Sine Vibration Control System Resonance Dwell Option

K2 K2Sprint

Amplitude Search Option Instruction Manual

Constraint of K2Sprint/SINE:

• Maximum numbers of usable input channel are '2' channels

IMV CORPORATION

Type of Document : Instruction Manual

System Applied :

Software <Resonance Dwell>

K2/K2Sprint

later than Version 20.2.0

This application does not run without <u>K2/SINE and</u> <u>Resonance Dwell Option</u>.

Japanese Edition

Version	Date	Contents
1.0.0	2006.02.11	First edition
1.0.1	2006.03.11	Resonance Search Mode: Amplitude Search [High Speed] is added.
1.0.2	2006.04.11	Set up: CSV Data Format is added.
2.0.0	2008.01.18	Resonance Search Mode: Phase Search and Frequency Fixing are added.
10.0.0	2013.08.09	Renewal of screen display, additional description of 'Operation Status' in Setup.
20.2.0	2021.03.15	The description is changed by the renewal of the definition screen.

English Edition

Version	Date	Contents
2.0.1	2011.09.30	First edition
10.0.0	2013.08.09	Renewal of screen display, additional description of 'Operation Status' in Setup.
10.0.1	2013.11.29	Correction of misprints
10.0.2	2016.07.29	Correction of misprints
10.0.3	2017.10.19	Correction of misprints
20.2.0	2021.03.17	The description is changed by the renewal of the definition screen.

CONTENS

Chapter	1 Resonance Dwell Test 1-1
1.1	Outline
	1.1.1 Resonance Survey
	1.1.2 Resonance Search
	1.1.3 Resonance Dwell
1.2	Resonance Dwell (Resonance search mode: Amplitude search [Normal])
1.3	Resonance Dwell (Resonance search mode: Amplitude search [High speed])1-15
1.4	Resonance Dwell (Resonance search mode: Phase Search)
1.5	Resonance Dwell (Resonance search mode: Frequency fixing)
Chapter	2 Test Definition
2.1	Peak Frequency
	2.1.1 Selection of Sweep test file
	2.1.2 Channel setting
	2.1.3 Resonance judgment criteria
	2.1.4 Resonance search mode
2.2	Resonance Reference Definition
	2.2.1 Test target element
	2.2.2 Resonance reference level
	2.2.3 Alarm / Abort level
	2.2.4 Dwell time
	2.2.5 Test time
	2.2.6 Repeat pause time
	2.2.7 Phase difference (Resonance search mode: Phase search only)
	2.2.8 Max. resonance dwelling rate (Resonance search mode: Phase search only) 2-6
2.3	Resonance Limit Condition
	2.3.1 Transmissibility
	2.3.2 Frequency (Resonance search mode: Amplitude search (normal) and (high-speed),
	Phase search)
2.4	Resonance Search Condition
	2.4.1 Shift judging of resonance frequency (Resonance search mode: Amplitude search
	(common))
	2.4.1.1 Re-searching time
	2.4.1.2 Transmissibility ratio
	2.4.2 Frequency step size
	2.4.3 Resonance frequency search range (Resonance search mode: Amplitude search
	(normal) only)
	2.4.3.1 Transmissibility
	2.4.3.2 Transmissibility ratio

2.4.3.3 Frequency 2.	-9
2.4.3.4 Frequency ratio 2.	-10
2.4.3.5 Searching range segment 2-	-10
2.4.4 Resonance frequency search range (Resonance search mode: Amplitude search (high	1-
speed) only)	-11
2.4.4.1 Maximum search range 2.	-11
2.4.4.2 Slope check range 2-	-11
2.4.4.3 Peak estimation condition 2-	-11
2.5 Q Factor	-11
2.6 Graph/Data save condition 2-	-12
2.6.1 Max time	-12
2.6.2 Time interval	-12
2.6.3 Time interval	-12
2.7 Operation Status	-13
2.8 Set Up	-16
2.9 Graph Kind Selection	-18
2.10 Graph Data Save	-19

Chapter 1 Resonance Dwell Test

1.1 Outline

Resonance Dwell Test requires Amplitude Search option.

Amplitude Search option requires Resonance Dwell option.

Two (2) major features of Amplitude Search option, in comparison with Resonance Dwell option, are as follows.

- Resonance Dwell test using <u>amplitude</u> is available^{*1}.
- <u>Time-series graphic</u> display of test history is available. Frequency-base graphic display of test history that Resonance Dwell option can offer is not available.

Using two (2) sensors, a controlling sensor and a monitoring sensor that checks on the resonating part of a specimen, Resonance Dwell Test detects the resonance frequency of the specimen and automatically allows dwelling to resonance point even when the resonance frequency varies.

Just before the implementation of Resonance Dwell Test, carry out Pre-sweep test (**Resonance Survey**) over the frequency range that includes resonance frequency. Then, make up a list of resonance frequency based on the measurement data of the sweep test (resonance search) and select the excitation frequency. Last of all, set the test conditions (excitation level, dwell time, etc.).

Start the test after the test definition is complete. Resonance dwelling operation (**Resonance Dwell**) is automatically performed and the test continues until the set time is up.

Resonance Dwell Test uses settings of the Pre-sweep test (**Resonance Survey**) without change and just requires setting of conditions specific to Resonance Dwell Test while normal SINE Test requires setting of I/O module configuration, excitation system information, basic and control conditions, excitation system setting, input channels, etc.

All the defined "Test" information can be saved as "Test File" in specified format.

If there is a previously saved "Test File" of defined "Test" information, a test can be executed only by loading the file.

Note) Resonance frequency may vary depending on the specimen-testing environment such as temperatures. Carry out Resonance Survey right before Resonance Dwell Test and determine an excitation frequency. It will help ensure accurate test results.

*1) In general, viscoelastic materials such as rubber have dynamic properties that change with temperature. In addition, the material itself may generate heat due to vibration. In the case of such materials, transmissibility and phase will change even during the test. To constantly excite at the resonance frequency, it is necessary to periodically re-search for the frequency at which the transmissibility peaks. Since the dynamic characteristics change during the re-search, the re-search time must be short to minimize this effect. The half-power bandwidth method requires sweeping over a wide frequency band, which takes too much time, so this system introduces a unique mechanism that can re-search the resonance frequency with the shortest excitation time. In addition, the Q factor of this system is not calculated by the half-power bandwidth method, but by a method suitable for viscoelastic materials that can be calculated in real time manner even during test.

1.1.1 Resonance Survey

Before executing Resonance Dwell, carry out a sweep test (**peak amplitude estimation: tracking**) in a proper frequency range covering resonance frequencies and measure the resonance frequencies. <u>It is always necessary to obtain the measurement data through a</u> <u>sweep test before executing Resonance Dwell. Note that some specimens may require</u> <u>Resonance Survey at the excitation level of Resonance Dwell Test in order to obtain</u> <u>measurement data.</u>

1.1.2 Resonance Search

Based on the measurement data obtained through the sweep test, frequencies meeting the prescribed resonance judgment criteria are list-displayed. An operator shall set the excitation reference by selecting a resonance frequency for Resonance Dwelling among list-displayed excitation target candidates.

1.1.3 Resonance Dwell

During resonance dwelling, the system automatically detects the resonance frequency of a specimen and adjusts the excitation frequency so that it coincides with the newly detected resonance frequency.

· Amplitude search

This is a method to newly search a resonance frequency by running sweep in a frequency range according to set conditions. Excitation is performed at the resonance point.

• Phase search

This is a method to perform excitation at a resonance point while maintaining a constant phase difference between the base channel and resonance search channel.

• Frequency fixing

This is a method to perform excitation at a peak frequency (resonance frequency) of transmissibility detected through pre-sweep.

1.2 Resonance Dwell (Resonance search mode: Amplitude search [Normal])

<Example>

This is an example of Resonance Dwell test as given below. [Fundamental / Control Condition (Resonance Survey)]

Peak amplitude estimation: Tracking



[Reference Pattern (Resonance Survey)]

[Pre-sweep test time]

Sweep time: 1.000 (octave/min)

Times of double sweep: 1 (single-sweep)

[Information of used sensors]

Two (2) piezoelectric acceleration pickups are used: one for control and other for monitoring. Ch1: Control, Sensitivity of $3pC/(m/s^2)$

Ch2: Monitoring, Sensitivity of $3pC/(m/s^2)$

This example is based on the assumption that the above information has been entered in Input Environment Information and the excitation system information such as rating has been registered in Excitation System Information as well.

[Resonance Search Condition]

Resonance judgment criteria: Transmissibility is 1.5 and over.

[Resonance Dwell Condition]

Resonance search mode: Amplitude search (Normal)

Resonance frequency: The first peak frequency extracted through Resonance Search is used. Excitation level: $20.0 \text{ (m/s}^2)$

Alarm upper:6.0 (dB)Alarm lower:-6.0 (dB)Abort lower limit:3.0 (dB)Alarm upper:-3.0 (dB)Dwell time:1 minuteTest time: No repetitionShift judging of resonance frequency:Transmissibility ratio is within -10% to 10%.Frequency step size:1.0 (Hz/s)Resonance frequency search range:Frequency ratio is $\pm 10\%$.

