrometer and digital microscope in a compact footprint.
- **3-axis Control:** Offer 3-axis manual control for easy and accurate location pin point on DUT (Device Under Test).
- High Precision MV-H Series Laser Vibration Testing w/ Visible Indicating Light
- Wide Frequency Range: DC~2.5MHz.
- Digital Microscope and Associated Display GUI

1.1 Core Technology

The key component for the OSP-MV-H series laser displacement sensor is its all-in-one optical assembly (as shown in Fig. 1), which generally consists of a laser diode, a photo detector array, a proprietary optical processing chip (PIC) and an optical lens set (or a pigtailed fiber interface). Fig. 1 explains that how a generic coherent detection scheme is implemented into the all-in-one optical assembly as the core technology of the MV-H series laser vibrometer modules. The all-in-one optical assembly could come with different designs and form-factors, fitting for different applications.

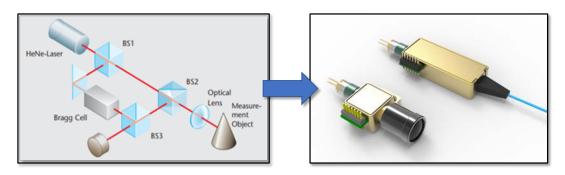


Fig. 1 All-in-one optical assembly that implementing the coherent detection scheme



Fig. 2: MV-H-TR model laser vibrometer

Targeting different application, each type of MV-H laser vibrometer module has its own lens selection (or fiber connector selection), dedicated PCB driving board, defined electronics interface and suitable exterior design. The entire module should meet industrial protection standard IP-65 or greater. Figure 2 shows the most functional MV-H-TR type laser vibrometer module.

1.2. Typical Applications

The VibroView-200 series laser vibration testing station has integrated the MV-H-TR type laser vibrometer along with a digital microscope. Mostly for R&D purpose, this testing station is designed to characterize the vibration performance of any small form-factor vibrating devices, components or module/subsystem. As shown in Figure 3, the typical applications could be:

1) Characterizting MEMS PMUT/CMUT devices:

Micromachined ultrasonic transducers, normally design in an array, have various form-factor and application. In example, an PMUTs is designed and babricated to operate at multiple frequencies, so each PMUT should be tested against its original designing performance. These characterization tests can be performed using the VibroView laver vibration testing station, where the testing laser beam can be easily aligned with the device center under the digital microscopeare designed while doing the device visual inspection in the same time.

2) Smart-phone vibration performance check:

The VibroView vibration station could also be used to test out the vibration performance of various common commercial electronics devices, such as the MEMS speaker, motorized vibrator, or vibrating touch screen.



(a) MEMS PMUT/CMUT device characterization
 (b) Smart-phone vibrator qulity check
 Fig. 3: Typical application of VibroView laser vibration testing station

2. Product Description & Specifications

2.1 Product descriptions

Fig. 4 describs the VibroView-200 system:

1) The VibroView-200 system has combined the laser vibromter and digital microscope into one complete system, the external PC can communicate with the VibroView-2000 through the Eithernet interface for both vibration testing and microscope image displaying.

2) The X/Y moving stage is manual for testing pin-point adjustment; and the Z direction is also manual for a quick focusing distance adjustment.

3) Optics zoom ratio can be adjusted as well from the front, while digital zoom ratio can be changed on the testing GUI.

4) There is a nub for LED light brightness adjustement.

5) The GUI is running on a PC, where the PC is connected to VibroView-200 though the Ethernet cable.

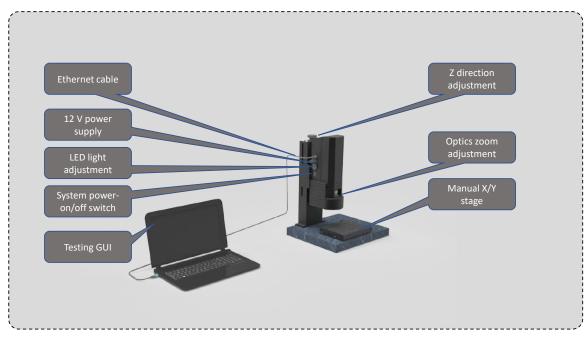


Fig. 4: Descriptions of VibroView-200

2.2 Optical measurement specifications

The following Table 2 shows the specification of VibroView-200 series laser vibration testing station: :.

Items	VibroView-200
Laser Vibrometer	
Detectable vibration frequency	DC~2.5MHz
Operating distance((from the lens to DUT)	10mm~30mm
Operation range	+/-15% of working distance
Velocity full scale	±1.5 m/s (regular mode)
Typical vibration resolution	~1nm or better
Testing laser class	Class 1, <5mW output
Testing laser wavelength	1310 nm (invisible near infrared, detector card included)
Visible light wavelength	650nm
Visible light class	Class 2, <1mW
Visible light spot size	~100um
Digital Microscope	
Optics zoom	0.7~4.5
Digital zoom	100
Resolution	4~11um
System	
Weight	~3Kg
Operating temperature	0-50°C
Power supply	12V, typical 10W
Digital interface	Ethernet
Software	GUI

Table 1: VibroView-200 series laser vibration testing station specification	ons
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2.3 Mechanical specification for VibroView-200

The following figure defines the mechanical information of VibroView-200.

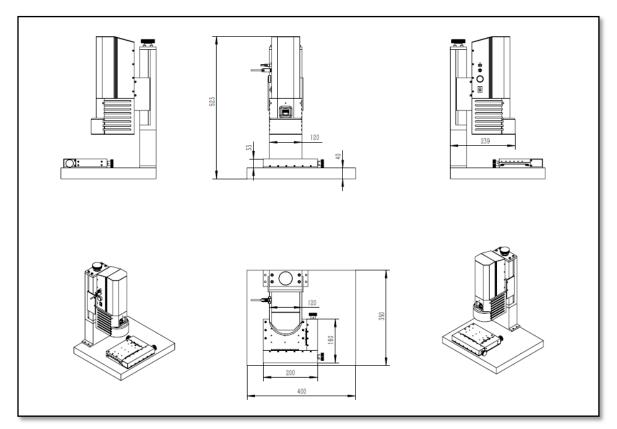


Fig. 5: The mechanical information of VibroView-200 laser vibration testing station

3. Communications & Application Software

The standard electrical interface for OmniSensing Photonics' MV-H series laser vibrometer modules is Ethernet 100Mb/s, so does the digital microscope. The VibroView-200 system has one Ethernet port for external communication, where the Ethernet port is internally connecting to the laser vibrometer and the digital microscope through a built-in Ethernet switch.

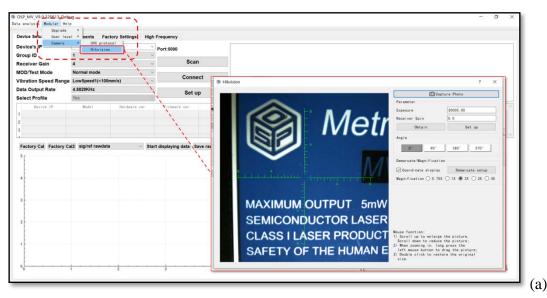
3.1 Ethernet connection and TCP/IP setting:

VibroView-200 uses below Ethnernet setting.

- Support 100Mb/s Ethernet interface
- Support DHCP
- Default IP address: 192.168.1.2
- Communication port: 5000

3.2 GUI quick introduction

Unless there is an special request from the customer, OmniSensing Photonics will offer a common testing GUI to all customers. This testing GUI is an modified SW based on a standard MV-H series laser vibrometer testing GUI. Figure 6(a) shows how the digital microscope function is enabled through the menu, where some basic measurement can be performed though this functional window.



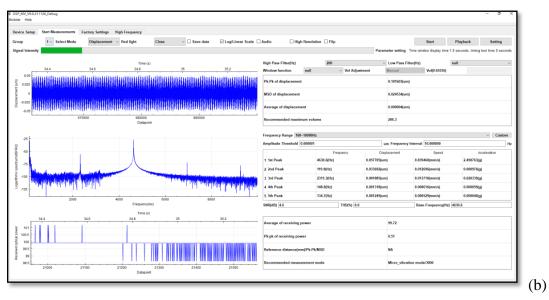


Fig. 6: VibroView-200 testing GUI

Figure 6(b) shows the vibration testing page of VibroView-200 system, which is basically the same as a standard MV-H series laser vibrometer.