<Operation Procedure>

[Resonance Survey]

<Step 1>

Define above-mentioned [Reference Pattern (Resonance Survey)] and [Pre-sweep test time] according to "Chapter 3 Basing Operation Example" of the K2/SINE Instruction Manual, and measure resonance frequencies. (Peak Amplitude Estimation: Tracking)

<Step 2>

After "Excitation is completed (Test time is completed)" has appeared in Operation Status window of Presweep test, click [Test save] button.



<Step 3>

Go back to Test Definition. Then, exit K2/SINE with "Continuing excitation data" set (SET) in Test Definition Information.



[Resonance Search]

<Step 1>

Start K2/Resonance Dwell. Then, click [New] button.

File(F) C	peration(P)	Edit(E)	View(V)	Window(W)	Option(0) H
	FOR	EA.	40	7	-	5
New	Open	Test save	Data save	Correct	Print	Previe
Freque	ncy F	Reference	Resp	onse	Drive	_
	LI-				mV 0	
	Hz				mV ⁰	P

<Step 2>

Set the condition of "Resonance Judgment Criteria". Open the sweep test file saved in "Resonance Survey".

wee	p test file				_						
C:\U	sers\IMV\Documents\Pre	SineTest.swp	o2	Sele	ct(S)		100.0 ^{(m/s²}	²)/(m/s²)			
			1								
lo.	Frequency Phas	e Tra	ansmissibility	Q factor			10.0			ń	,
1	132.00 Hz 178.67	796	6.4849	6.4074					مر ا	$\sim \Lambda$	
2	252.00 Hz -109.04	451	14./041	14.670			1.0			\{ \{	
	. ** /	/					1.0	<	4	U V	
								\sim /			
	2					1	.000e-1	V			
						1	.000e-2				
							10.0 Hz		100.0	0 4	00.
hanı	nel settina					Be	sonance iudo	ment criteri	a		
)		Ch1		ei l			по (- 1	50	
base	criarinei	GIT		*		1	_ ų ractor		1	.ou ab	ove
Reso	nance search channel	Ch2		•			OR 🔿 A	ND			
							7 Transmissik	Jian	1	50 📥 .	
^p eak	. amplitude hysteresis ratio	[0.10					Jiiity		ab	ove
Reco	nance search mode	Amplitude :	search(normal)					ſ	ОК	Ca	ncel
1030	nance search mode			2000				L			197920
											_
							<u>کر</u>	<u>> </u>			

<Step 3>

When "Base Channel" and "Resonance Search Channel" are set, the transmissibility (Response data of Resonance Search Channel / response data of Base Channel) is calculated and peak frequencies that meet the resonance judgment criteria are list-displayed. Check that frequencies are list-displayed. Select "Resonance Search mode: Amplitude search (normal)". Click [OK] button.



<Step 4>

Press the button of [Next] to go to the next definition.



[Resonance Reference Definition]

<Step 1>

Note that all of peak frequencies list-displayed in [Resonance Search] are registered as excitation reference by default. Select an inappropriate Target element and uncheck the [Test target element] box. Then, click [Change] button to delete the corresponding peak frequency from the excitation reference list.



<Step 2>

Select a Target element that requires setting of Resonance Dwell conditions.

1 132.00 Hz 178.6796 6.4949 6.4074 5.0039 m/s ² .0 ₂ , 0.01:00 6.00 dB -6.00 2 252.00 Hz -109.0451 14.7041 14.670 5.1453 m/s ² .0 ₂ , 0.01:00 6.00 dB -6.00	ldB <u>3.00 dB</u> -3.00 dB ldB <u>3.00 dB</u> -3.00 dB
2 252.00 Hz -109.0451 14.7041 14.670 5.1453 m/s ² 0.p 0.01:00 6.00 dB -6.00	dB 3.00 dB -3.00 dB
Test larget element	Change(I

<Step 3> Set [Excitation level], [Alarm and Abort tolerance], [Dwell time] and [Test time].



<Step 4>

Set [Shift judging of resonance frequency], [Frequency step size] and [Resonance frequency searching range].

	0.00.10		
 Transmissibility ratio 	-10.0	10.0 🔹 %	
Frequency step size	1.0 + Hz/sec		
Resonance frequency searching	range	_ \	
💿 Transmissibility	3.0		
🔘 Transmissibility ratio 🕠 🗌	10.0 🔹 %		0
Frequency	1.00 * <==>	1000.00 🔺 Hz	
Frequency ratio +-	10.0 📩 Search	ning range segment(E)]	ndefined
		1	

<Step 5>

Click [Change] button to update the reference definition. Then, click [OK] button.

No.	Target element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit
2		132.00 Hz 252.00 Hz	178.6796 -109.0451	<u>6.4849</u> 14.7041	6.4074 14.670	5.0039 m/s² 0.p 5.1453 m/s² 0.p	0:01:00 0:01:00	6.00 dB 6.00 dB	-6.00 dB -6.00 dB	3.00 dB 3.00 dB	-3.00 dB -3.00 dB
] Test	target element						//				Change(C)
 Acc Abort 	Upper limit	elocity 🔘 Di	dB Alarm	20.0 🕎	m/s² 0-p	CALC(X)	Test time On	ce 🗸 🗸	eck	**	<u>*</u> /
	Lower limit	-6.00	dB	Lower limit	-3.00 🚔 dE					*	L)
Dwel	II time 0:01	:00 🍂 E	By time							Ľ	IJ
Reson	ance searching co	ondition					Q factor				
© F	judging of resonar Re-searching time	0:00:1	0				A=Transm	sqrt(A ² -	1.0 🌐)		
O T	ransmissibility ratio	-10.0) (****	10.0 📩 %			Resonance li	mit condition			
Freque	ency step size	1.0	Hz/sec				🕅 Transmis	sibility 1	(==>) ^ (0)	100.0	
Reso	onance frequency	searching range					Frequenc	y 1.0		1000.00 + Hz	◆
© T	ransmissibility		3.0					~ •			2
© T	ransmissibility ratio	· ·	10.0 * %								\sim
© F	requency		1.00	1000.00	Hz						
					10000					<i>p</i>	¥

<Step 6>

Press the button of [Next] to go to the next definition.

	🕋 Nev	w test definit	ion - K2	2/Reso	nanceDwe	ell		
	File(F)	Test definiti	ion(T)	Орег	ration(P)	Edit(E)	View(V)	Windo
		Part Part		D	Lb.			
	New	Open	Test :	save	Data save	Print	Preview	V Op
	Freq	juency	Refere	nce	Resp	onse	Drive	, <u> </u>

• <mark> </mark>		Hz					п	1V 0-р
Q		Test de	finitio	n				
X		Test D	efiniti	on	_	_	_	
	Next	Test	definiti	on inf	ormation			
		JI - S V	'O Mod	ule Co	onfiguratio	on		
	17/	' <mark>S</mark> E	xcitatio	n Syst	em Inform	nation		
		🧐 F	undam	ental/	Control Co	onditi		
	Change	- 🧐 E	xcitatio	n syst	em setting			
		_ ⊕.•{S) lr	nput ch	annel				

[Graph/Data save condition]

<Step 1>

It is imperative "Max time" and "Time interval" are set. Select 'Not save' and press the button of [OK].

	Graph/Data save condition	×
	O Save Not save	
*	Refer	
2	Save the test file name as a prefix.	
	Sequence number	
	Beginning value	
ث		
	Max. time 1 Hour	
	Time interval 1 Sec	-
	OK Cancel	

<Step 2>

The definition setting is complete.

Rew 1	test definition - K2/ResonanceDwell	View(0) Window(00) Ontion(0)					— C	×
New	Open Test save Data save Prin	t Preview Ope. start Ope. end	Start Retry	Stop Pause	Continue			
Frequ	ency Reference Response	Drive mV ≎∌	Peak Number		Drive	Limit Ala	arm Abort	ECO
	Test definition							
	Test Definition							x
Next Change	Test definition information V/O Module Configuration Vexitation System Information Excitation System Information Excitation system setting Safety check Safety check Peak frequency Resonance reference	Module Configuration Module ID 000 4ch 001 8ch I Excitation System Environme Exc. System Info. Sys Output channel	Module type I/O module TYPE II nput module TYPE II nt tem					
	Graph/Data save condition		Module ID	Ch	Polarity			
		Initial output voltage	000 30.0 mV ms	Ch1	Positive			
		Armature Mass	0.0 kg					
		Rating Information						~
		2021/ 3/10 06:20:09 Test defin	ition is completed.					
Test definit	tion is completed. Available to operate.					NUM	3/10/2021	06:22:33

<Test Save>

<Step 1>

Click [Test save] button.



<Step 2>

Enter file name. Then, click [Save] button.

Save in:	My Docume	nts	- G 🖸 🖻 🗔 -	
C.	TEST01.dwl	2	3	
ecent Places				
Desktop				
Libraries			***	
			•	۰ ۴
Computer				
Network	File name:	TEST01	<u>*</u>	Save
	Save as type:	Resonance test definition file	(*.dwl2) 🔹	Cancel
		-		557T

<Test Operation>

<Step 1>

Click [Ope.start] button.



<Step 2>

Click [Start] button.

Clicking the button automatically implements Initial loop check and Initial equalization, and executes a test.