Appendix: Operation of VibroView-200 Testing GUI

Below is the installation and operation procedure for the standard application software GUI:

Step 1:Initial steps

1) Turn on the system, and click to open the GUI program on PC



Step 2: Connect

On the "Device Setup" Page, click the "Scan" button and get the IP address.

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	<pre>OSP_MV_V9.0.211102_D</pre>	ebug					
N	Modular Help						
1							
	Device Setup Start	Measurements	Factory	/ Settings	High I	Frequency	
	Device's IP				\sim	Port:5000	[
	Group ID	1			~	Scan	
	Receiver Gain	4			\sim		
	MOD/Test Mode	Normal mod	e		\sim	Connect	
	Vibration Speed Ran	ge LowSpeed1	(<100mm/	s)	\sim	Cotup	
	Data Output Rate	78.125KHz			~	Set up	
	Device IP	Model		Hardware v	er	Firmware v	e

When get the IP address, click the "Connect" button, the hardware parameters will be displayed.

Device's IP	192.168.1.2			Hardware: V3						
Group ID	1		Scan	Firmware: V9.0.3 DLL : V1.0.20210915						
Receiver Gain	4		~	FPGA: V1.5.210910						
MOD/Test Mode	Normal mode		 Disconnect 							
Vibration Speed Ran	nge LowSpeed1(<1	(c/mm0	~							
Data Output Rate	78.125KHz		Set up							
Device IP	Model	Hardware ver	Firmware ver	FPGA ver	Gain	Bias current(mA)	Modulation depth	Sampling rate(KHz)	Status	EEPROM
1 192.168.1.2	MD-H	V3	V9.0.3	V1.5.210910	4	64.00	Normal mode	78	Connect	OK
2										

Step 3: Select the basic parameters and click "Set up"

Retain the default Settings: Gian, Test Mode, Vibration Speed Range, Data Output Rate, click the "Set up" button

Device Setup	Start Mea	asurements	Factory Settings	High	Frequency
Device's IP		192.168.1.2		\sim	Port:5000
Group ID		1		\sim	Scan
Receiver Gain		4		\sim	ocum
MOD/Test Mod	e	Normal mod	e	~	Disconnect
Vibration Spee	ed Range	LowSpeed1	(<100mm/s)	\sim	Orton
Data Output R	ate	78.125KHz		\sim	Set up

After Set up, the buttons/parameters will change to gray.

Device Setup Start M	leasurements Fac	tory Settings High	Frequency
Device's IP	192.168.1.2	\sim	Port:5000
Group ID	1	~	Scan
Receiver Gain	8	\sim	
MOD/Test Mode	Normal mode	~	Disconnect
Vibration Speed Rang	Mediumspeed2(10	00mm/s~1500mm/s) ~	
Data Output Rate	78.125KHz	\sim	Set up
Device IP	Model	Hardware ver	Firmware ver
1 192.168.1.2	MD-H	V3	V9.0.3
2			

Step 4: Adjust exposure parameters

1) Before the test, the receiving signal strength/condition should meet certain exposure state:

Europune fine	Ready Sormal receiving power
Exposure fine	
Underexpose	😑 Wait 😑 No vibration signal detected
Overexposure	Wait Receiving power saturation

2) To adjust the exposure state

• When the exposure state is not fine (underexpose or overexposure), click the "Stop displaying data" button.