C:\Users\IMV\Do	cuments\TEST02.dwl2	- K2/ResonanceD	well				
File(F) Operation(P) Edit(E) View(V)	Window(W) Or	otion(O) Help(H)				
New Open	Test save Data save	Correct Prir	nt Preview	Ope. start	Ope. end S	itart	Stop I
Frequency	Reference Res	ponse Driv	ve Elapsed tim	e Peak Numbe	er		
132.00	20.0	0.0	0.0 0:00:0	00 1 /	1	Stop	N
Hz	m/s² 0-p	m/s ^{20-p}	mV ⁰-₽				
Operation statu		ah					
Operation stat	IS						
Waiting for excita	ation start						
Frequency 132.0	0 Hz 20	13/07/25 4:45:12	PM				
Ref.(m/s ² 0-p)	Resp.(m/s ² 0-p) Drive(mV)				
20.0	0.0	0.0)				
Trans. amp.((m/ 0.0	/s²)/(m/s²))	Trans. phase(de 0.00	gree) Q-value	0			
Resonance sea	rch mode Amplitud	e search(fast)	Sto	р			

<Step 3>

When conditions of Shift judging of resonance frequency are complete, resonance re-search automatically starts to detect a new resonance point. Excitation at the new resonance point continues until the test time is over.

Note: Clicking [Retry] button → [Start] button to execute re-excitation after stopping excitation by clicking [Stop] button initializes all the data, resulting in re-excitation at a peak frequency set in Test definition. On the other hand, stopping excitation by using [Pause] button allows continuing excitation by clicking [Restart] button.

C:\Users\IMV	∧Documents\TE	ST01.dwl2 - K2/Res	onanceDwell						
File(F) Operati	ion(P) Edit(E)	View(V) Window	v(W) Option	(O) Help(H)					
New Or	pen Test save	Data save	et Print	Preview	Ope, start	Ope. end Start	Retry Stop	Pause	Restar
Frequency 132.00 Hz	Reference 20.(m/s²o	Response 19.9994 p m/s ²⁰⁻ p	Drive 994. (mV 0	Elapsed tii 6 0:00:	ne Peak Numb	er 1 Fb	king frequency	Drive	
Operation st	atus Respo	nse graph							
Operation s	tatus	- 10							
In excitation									
Frequency 13	32.00 Hz	2013/07/25	4:13:05 PM						
Ref.(m/s ² 0-p) 20.0) Resp 19	.(m/s² 0-p)).9994	Drive(mV) 994.6						
Trans. amp. 6.3	((m/s²)/(m/s²)) 3359	Trans. p	hase(degree 178.69	e) Q-valu 6.2565	e S				
Resonance s	search mode	Amplitude search	n(normal)	Fix	ing frequency				
Base channe Resonance s Elapsed time	el search channe e	Ch1 (000-C I Ch2 (000-C 0:00:10	ch1) ch2)						
Resonance e	element 1/1	0:00:10	1	341 cycle					
Check result	3 12277	Alarm	OK A	Abort (DK				
Real-time pro	ocessing CPU	load factor	0.97 %						
Reference/R	esponse data								
Ac	celeration	Velocity	Di	splacement					

<Step 4>

Clicking [Ope.end] button brings you back to Test definition mode.

C:\Users\IMV	∧Documents\TE	ST01.dwl2 - K2/Res	onanceDwell				
File(F) Operat	ion(P) Edit(E)	View(V) Window	w(W) Option(O) Help(H)			
		1		R	E X		
I New Or	pen Test save	Data save Corre	et Print P	review	Ope. start Ope. end	Start Ketry	1 20
Frequency	Reference	Response	Drive	Elapsed time	Peak Number		
132.00	20.0	19.9995	1000.5	0:01:00	1 / 1	Stop	
Hz	m/s²0	-p m/s²0-p	mV 0-p			000	
Operation st	atus Respo	nse graph				· A	
Operation s	tatus		_	_		U	
Excitation is o	completed. (Te	est time is comple	eted.)				
Frequency 13	32.00 Hz	2013/07/25	54:13:56 PM				
Ref.(m/s ² 0-p) 20.0) Resp 19	о.(m/s² 0-р) 9.9995	Drive(mV) 1000.5				
Trans. amp. 6.3	((m/s²)/(m/s²)) 3376	Trans. p	ohase(degree) 178.63	Q-value			
Resonance s	search mode	Amplitude search	n(normal)	Stop			

<Graph Data Save>

When saving of graph data during excitation, operate as the below;

<Step 1>

Select [Save graph data] in the menu bar.



<Step 2>

Enter file name. Then, click [Save] button.

Save As					
Save in:	My Docume	nts	- (3 🤣 📂 🛄 -	
Recent Places	TEST01001, TEST01002, TEST01003, TEST01004, TEST01004,	vdf2 vdf2 vdf2 vdf2 vdf2 vdf2			
Desktop		1212			
Libraries					
Computer					
					Ø
Network	File name:	TestData		•	Save
	Save as type:	Excitation data file(*.vdf2)		•	Cancel
	Comment	-			

1.3 Resonance Dwell (Resonance search mode: Amplitude search [High speed])

<Example>

This is an example of Resonance Dwell test as given below. [Fundamental / Control Condition (Resonance Survey)]

Peak amplitude estimation: Tracking



[Reference Pattern (Resonance Survey)]

[Pre-sweep test time]

Sweep time: 1.000 (octave/min)

Times of double sweep: 1 (single-sweep)

[Information of used sensors]

Two (2) piezoelectric acceleration pickups are used: one for control and other for monitoring.

Ch1: Control, Sensitivity of $3pC/(m/s^2)$

Ch2: Monitoring, Sensitivity of 3pC/(m/s²)

This example is based on the assumption that the above information has been entered in Input Environment Information and the excitation system information such as rating has been registered in Excitation System Information as well.

[Resonance Search Condition]

Resonance judgment criteria: Transmissibility is 1.5 and over.

[Resonance Dwell Condition]

Resonance search mode: Amplitude search (High speed)

Resonance frequency: The first peak frequency extracted through Resonance Search is used. Excitation level: $20.0 \text{ (m/s}^2)$

	, , , , , , , , , , , , , , , , , , ,			
Alarm upper:	6.0 (dB)	Alarm lower:	-6.0 (dB)	
Abort lower limit:	3.0 (dB)	Alarm upper:	-3.0 (dB)	
Dwell time:	1 minute	Test time: No repet	tition	
Shift judging of res	onance frequency	: Transmissibility ra	atio is within -10%	to 10%.
		Frequency step size	ze: 5.0 (Hz/s)	
		Resonance freque	ncy search range:	Max. searching range
		Frequency ratio: ±	± 40% Slope check	Frequency ratio:
		Frequency ratio 5	%.	
		Peak condition	Peak amplitude H	ysteresis ratio: 2%

<Operation Procedure>

[Resonance Survey]

<Step 1>

Define above-mentioned [Reference Pattern (Resonance Survey)] and [Pre-sweep test time] according to "Chapter 3 Basing Operation Example" of the K2/SINE Instruction Manual, and measure resonance frequencies. (Peak Amplitude Estimation: Tracking)

<Step 2>

After "Excitation is completed (Test time is completed)" has appeared in Operation Status window of Presweep test, click [Test save] button.



<Step 3>

Go back to Test Definition. Then, exit K2/SINE with "Continuing excitation data" set (SET) in Test Definition Information.



[Resonance Search]

<Step 1>

Start K2/ResonanceDwell. Then, click [New] button.

File(F) Op	eration(P) Edit	(E) View(V)	Window(V	V) Option(O) H
	FRA T	3 49	1	5	0
New	Open Tests	avel Data sav	e Correct	Print P	reviev
Frequenc	oyReferen	ice Re	sponse	Drive	
1	Hz			mV ⁰-₽	

<Step 2>

Set the condition of "Resonance Judgment Criteria". Open the sweep test file saved in "Resonance Survey".

Sweep test file			
C:\Users\IMV\Documents\Pr	eSineTest.swp2	Select(S)	100.0 (m/s²)/(m/s²)
No. Frequency Pha 1 132.00 Hz 178.6 2 252.00 Hz -109.0	se Transmissibility 796 6.4849 1451 14.7041	Q factor 6.4074 14.670	10.0 1.0 1.000e-1 1.000e-2 10.0 Hz 100.0 400.0
Channel setting			Resonance judgment criteria
Base channel	Ch1	•	Q factor 1.50 above
Resonance search channel	Ch2		OR O AND
Peak amplitude hysteresis ratio	0.10		Transmissibility 1.50 🚔 above
Resonance search mode	Amplitude search(normal)		OK Cancel

<Step 3>

When "Base Channel" and "Resonance Search Channel" are set, the transmissibility (Response data of Resonance Search Channel / response data of Base Channel) is calculated and peak frequencies that meet the resonance judgment criteria are list-displayed. Check that frequencies are list-displayed. Select "Resonance Search mode: Amplitude search (High speed)". Click [OK] button.

? X Peak frequency Sweep test file C:\Users\IMV\Documents\PreSineTest.swp2 100.0 (m/s²)/(m/s²) Select(S) Q factor No. Frequency Phase Transmissibility 10.0 132.00 Hz 178.6796 6.4849 6.4074 1 2 14.7041 252.00 Hz -109.045114.670 1.0 1.000e-1 1.000e-2 10.0 Hz 100.0 400.0 Channel setting Resonance judgment criteria Ch1 above Base channel 🔲 Q factor 1.50 Resonance search channel Ch2 💿 OR 🛛 🔘 AND 1.50 🌲 above V Transmissibility 0.10 Peak amplitude hysteresis ratio 0K Resonance search mode Amplitude search(fast) Cancel •

<Step 4>

Press the button of [Next] to go to the next definition.



[Resonance Reference Definition]

<Step 1>

Note that all of peak frequencies list-displayed in [Resonance Search] are registered as excitation reference by default. Select an inappropriate Target element and uncheck the [Test target element] box. Then, click [Change] button to delete the corresponding peak frequency from the excitation reference list.

	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit
•	132.00 Hz	178.6796	6.4849	6.4074	5.0039 m/s ² 0-p	0:01:00	6.00 dB	-6.00 dB	3.00 dB	-3.00 dB
			1							
arget element]					0				Change(
elevirion 💿 V Upper Imit	elocity 🔘 Di	splacement	5.1453 🌲 , Jpper limit	n/s² 0-p 3.00 ♀ JE		V Alarm chec	sk 🔽 Lower limit ch	eck		
\ -	-6.00	dB l	.ower limit	-3.00 🜲 de						/
Lower limit			200		\					1
Lower limit	:00 🔺 E	ly time								/

<Step 2>

Select a Target element that requires setting of Resonance Dwell conditions.

0.	Target element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alam lower limit
	*	132.00 Hz	178.6796	6.4849	6.4074	5.0039 m/s² ()-p	0:01:00	6.00 dB	-6.00 dB	3.00 dB	-3.00 dB
2		252.00 Hz	-109.0451	14.7041	14.670	5.1453 m/s ² 0-p	0:01:00	6.00 dB	-6.00 dB	3.00 dB	-3.00 dB
											Change(C)

<Step 3>

Set [Excitation level], [Alarm and Abort tolerance], [Dwell time] and [Test time].



<Step 4>

Set [Shift judging of resonance frequency], [Frequency step size] and [Resonance frequency searching range].

	Shift judging of resonance frequency Re-searching time 0:00:10
•• /	▼ (Transmissibility ratio -10.0 + <==> 10.0 + ½
	Frequency step size 5.0 Hz/sec
-	Resonance frequency searching range Max. searching range Frequency ratio +- 10.0 🚔 🐒
	Slope check range Frequency ratio 5.0 🚔 %
	Peak estimation condition Peak amplitude hysteresis ratio

<Step 5>

Click [Change] button to update the reference definition. Then, click [OK] button.

rarget element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit
	132.00 Hz 252.00 Hz	178.6796 -109.0451	6.4849 14.7041	<u>6.4074</u> 14.670	20.0 m/s² _{0-p} 5.1453 m/s² 0-p	0:01:00 0:01:00	6.00 dB 6.00 dB	-6.00 dB -6.00 dB	3.00 dB 3.00 dB	-3.00 dB -3.00 dB
ist target element vcceleration (*) rt Upper limit	Velocity 💿 Dis 6.00 🖨	splacement dB Alarm I	20.0 💌 Upper limit	m/s² 0-p □ 3.00 🐳 dB	ALCX)	♥ Alarm chec Test time Or	k 👿 Lower limit ch	eck		Change(C)
Lower limit well time	-6.00 🖨 D1:00 👘 B	dB I	Lower limit	-3.00 🚔 dB					1	ノ
sonance searching	condition					Q factor				
hift judging of resor	ance frequency					🔲 Q factor	= sqrt(A ² .	1.0 🗼)		
Re-searching tim	e 0:00:10	ō 🚑				A=Transr	nissibility			
Transmissibility ratio	itio -10.0) 🌲 <==>	10.0 🔔 🐒			Beconarco	imit condition			
anuonou aton aina	50]				Transmis	sihilitu 1	.0 (100.0	
equency step size	u coprobing range	Hz/sec								
May searching ron	y soaroning rafige					Frequen	cy 1.		1000.00 + Hz	
Frequency ratio	go +-	10.0 🌲 🕺								
Slope check range		-								
Frequency ratio		5.0 🌲 %								
Peak estimation co	ndition	2	0 🛋 🦏						ОК	Cancel
	1.90000000010000		· · · · ·							R
r cak ampikado										

<Step 6>

Press the button of [Next] to go to the next definition.

	🔝 Nev	v test definiti	on - K2/Res	onanceDw	ell		
	File(F)	Test definiti	on(T) Op	eration(P)	Edit(E)	View(V)	Windo
	V	For the second		Lb.			
	New	Open	Test save	Data save	Print	Preview	v Op
	Freq	uency	Reference	Resp	onse	Drive	
		Hz				n	nV ⁰-p
\sim		Test de	finition				
1		Test De	efinition				
	Next	Test o	definition in	formation			
		§ ⊭	O Module O	Configuratio	on		
	17	' – 🔮 Đ	citation Sys	tem Inform	nation		
		- S Fi	undamental	/Control C	onditi		
	Change	- II - 🧐 Đ	citation sys	tem setting			
		- ⊕- (S) In	iput channe				

[Graph/Data save condition]

<Step 1>

It is imperative "Max time" and "Time interval" are set. Select 'Not save' and press the button of [OK].

	Graph/Data save condition	×
	○ Save ● Not save	
	Specify destination folder	
•	Refer	1
2	Save the test file name as a prefix.	
	Sequence number	
	Beginning value	
	Min. digits number	1
	Save at testing completion.	
	Max. time 1 🚔 Hour	3
	Time interval	
	OK Cancel	

<Step 2>

The definition setting is complete.

New test definition - K2/ResonanceDwell File(F) Test definition(T) Operation(P) Edit(F)	View(V) Window(W) Option(Q)	Help(H)				-	0 ×
New Open Test save Data save Print	Preview Ope. start Ope. end	Start Retry	Stop Pause	Continue			
Frequency Reference Response	Drive mVoe	Peak Number		Drive		Alarm Abort	EC0
Test definition							×
Next S Test definition Change S Test definition information S Test definition information S Location System Information S Excitation System Setting S Information S S Excitation System Setting S S Expt check S Peak frequency S Resonance reference S Graph/Data save condition	Module Configuration Module ID 000 4ch I 001 8ch Ir Excitation System Environmer Exc. System Info. Sys Output channel Initial output voltage Armature Mass Rating Information	Module type /O module TYPE II iput module TYPE II it tem Module ID 000 30.0 mV ms 0.0 kg	Ch Ch1	Polarity Positive			~
Test definition is completed. Available to operate.					NUM	3/10/202	1 06:22:33

<Test Save> <Step 1>

Click [Test save] button.



<Step 2>

Enter file name. Then, click [Save] button.

	-		
Save in	: 📗 My Docume	nts 🔻 🎯 🗗 📴 🛄 🔻	
e.	TEST01.dwl	2	
Recent Places			
Desktop			
Libraries			
		***	*
Computer		*	× C
0			
Network	File name:	TEST02	• Save
	Save as type:	Resonance test definition file(*.dwl2)	▼ Cancel
	Comment		

<Test Operation>

<Step 1>

Click [Ope. Start] button.



<Step 2>

Click [Start] button.

Clicking the button automatically implements Initial loop check and Initial equalization, and executes a test.

C:\Users\IMV\Do	ocuments\TEST02.dwl2	- K2/ResonanceDwe	211				
File(F) Operation(P) Edit(E) View(V)	Window(W) Opti	ion(O) Help(H)				
New Open	Test save Data save	Correct Print	Preview	Ope. start Ope. end	Start	Stop I	
Frequency	Reference Res	ponse Drive	Elapsed time	Peak Number			
132.00	20.0	0.0	0.0 0:00:00) 1 / 1	Stop	*	Ê
Operation statu Operation statu	IS Response gra	bh					C
Waiting for excita	ation start	3					
Frequency 132.0	0 Hz 20	13/07/25 4:45:12 PI	M				
Ref.(m/s ² 0-p)	Resp.(m/s ² 0-p) Drive(m	IV)				
20.0	0.0	0.0					
Trans. amp.((m/ 0.0	/s²)/(m/s²))	Trans. phase(deg 0.00	ree) Q-value				
Resonance sea	rch mode Amplitud	e search(fast)	Stop				

<Step 3>

When conditions of Shift judging of resonance frequency are complete, resonance re-search automatically starts to detect a new resonance point. Excitation at the new resonance point continues until the test time is over.

Note) Clicking [Retry] button → [Start] button to execute re-excitation after stopping excitation by clicking [Stop] button initializes all the data, resulting in re-excitation at a peak frequency set in Test definition. On the other hand, stopping excitation by using [Pause] button allows continuing excitation by clicking [Restart] button.

C:\Users\IMV\Documents\TEST02.c File(F) Operation(P) Edit(E) View	dwl2 - K2/ResonanceDwell /(V) Window(W) Optic	l on(O) Help(H)					
New Open Test save Data	save Correct Print	Preview	Ope. start Ope. end	Start Retry Stop	Pause	Restart	
Frequency Reference	Response Drive 20.0068 994 m/s²ºp m³	Elapsed time 0:00:03 / 0-p	Peak Number	Fixing frequency	Drive	Limit Alarm	Abort
Operation status Response g	graph						
Operation status							
Frequency 132.00 Hz Ref.(m/s² 0-p) Resp.(m/s² 20.0 20.0068	2013/07/25 4:46:32 PM ² 0 _' P) Drive(mV 3 994.2	1 /)					
Trans. amp.((m/s²)/(m/s²)) 6.3587	Trans. phase(degre 179.07	ee) Q-value 6.2796					
Resonance search mode Ampli	itude search(fast)	Fixing fre	quency				
Base channel Resonance search channel Elapsed time	Ch1 (000-Ch1) Ch2 (000-Ch2) 0:00:03						
Resonance element 1/1 Check result Real-time processing CPU load	0:00:03 Alarm OK factor 1.00 %	449 cycle Abort OK					
Poforonco/Pocnonco data							
Acceleration	Velocity [Displacement					
(m/s ²)	(m/s)	(mm)					
Ref. 20.0	2.411e-2	5.815e-2					
Resp. 20.0068	2.412e-2	5.817e-2					

<Step 4>

Clicking [Ope. end] button brings you back to Test definition mode.