Factory	Cal Factory Cal2 sig/ref raw	data 🗸	Stop displayin	g data Save ra	w data 😑 Read	ly 🔴 Recei	iving p	ower saturation
					sig-i.p		2700	
2000	and an an and the state of the	stration of the second se	MANANAN	withing	Sig-o.p	-p=1	2600	
1500							2500	
1000							2400	
500 -							2300	
-							2200	
ŀ	500 1000	1500	2000	2500	3000	3500	2100	500

• Repeat step 3, select the suitable value from "0" to "12"

Receiver Gain	10 ~
MOD/Test Mode	0 ^
Vibration Speed Range	e 2 3
Data Output Rate	4
Device IP	6
1 192.168.1.2	
2	89 ~

• Repeat step 4, until the exposure fine.

evice's IP roup ID	192.168.1.2 1		Port:5000	Hardware: V3 Firmware: V9.0.3 DLL : V1.0.20210915						
eceiver Gain	D/Test Mode Normal mode pration Speed Range Mediumspeed2(100mm/s-18 ta Output Rate 78.125KHz Devroe (P Vode1 Rarde			FPGA: V1.8.211019						
		100mm/c_1600mm/c\	Disconnect							
ata Output Rate		indentities - resolutions)	Set up							
Device IP	Wode I	Bardware ver	Fireware ve		Gain	Bias current (mA)	Modulation depth	Sampling rate(KHz)	Status	EEPROW
192.168.1.2	MD-H	A2	V9.0.3	V1.8.211019	2097184	64.00	Normal mode	78	Connect	ок
Factory Cal Factory 1	Cat2 sig/ref rawds	sta - St Hullden Hul	op displaying dats		Pady Normal receiv p=p=1587 p=p=1605 3250	ing power	MM	M M M	M M M	ref-i,p*p=110 ref-q,p=p=113
1 1			op displaying data		p-p=1587 p-p=1605	Ing power				

Exposure ready

• When ready, **click the** "Stop displaying data" button. Setting finished.

Step 5: Loading configuration file if provided

Device Setup Start Measurements	Factory Settings	High Frequency								
Register setting)	EEPROM settin	gs						
	(2)_	Read	SN	WMG2052	20099					Read from sense
	(Read	PN	MV-G12						Read from sense
	C	Reset	Data	202012						Write to senso
	(3)*	Kesec	PCB type	FPGA 5M	A ETH				Ŷ	
	0.000	blk_wnd: 0	paba laser type	Low powe	er laser				5	1
			afe	250K					4	4
			PCB version	V401.1						1
			PCB batch	104						1
				F14						8
									v	8
			Optical version 0		1					
			tcoef phase	0.0000]
			tcoef distance 0.0000 Focal distance 0					2		
]					
			Base ruler						-	
			ld lambda	1.3050		1111111	20000]
			MAG	112	179	213	112	208	14]
		Write configuration file	current_center	100500]		
	1	-	current_dc	14]
	9	Load from configuration file	Modulation dept							1
		Store EEPROM		0						1
		Load from EEPROM	id_start_mv x0_2_default	221 50000						Load from file
		Clear EEPROM		50000					_	Save to file

Turn to the "Factory Setting" page, following the 3 steps showing on the figure to load in the **.rcf** file provided. Then switch back to "Start Measurement" page to do the testing.

Step 6: Turn on the visible Red Light on "Start Measurement" page

Turn on the "Red light" by sliding the current setting nub to the proper value, maybe around 600.

0011	ce Setup Start Me	easurements	Factory Settings	High Frequency	_
Grou	p 1 ~ Select Mode	Displacement	✓ Red light	600	🗆 Save data 🛛 Log
Sign	al Intensity				J
5 -					
Ĩ					
4					
÷					
3 -					
3 -					
2					

Step 7: Enable the digital microscope functional window

Following the below instructions to enable the digital microscope functional window

roup ID							
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ration Speed Rang	ge LowSpeed1(<100mm/s) 4.8828KHz	X	3 Hikvis	sion			7 ×
lect Profile	Yes	1	Set up				lapture Photo
Device IP	Bodel Hars	leare ver Virneare	var			Parameter	30000.00
		1				Receiver Gain	0.0
		· · · · · · · · · · · · · · · · · · ·			Me	Obtain	Set up
			`			Argle	
actory Cal Factory							
	Cal2 sig/ref rawdata	 Start displaying d 	data Save ray			0" 90"	180" 270"
[CalZ sig/ref rawdata	 Start displaying of 	data Save ra			o" 90"	
	Cal2 sig/ref rawdata	 Start displaying of 	data Save ras			0° 90° Demarcate/Wagnificat ⊘ Coordinate displa	tion
	Cal2 sig/ref rawdata	 Start displaying c 	data Save rav			Coordinate displa	tion
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	Car2 signer rawats	 Start displaying c 	ista (Save ra	SEMICONE CLASS I LA		Coordinate disals Nagnification ○ 8.7 mW SER UCT Nuese function: 1).Screll up to entar	tion m Description setup TEX O 1X