C:\Users\IMV\Documents	TEST02.dwl2 - K2/Reson	anceDwell				
File(F) Operation(P) Edit((E) View(V) Window(V	V) Option(O)	Help(H)			
New Open Test sa	ave Data save Correct	Print Pre	Niew 1	Ope. start Ope. end	Start	Retry Stop
Frequency Reference	ce Response	Drive	Elapsed time	Peak Number		
132.00 20	0.0 20.0005	1003.6 mV 0-p	0:01:00	1 / 1		Stop
Operation status Res Operation status	sponse graph				<u> </u>	9
Excitation is completed.	(Test time is complete	d.)				
Frequency 132.00 Hz	2013/07/25 4	47:30 PM				
Ref.(m/s²0-p) Re 20.0	esp.(m/s² 0-p) 20.0005	Drive(mV) 1003.6				
Trans. amp.((m/s²)/(m/s 6.3582	²)) Trans. pha 17	ise(degree) 9.03	Q-value			
Resonance search mod	le Amplitude search(fa	ast)	Stop			
Rase channel	Ch1 (000-Ch1)				

1.4 Resonance Dwell (Resonance search mode: Phase Search)

<Example>

This is an example of Resonance Dwell test as given below. [Fundamental / Control Condition (Resonance Survey)]

Peak amplitude estimation: Tracking



[Reference Pattern (Resonance Survey)]

[Pre-sweep test time]

Sweep time: 1.000 (octave/min)

Times of double sweep: 1 (single-sweep)

[Information of used sensors]

Two (2) piezoelectric acceleration pickups are used: one for control and other for monitoring.

Ch1: Control, Sensitivity of 3pC/(m/s²)

Ch2: Monitoring, Sensitivity of 3pC/(m/s²)

This example is based on the assumption that the above information has been entered in Input Environment Information and the excitation system information such as rating has been registered in Excitation System Information as well.

[Resonance Search Condition]

Resonance judgment criteria: Transmissibility is 1.5 and over.

[Resonance Dwell Condition]

Resonance search mode: Phase Search

Resonance frequency: The first peak frequency extracted through Resonance Search is used. Excitation level: 20.0 (m/s²)

Phase difference: Use results of Pre-sweep without change.

		1	e
Alarm upper:	6.0 (dB)	Alarm lower:	-6.0 (dB)
Abort lower limit:	3.0 (dB)	Alarm upper:	-3.0 (dB)
Dwell time:	1 minute	Test time: No rep	petition

Max. resonance dwelling rate: Normal

<Operation Procedure>

[Resonance Survey]

<Step 1>

Define above-mentioned [Reference Pattern (Resonance Survey)] and [Pre-sweep test time] according to "Chapter 3 Basing Operation Example" of the K2/SINE Instruction Manual, and measure resonance frequencies. (Peak Amplitude Estimation: Tracking)

<Step 2>

After "Excitation is completed (Test time is completed)" has appeared in Operation Status window of Presweep test, click [Test save] button.



<Step 3>

Go back to Test Definition. Then, exit K2/SINE with "Continuing excitation data" set (SET) in Test Definition Information.

Frequer	icy Reference	Response	Drive	
Ð	Hz Test definition F Test Definition	leference	mV ûp	
Next Change	S Test Definition Inf S I/O Module C S Excitation Syst C S Fundamental/ S Excitation syst C S Sweep referen S Sweep referen Resonance dw Aux. output Data Save Cor	formation onfiguration tem Information (Control Conditi tem setting tee vell	Sweep mode Sweep direction Sweep rate Sweep pause time Test time Internal record Manual Sweep profile	
	S Continuing ex	citation data	Frequency range Acc.	1(

[Resonance Search]

<Step 1>

Start K2/ResonanceDwell. Then, click [New] button.

File(F) Operatio	n(P) Edit(E)	View(V) Windov	v(W) Option(O)	Help
		40 7/		-
New Ope	n Test save	Data save Correc	t Print Pri	eview
Frequency	Reference	Response	Drive	

<Step 2>

Set the condition of "Resonance Judgment Criteria". Open the sweep test file saved in "Resonance Survey".

ak freque	ency				8
Sweep te	est file				
C:\Users	s\IMV\Documents\Pre	SineTest.swp2	Selec	ot(S)	100.0 (m/s²)/(m/s²)
		N			
No. F	requency Phas	e Transmissibility	Q factor		
1 1	132.00 Hz 178.67 252 00 Hz -109 04	96 6.4849 14 7041	6.4074 14.670		$\sim 10^{-10}$
			11.070		1.0
		000			\sim / \sim
		A matrix			1,000e-1
		2			
		_			1.000-2
					10.0 Hz 100.0 400.0
Channel	settina				Besonance judgment criteria
Dava ala		Ch1			
Dase cri	annei	un			above
Resonar	nce search channel	Ch2	•		💿 OR 🔘 AND
		-			Transmissibility
Peak am	nplitude hysteresis ratio	0.10			
Resonar	nce search mode	Amplitude search(norma	al) 🖵		OK Cancel
		91			
					•́
					1

<Step 3>

When "Base Channel" and "Resonance Search Channel" are set, the transmissibility (Response data of Resonance Search Channel 1 / response data of Base Channel) is calculated and peak frequencies that meet the resonance judgment criteria are list-displayed. Check that frequencies are list-displayed. Select "Resonance Search mode: Phase search". Click [OK] button.



<Step 4>

Press the button of [Next] to go to the next definition.



[Resonance Reference Definition]

<Step 1>

Note that all of peak frequencies list-displayed in [Resonance Search] are registered as excitation reference by default. Select an inappropriate Target element and uncheck the [Test target element] box. Then, click [Change] button to delete the corresponding peak frequency from the excitation reference list.



<Step 2>

Select a Target element that requires setting of Resonance Dwell conditions.

No. Target element Frequency Phase Transmissibility Q factor Level Dwell time Abort upper limit Alarm upper limit
1 - 122.00 Hz 172.6796 6.4849 6.4074 5.0038 m/s² 0p 0.01.00 6.00.48 -6.00.48 3.00.48 2 2 252.00 Hz -109.0451 14.7041 14.670 5.1453 m/s² 0p 0.01.00 6.00.48 -6.00.48 3.00.48
7 Test target element

<Step 3>

Set [Excitation level], [Phase difference], [Alarm and Abort tolerance], [Dwell time] [Max. resonance dwelling rate] and [Test time].



<Step 4>

Click [Change] button to update the reference definition. Then, click [OK] button.

. Target element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit
2	132.00 Hz 252.00 Hz	178.6796 -109.0451	6.4849 14.7041	6.4074 14.670	20.0 m/s² 0 ₁₀ 5.1453 m/s² 0 ₁ p	0:01:00 0:01:00	6.00 dB 6.00 dB	-6.00 dB -6.00 dB	3.00 dB 3.00 dB	3.00 dB -3.00 dB
st target element										
Acceleration 💿 Velo	ocity 🔘 Displac	ement	20.0 🔹 m/s² 0-p		📝 Alarm che	ck 📝 Check I	oy lower limit			
hase difference	178.68	degree			Test time C	Ince	•			
ort Upper limit	6.00 🌲	dB Alarm	Upper limit	3.00 🖨 dB						
Lower limit	-6.00 🌲	dB	Lower limit	-3.00 🗘 dB						
well time	0:01:00	By time	•		Q factor					
ax.resonance dwelling	rate Normal	• [0.10	%Лоор	🔲 Q factor	sqrt(A ² .	1.0 👘)			
					A = Trans	smissibility				
					Resonance I	imit condition				
					🥅 Transmis	sibility	1.0 × <==>	100.0		
					🕅 Frequen	су 🗌	1.00	1000.00 + Ha		
										OK

<Step 5>

Press the button of [Next] to go to the next definition.



[Graph/Data save condition]

<Step 1>

It is imperative "Max time" and "Time interval" are set. Select 'Not save' and press the button of [OK].

		~
	Graph/Data save condition	^
	O Save Not save	
	Refer	
2	Save the test file name as a prefix.	
	Sequence number	
	Min. digits number 3	
	Save at testing completion.	· · A
	Max. time 1 🛉 Hour	3
	Time interval 1 🔹 Sec	
	OK Cancel	

<Step 2>

The definition setting is complete.



<Test Save>

<Step 1>

Click [Test save] button.



<Step 2>

Enter file name. Then, click [Save] button.

Save As			— ×
Save in:	My Docume	its 👻 🤤 🗊 🔻	
Recent Places	TEST01.dwl		
Desktop			
Libraries		*	
Computer			2
Network	File name:	TEST03	Save
	Save as type:	Resonance test definition file(*.dwl2)	▼ Cancel
	Comment		•
			Ŧ

<Test Operation>

<Step 1>

Click [Ope. Start] button.



<Step 2>

Click [Start] button.

Clicking the button automatically implements Initial loop check and Initial equalization, and executes a test.

C:\Users	s\IMV\Doc	uments\TE	ST03.dwl2 -	K2/Resona	nceDwell								
File(F) O	peration(P)) Edit(E)	View(V)	Window(W) Optio	n(O) Helj	o(H)						
New	Open	Test save	Data save	Correct	Print	Preview		Ope. start	Ope. end	Start	Retry	Stop	
Frequer	ncy I	Reference	Respo	onse	Drive	Elap	sed time	Peak Numbe	n			Ť	
132	.00	20.0		0.0	0	.0 0:	00:00	1 /	1		Stop	\Box	
Operatio Operatio	on status on status	Respo s	nse grapl	1						_	_	_	
Waiting	for excitat	ion start											
Frequen	cy 132.00	Hz	201	3/07/25 4:5	59:51 PM								
Ref.(m/s 20.0	з ² 0-р))	Resp	.(m/s² 0-p) 0.0	[Drive(mV 0.0	0							
Trans. a	amp.((m/s 0.0	²)/(m/s²))	Т	rans. pha: 0.	se(degre 00	e) Q·	value						
Resonal	nce searc	ch mode l	Phase sea	arch			Stop						

<Step 3>

After excitation starts, the system continues Resonance dwelling while adjusting the excitation frequency in such a way that the phase difference registered in the "Resonance reference definition" dialog is satisfied.

Note: Clicking [Retry] button → [Start] button to execute re-excitation after stopping excitation by clicking [Stop] button initializes all the data, resulting in re-excitation at a peak frequency set in Test definition. On the other hand, stopping excitation by using [Pause] button allows continuing excitation by clicking [Restart] button.

C:\Users\IMV\Documents\TEST0	3.dwl2 - K2/ResonanceDwell	
File(F) Operation(P) Edit(E) Vie	w(V) Window(W) Option(O) Help(H)	
New Open Test save Dat	a save Correct Print Preview Preview	Pause Restart
Frequency Reference 132.72 20.0 Hz m/s²≎e	Response Drive Elapsed time Peak Number 19.9989 1005.1 0:00:04 1 / 1 m/s²º·p m/v·p 1 / 1 1	Drive Limit
Operation status Response	graph	
Operation status		
In excitation		
Frequency 132.72 Hz	2013/07/25 5:00:36 PM	
Ref.(m/s ² 0-p) Resp.(m/ 20.0 19.99	s ² 0 _p) Drive(mV) 39 1005.1	
Trans. amp.((m/s²)/(m/s²)) 6.3993	Trans. phase(degree) Q-value 178.67 6.3207	
Resonance search mode Pha	se search Dwelling	
Base channel	Ch1 (000-Ch1)	
Resonance search channel Elapsed time	Ch2 (000-Ch2) 0:00:04	
Resonance element 1/1	0:00:04 577 cycle	
Check result	Alarm OK Abort OK	
Real-time processing CPU loa	d factor 1.01 %	

<Step 4>

Clicking [Ope. end] button brings you back to Test definition mode.

C:\Users\IMV\Documents\TEST03	3.dwl2 - K2/ResonanceDwe	11		
File(F) Operation(P) Edit(E) Vie	w(V) Window(W) Opti	on(O) Help(H)		
New Open Test save Dat	ta save Correct Print	Preview	Ope. start Ope. end	Retry Stop Pause Res
Frequency Reference 131.95 20.0 Hz m/s²09	Response Drive 20.0027 1003 m/s²0-p m	Elapsed time 8.5 0:01:00	Peak Number	Drive Li
Operation status Response	graph			
Operation status				
Excitation is completed. (Test ti	me is completed.)			
Frequency 131.95 Hz	2013/07/25 5:01:33 PI	N		
Ref.(m/s ² 0-p) Resp.(m/ 20.0 20.002	's² 0-p) Drive(m 27 1008.5	Ś		
Trans. amp.((m/s²)/(m/s²)) 6.3836	Trans. phase(degi 178.68	ree) Q-value		
Resonance search mode Pha	se search	Stop		
Base channel	Ch1 (000-Ch1)			
Resonance search channel	Ch2 (000-Ch2)			
Elapsed time	0:01:00			
Resonance element 1/1	0:01:00	7950 cycle		
Check result	Alarm OK	Abort OK		
Real-time processing CPU load	d factor 1.04 %			

1.5 Resonance Dwell (Resonance search mode: Frequency fixing)

<Example>

This is an example of Resonance Dwell test as given below. [Fundamental / Control Condition (Resonance Survey)]

Peak amplitude estimation: Tracking



[Reference Pattern (Resonance Survey)]

[Pre-sweep test time]

Sweep time: 1.000 (octave/min)

Times of double sweep: 1 (single-sweep)

[Information of used sensors]

Two (2) piezoelectric acceleration pickups are used: one for control and other for monitoring.

Ch1: Control, Sensitivity of $3pC/(m/s^2)$

Ch2: Monitoring, Sensitivity of 3pC/(m/s²)

This example is based on the assumption that the above information has been entered in Input

Environment Information and the excitation system information such as rating has been registered in Excitation System Information as well.

[Resonance Search Condition]

Resonance judgment criteria: Transmissibility is 1.5 and over.

[Resonance Dwell Condition]

Resonance search mode: Frequency fixing

Resonance frequency: The first peak frequency extracted through Resonance Search is used.

Excitation level: 20.0 (m/s^2)

Alarm upper:	6.0 (dB)	Alarm lower:	-6.0 (dB)
Abort lower limit:	3.0 (dB)	Alarm upper:	-3.0 (dB)
Dwell time:	1 minute	Test time: No rep	oetition

<Operation Procedure>

[Resonance Survey]

<Step 1>

Define above-mentioned [Reference Pattern (Resonance Survey)] and [Pre-sweep test time] according to "Chapter 3 Basing Operation Example" of the K2/SINE Instruction Manual, and measure resonance frequencies. (Peak Amplitude Estimation: Tracking)

<Step 2>

After "Excitation is completed (Test time is completed)" has appeared in Operation Status window of Presweep test, click [Test save] button.

🔐 PreSi	neTest.swp2 - K2/S	öine						
File(F)	Test definition(T)	Operation(P)	Edit(E)	View(V)	Window(W) Option(O) Help(H)	
			4			W	Ŗ	X
i ivev	opie O	pen Test save	Data sav	e Print	Preview	Report	[] Opel start	Ope. end
Freq	Refere	ence Resp	ionse	Drive	Elap	osed time	Vibration Cycle	
	700.00	10.0 9	.9974		30.0	0:00:37	2119	
	Hz m	/s² 0-p n	n/s² 0-p	m∖	0-р		cycle	
1	Reference/	Response 0	peration	n status				
Ę	Operation	status						
Next	Excitation is	completed. (T	est time i	s comple	eted.)			
	Frequency	700.00 Hz	2	013/07/2	5 9:06:01 AN	Λ		
	Ref.(m/s ² 0 ₁	b) Res	p.(m/s² 0-	p)	Drive(m)	S)		
Change	10.0		9.9974		30.0			
change	Elapsed tim	e 0:00:37	2	119 cycle	15			
3	Sweep F	Forward(F)	1/1	single-sv	veep			
EL.	Manual	0.00 dB	Sweep	rate mag	nification	1.0		
Add	Check resul	t	A	larm	OK	Abort	OK	

<Step 3>

Go back to Test Definition. Then, exit K2/SINE with "Continuing excitation data" set (SET) in Test Definition Information.



[Resonance Search]

<Step 1>

Start K2/ResonanceDwell. Then, click [New] button.

1	File(F)	Operation(P) Edit(E)	View(V)	Window(W)	Option(O)	Help(H
14444		FOR	EA.	Lyla			3
\langle	New	Open	Test save	Data save	Correct	Print Pr	review
ן ו	Freq	uency	Reference	Resp	onse	Drive	
		Цъ				mV (La	
4							

<Step 2>

Set the condition of "Resonance Judgment Criteria". Open the sweep test file saved in "Resonance Survey".

Peak frequency			
Sweep test file			
C:\Users\IMV\Documents\	PreSineTest.swp2	Select(S)	100.0 (m/s²)/(m/s²)
No. Frequency PI 1 132.00 Hz 178 2 252.00 Hz -103	hase Transmissibili 6796 6.4849 14.7041 ↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓	ty Q factor 6.4074 14.670	10.0 1.0 1.000e-1 1.000e-2 10.0 Hz 100.0 400.0
Channel setting			Resonance judgment criteria
Base channel	Ch1	-	🕅 Q factor 1.50 🚔 above
Resonance search channel	Ch2	*	I OR O AND
Peak amplitude hysteresis ra	tio 0.10	*	Transmissibility 1.50 above
Resonance search mode	Amplitude search(non	mal) 👻	OK Cancel

<Step 3>

When "Base Channel" and "Resonance Search Channel" are set, the transmissibility (Response data of Resonance Search Channel / response data of Base Channel) is calculated and peak frequencies that meet the resonance judgment criteria are list-displayed. Check that frequencies are list-displayed. Select "Resonance Search mode: Frequency fixing". Click [OK] button.