Step 8: Position adjustment through the digital microscope

- 1) Adjust the optics zoom selection on the front of the VibroView-200 system, i.e. 2X
- 2) Select the same optics zoom option on the digital microscope function window
- 3) While looking at the "live" image dispayed by the digital microscope, adjust the Z direction nub to get the most clear picture, so does the Red light spot, which indicating the testing laser spot location.
- 4) Adjust the X/Y stage, to move the DUT to the right location
- 5) Adjust the Z direction when needed.

Step 9: Doing the vibration testing

Switch to the "Start Measurements" page.

1) Setting measurement Parameters

ce Setup Start Measurements up w Select Mode Dir al Intens	Factory Settings High Freq placement - Red light Stri		sta 🗆 Log/Linear Scale	Audio High	Resolution Fip	meter setti Time window	Start display time 10.0 secon	Playback ds, timing lest tim	Setti No O se
9 0,5	Time (s)	1,6	1	High Pass Filter(Hz) Window function	null ull Vol Adj	- Low Pass	Filter(Hz) n Vol(0-65536)	ul	
as mun your Humall	wittle.co.or.ellinatura	millimmene	International International	Pk-Pk of displacement	nt	1.143691(um)		_
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				Angenue mresnou	Frequency	Pisplacement	Joess	Accele	-
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-0.5				2 2nd Peak	10.6(Hz)	0.132510(um)	0.004419(mm/s)	0.000030(g)	6
				3 3rd Peak	69.1(Hz)	0.020300(um)	0.004406(mm/s)	0.000195(g)	
1.75				4 4th Peak	90.5(Hz)	0.015314(um)	0.004355(mm/s)	0.000253(g)	
-1 30	40	60	60 10	6 5th Peak					
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400		ALLO.	all in	Reference distance(nm)/Pk-Pk/MSD	NA			
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(1) Set display windows

Parameter Settings		?	×				
Warning: the display time of time domain window can be a float one decimal place, which must be no less than 0.4 seconds and The timing test time is an integer and cannot be set as a float							
Display Window(seconds) 10.0							
Test Window	(seconds)						
	Set up						

(2) Set frequency range customized(1-100Hz)

Band Custom Settings		?	×
Low Frequency	1		
High Frequency	100		
Set u	ıp		

(3) Set frequency interval (20Hz)

Frequency Interval	20	Hz	l

- (4) Choose Save data or not
- (5) Choose Log or linear scale
- (6) Other settings: default

2) Start measurement

(1) Press "Start" button to start. We can see real-time data in the Windows.

	Start	Playback	Setting
dow displa	ay time 10.0 seco	onds, timing test	time 0 seconds
Pass Filte	r(Hz)	null	~
\sim	Vol(0-65536)		
691(um)			
704(

(2) Windows

Device Setup Start Measurements Factory Settings High Frequency					
	Scale Audio High	Resolution Fip	· Power n	ormal Stop	Playback Setting
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100	Amplitude Threshold			noy Interval 20	
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2	2 2nd Peak	23.5(Hz) (5	13.691637(um)	1.008778(mm/s)	0.015159(g)
50	3 3rd Peak	44.0(Hz)	5.166844(um)	0.726644(mm/s)	0.020843(g)
23	4 4th Peak	74.8(Hz)	2.222696(um)	0.522421(mm/s)	0.025044(g)
20 49 49 89	5 Sth Peak	95.8(Hz)	1.833886(um)	0.551728(mm/s)	0.033855(g)
PT REGREEP (PR)	ONR(00) 11.4	-THD(%	2.1	Berr Frequency!	144 14.7
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- ① Time domain graph; ② Frequency domain graph; ③ Optical power chart;
- (4) (5) (6) Analysis parameter table

Step 10: Store(Save) the data when needed Details to be added.