<Step 4>

Press the button of [Next] to go to the next definition.



[Resonance Reference Definition]

<Step 1>

Note that all of peak frequencies list-displayed in [Resonance Search] are registered as excitation reference by default. Select an inappropriate Target element and uncheck the [Test target element] box. Then, click [Change] button to delete the corresponding peak frequency from the excitation reference list.



<Step 2>

Select a Target element that requires setting of Resonance Dwell conditions.

1	riequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit	
	 132.00 Hz	178.6796	6.4849	6.4074	5.0039 m/s ² 0-o	0:01:00	6.00 dB	-6.00 dB	3.00 dB	-3.00 dB	
2	252.00 Hz	-109.0451	14.7041	14.670	5.1453 m/s² _{0-p}	0:01:00	6.00 dB	-6.00 dB	3.00 dB	-3.00 dB	
T											Changel

<Step 3> Set [Excitation level], [Alarm and Abort tolerance], [Dwell time] and [Test time].



<Step 4>

Click [Change] button to update the reference definition. Then, click [OK] button.

No. Target elemen	t Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit	
2	132.00 Hz 252.00 Hz	178,6796 -109.0451	6.4849 14.7041	6.4074 14.670	5.0039 m/s² 0 ₁₀ 5.1453 m/s² 0 ₁ p	0:01:00 0:01:00	6.00 dB 6.00 dB	-6.00 dB -6.00 dB	3.00 dB 3.00 dB	-3.00 dB -3.00 dB	
est target element			20.0							ļ	Change
OAcceleration ()	6.00 😫	ille Alarm Up	perlimit .	3.00 🜩 dB	[X] Test time	eck 🗹 Check Once	by lower limit				•
Lower limit	-6.00 🚔 ,	By time	ver limit 🧠	3.00 🚔 dB							
					Q factor	= sqit(A ² -	1.0 (A)				
					A = Tran Resonance	ismissibility limit condition					
					🛅 Transmi	ssibility	1.0	100.0			
										ОК	Cano
										\$	Ť

<Step 4>

Press the button of [Next] to go to the next definition.



[Graph/Data save condition]

<Step 1>

It is imperative "Max time" and "Time interval" are set. Select 'Not save' and press the button of [OK].

Graph/Data save condition	<
O Save Not save Specify destination folder	
Refer	
Save the test file name as a prefix.	
Sequence number Beginning value	
Min. digits number 3	. • •
Save at testing completion.	
Time interval	
OK Cancel	

<Step 2>

The definition setting is complete.



<Test Save>

<Step 1>

Click [Test save] button.



<Step 2>

Enter file name. Then, click [Save] button.

Save As			
Save in:	My Docume	nts 🔹 🧕 🎯 🏚 🔛 🖬 🗸	
Recent Places	TEST01.dwl	2 2 2	
Desktop			
Libraries			
Computer			
Network	File name:	TEST04	Save
	Save as type:	Resonance test definition file(*.dwl2)	Cancel
	Comment		*

<Test Operation>

<Step 1>

Click [Ope.start] button.

e(F) Operation(P) Edit(E) View(V	Window(W) Option	(O) Help(H	1)	
New Open Test save Data s	ave Correct Print	Preview	Ope, start	
Frequency Reference R	esponse Drive		Peak Number	Ť
			1	
Hz	mV	Ър		
est definition				
est Definition				
est Definition Test definition information	Module Configuration			
est Definition Test definition information I/O Module Configuration	Module Configuration Module ID	м	odule type	
est Definition Test definition information I/O Module Configuration Excitation System Information Fundamental/Control Conditi	Module Configuration Module ID 000	M 4ch l/O	odule type module TYPE I	
est Definition Test definition information I/O Module Configuration Excitation System Information S Fundamental/Control Conditi Excitation system setting	Module Configuration Module ID 000 001	M 4ch I/O 8ch Inpu	odule type module TYPE I it module TYPE I	
est Definition Test definition information I/O Module Configuration Excitation System Information Fundamental/Control Conditi Excitation system setting Input channel	Module Configuration Module ID 000 001 Excitation System Env	M 4ch I/O 8ch Inpu vironment	odule type module TYPE I It module TYPE I	
est Definition Test definition information VO Module Configuration Excitation System Information Fundamental/Control Conditi Excitation system setting Resonance reference	Module Configuration Module ID 000 001 Excitation System Env Exc. System Info.	M 4ch I/O 8ch Inpu vironment Systen	odule type module TYPE I It module TYPE I 101	
est Definition Test definition information U Module Configuration Excitation System Information Fundamental/Control Conditi Excitation system setting Note: Source reference	Module Configuration Module ID 000 001 Excitation System Env Exc. System Info. Excitation group	M 4ch I/O 8ch Inpu vironment Systen	odule type module TYPE I It module TYPE I 101	
est Definition Test definition information S I/O Module Configuration Excitation System Information Fundamental/Control Conditi Excitation system setting S Input channel Resonance reference	Module Configuration Module ID 000 001 Excitation System Env Exc. System Info. Excitation group Excitation group	M 4ch I/O 8ch Inpu vironment Systen p name	odule type module TYPE I It module TYPE I n01	
est Definition Test definition information VO Module Configuration Excitation System Information Fundamental/Control Conditi Excitation system setting Night Channel Resonance reference	Module Configuration Module ID 000 001 Excitation System Env Exc. System Info. Excitation group Excitation group Excitation group Output channel	M 4ch I/O 8ch Inpu vironment Systen p name	odule type module TYPE I It module TYPE I n01	
est Definition Test definition information VO Module Configuration Excitation System Information Fundamental/Control Conditi Excitation system setting Input channel Resonance reference	Module Configuration Module ID 000 001 Excitation System Env Exc. System Info. Excitation group Excitation group Output channel Channel na	M 4ch I/O 8ch Inpu vironment Systen p name	odule type module TYPE I it module TYPE I n01 Module ID	Ch

<Step 2>

Click [Start] button.

Clicking the button automatically implements Initial loop check and Initial equalization, and executes a test.



<Step 3>

Continue excitation with the frequency fixed until the test time is over.

Note: Clicking [Retry] button → [Start] button to execute re-excitation after stopping excitation by clicking [Stop] button initializes all the data, resulting in re-excitation at a peak frequency set in Test definition. On the other hand, stopping excitation by using [Pause] button allows continuing excitation by clicking [Restart] button.

C:\Users\IMV\Documents\TEST0	4.dwl2 - K2/ResonanceD	well			
File(F) Operation(P) Edit(E) Vie	ew(V) Window(W) O	ption(O) Help(H)			
New Open Test save Da	ta save Correct Pri	nt Preview	Ope, start Ope, en	d Start Retry Stop	Pause Re
Frequency Reference 132.00 20.0 Hz m/s²0-p	Response Dri 20.0025 9 m/s²0-p	ve Elapsed tir 997.4 0:00: mV ⁰₽	ne Peak Number	Fixing frequency	Drive
Operation status Response	e graph				
In excitation					
Frequency 132.00 Hz Ref.(m/s ² 0-p) Resp.(m, 20.0 20.00	2013/07/25 5:13:00 /s² 0-p) Drive 25 99	PM (mV) 7.4			
Trans. amp.((m/s²)/(m/s²)) 6.3764	Trans. phase(de 179.36	egree) Q-valu 6.2975	9		
Resonance search mode freq	uency fixing	Fix	ing frequency		
Base channel	Ch1 (000-Ch1)				
Resonance search channel Elapsed time	Ch2 (000-Ch2) 0:00:04				
Resonance element 1/1	0:00:04	626 cycle			
Check result	Alarm OK	Abort (Ж		
Real-time processing CPU loa	d factor 1.11 %				

<Step 4>

Clicking [Ope. end] button brings you back to Test definition mode.



Chapter 2 Test Definition

Chapter 2 describes test definition items required for Resonance Dwell test.

2.1 Peak Frequency

Extract a peak frequency considered appropriate as resonance point from data collected through Presweep test implemented before Resonance Dwell test.

Note: A value of 10.0% of the largest peak amplitude of transmissibility (Peak amplitude hysteresis ratio: 0.1) is used as extraction threshold by default in order to discriminate between peak and noise. When amplitude fluctuation before and after a peak is not more than the extraction threshold, the peak falls under noise and is not list-displayed. You may change the extraction threshold as needed. In addition, Qfactor used for calculation is 0.0 when transmissibility is 1.0 and under. (See "Paragraph 2.5")

0,4400	p test file				
C:\L	sers\IMV\Documer	nts\PreSineSw	eep.swp2	Select(S)	100.0 (m/s²)/(m/s²)
No.	Frequency	Phase	Transmissibility	Q factor	10.0
1 2 3	10.40 Hz 31.20 Hz 32.20 Hz	-2.8578 -87.6886 -136.5381	8.0605 9.4623 7.3767	7.9982 9.4093 7.3087	1.0
					1.000e-1
					1.000e-2 10.0 Hz 100.0 700
Chan	nel setting				1.000e-2 10.0 Hz 100.0 Resonance judgment criteria
Chan Base	nel setting channel	Ch1		•	1.000e-2 10.0 Hz 100.0 700 Resonance judgment criteria Image: Q factor 1.50 1.50 above
Chan Base Reso	nel setting : channel onance search char	Ch1 nnel Ch2		•	1.000e-2 10.0 Hz Resonance judgment criteria Q factor OR AND

2.1.1 Selection of Sweep test file

(1) Meaning

Select a definition file (with continuing excitation data) of Pre-sweep test for searching specimen's resonance point implemented before Resonance Dwell test.

2.1.2 Channel setting

(2) Meaning

Set Base channel and Resonance search channel in order to execute Resonance dwelling. Transmissibility data (Response data of Resonance Search Channel / response data of Base Channel) used for peak frequency detection is created based on the channel setting registered here.

- Base channel: Signal input channel of response point that is reference point
- Resonance search channel: Signal input channel of response point that is resonance search point

2.1.3 Resonance judgment criteria

(1) Meaning

Set conditions used for extracting peak frequencies considered appropriate as resonance point from data collected through implementation of Pre-sweep test. In this window, setting combining Q factor and transmissibility is available.

2.1.4 Resonance search mode

(1) Meaning

Four (4) options are provided for selection: Amplitude search (normal), Amplitude search (high-speed), Phase search and Frequency fixing.

• Amplitude search (normal)

Resonance dwelling is performed while periodically re-searching peak of transmissibility. Re-search is implemented on both high-frequency and low-frequency sides of the current excitation frequency.

• Amplitude search (high-speed)

Resonance dwelling is performed while periodically re-searching peak of transmissibility. Prior to re-search, the system estimates whether a new resonance point is in low-frequency side of or high-frequency side of the current excitation frequency based on the slope of transmissibility. By doing so, the search path can be shorter and the search processing speed is faster than that of Amplitude search mode (normal).

· Phase search

Resonance dwelling is performed while adjusting the frequency in such a way that a constant phase difference between the base channel and resonance search channel can be maintained.

• Frequency fixing

Excitation is performed at a peak frequency (resonance frequency) detected through Pre-sweep.

2.2 Resonance Reference Definition

Specify the definition of each of resonance points extracted from results of Pre-sweep. Following illustrations are definition windows showing respective buttons to use.

• Resonance Reference Definition: Resonance search mode: Amplitude search (normal)

. Target element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit
1	10.40 Hz 31.20 Hz 32.20 Hz	-2.8578 -87.6886 -136.5381	8.0605 9.4623 7.3767	7.9982 9.4093 7.3087	20.0 m/s² 0 ₁₀ 9.7106 m/s² 0 ₁₀ 10.0539 m/s² 0 ₁₀	0:01:00 0:01:00 0:01:00	6.00 dB 6.00 dB 6.00 dB	-6.00 dB -6.00 dB -6.00 dB	3.00 dB 3.00 dB 3.00 dB	-3.00 dB -3.00 dB -3.00 dB
est target element Acceleration () \	/elocity ◯ Dis	splacement	20.0	m/s²0.0	CALC(X)	Alarm chec	k. ⊽ Lowerlimitch	ieck		Change(C)
ort Upper limit	6.00	dB Alarm I dB I	Jpper limit	3.00 🜩 dB	3	Test time Or	ice 👻			
Dwell time 0:0	1:00 🔔 E	By time	•							
esonance searching Shift judging of reson Re-searching time	condition ance frequency . 0:00:11	0				Q factor Q factor A=Transn	= sqrt(A ² -	1.0 (*)		
Transmissibility ra	io -10.0)	10.0 🔪 %			Resonance I	imit condition			
Frequency step size	1.0	Hz/sec				🕅 Transmis	sibility 1	<pre></pre>	100.0	
Resonance frequenc	searching range					Frequence	cy 1.0	00	1000.00 + Hz	
🔘 Transmissibility		3.0 *					30			
Transmissibility ra	io ·	10.0 📩 🕺								
Frequency		1.00	1000.00	Hz						

• Resonance Reference Definition: Resonance search mode: Amplitude search (high-speed)

0.	Target element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit
23		10.40 Hz 31.20 Hz 32.20 Hz	-2.8578 -87.6886 -136.5381	9.4623 7.3767	9.4093 7.3087	20.0 m/s² 0-p 9.7106 m/s² 0-p 10.0539 m/s² 0-p	0:01:00 0:01:00 0:01:00	6.00 dB 6.00 dB 6.00 dB	-6.00 dB -6.00 dB -6.00 dB	3.00 dB 3.00 dB 3.00 dB	-3.00 dB -3.00 dB -3.00 dB
Tes	t target element						7				Change(C)
) Ac bort Dwe	celeration © Ve Upper limit Lower limit ell time 0:01	elocity Di 6.00 ¢ -6.00 ¢ :00 ¢ E	splacement dB Alarm I dB I dB I	20.0 Upper limit	m/s² 0-p 0 3.00 ♀ dB -3.00 ♀ dB	<u>μεαχ</u>	V Alarm chec	k 🔽 Lower limit ch	eck		
leso Shif ©	nance searching co t judging of resonan Re-searching time Transmissibility ratio	ondition Ince frequency 0:00:11	ō	10.0 🚔 🔹			Q factor Q factor A=Transm	sqrt(A ² .	1.0 (m)		
Frequ	iency step size	5.0	Hz/sec				Resonance I	mit condition	.0 ▲ √ (==>) ▲ 0.	100.0	
M. Sli	onance inequency : ax. searching range Frequency ratio ope check range Frequency ratio	+-	40.0 × %				Frequence	ay 1.		1000.00 + Hz	
Pe	ak estimation cond	lition	2	0 📥 .						OK	Cancel

• Resonance Reference Definition: Resonance search mode: Phase search

Resonar	nce reference def	inition (Phase s	earch)									? 🔀
No.	Target element	Frequency	Phase	Transmissibility	Q factor	Level	Dwell time	Abort upper limit	Abort lower limit	Alarm upper limit	Alarm lower limit	
23		10.40 Hz 31.20 Hz 32.20 Hz	-2 8578 -87.6886 -136.5381	8.0605 9.4623 7.3767	7.9982 9.4093 7.3087	20.0 m/s² 0-p 9.7106 m/s² 0-p 10.0539 m/s² 0-p	0:01:00 0:01:00 0:01:00	6.00 dB 6.00 dB 6.00 dB	-6.00 dB -6.00 dB -6.00 dB	3.00 dB 3.00 dB 3.00 dB	-3.00 dB -3.00 dB -3.00 dB	
Tes Ac Pha Abort	t target element cceleration O Ve se difference Upper limit	łocity O Displac -2.86 🜩 6.00 🌲	ement degree dB Alarm I	20.0 📩 m/s² 0-p Jpper limit	CALC(×	L V Alarm che Test time C	rck 📝 Check Dnce	by lower limit				Change(C)
Dwe Max	Lower limit ell time .resonance dwellin	-6.00 🜲 0:01:00 🜲 Igrate Normal	dB I By time ✔ [ower limit	-3.00 🗼 dB	Q factor Q factor A = Trans	= sqrt(A ²	1.0 *)				
						Resonance I	limit condition	1.0 × <==>	100.0			
						Frequent	cy	1.00 * <==>	1000.00 ÷ Ha			
											OK	Cancel

• Resonance Reference Definition: Resonance search mode: Frequency fixing

2	10.40 Hz 31.20 Hz 32.20 Hz	-2.8578 -87.6886 -136.5381	8.0605 9.4623 7.2767	7.9982 9.4093	20.0 m/s ² 0 p 9 7106 m/s ² 0 p	0:01:00	6.00 dB	-6.00 dB	3.00 dB	-3.00.48	
			1.3/0/	7.3087	10.0539 m/s ² 0-p	0:01:00	6.00 dB 6.00 dB	-6.00 dB -6.00 dB	3.00 dB 3.00 dB	-3.00 dB -3.00 dB	
Test target element	u 🖻 Displacen	nent 2	200		a 🖉 Alarm chu	ack 🔽 Check	hu lawer limit				Change(I
Abort Upper limit Lower limit Dwell time	6.00 ÷ dE -6.00 ÷ dE 0:01:00 ÷	3 Alarm Upp 3 Low By time	ver limit -3	.00 🜩 dB	Test time	Once					
					Q factor Q factor A = Tran	= sqrt(A ² - 🛛	1.0 👘)				
					Resonance	limit condition ssibility	1.0 × <==>	100.0			

[Change]: This button changes the excitation conditions of a selected resonance point. Select a desired resonance point. Change its excitation conditions. Click [Change] button.

2.2.1 Test target element

(1) Meaning

Registration of a resonance point at which excitation is executed.

First, select a desired resonance point in the list. Secondly, check the [Test target element] box. Then, click [Change] button. By doing so, the resonance point is registered as a test target element.

A symbol [*] in the Target element column of the list indicates that the corresponding frequency has been registered as a test target element.

2.2.2 Resonance reference level

(1) Meaning

Input reference level at each resonance point with a desired resonance point selected in the list.

The unit of reference level can be selected among three options: Acceleration, Velocity and Displacement.

[Calc] is a convenient function for doing objective calculation between Acceleration,

Velocity and Displacement. Click [Calc] button to use [Calc] function.

See K2/SINE Manual "4.4.6 CALC function" for details.

2.2.3 Alarm / Abort level

(1) Meaning

Input Alarm / Abort level of Reference level at resonance point with a desired resonance point selected in the list.

Specify check level using a value relative to the reference level.

Check includes Alarm and Abort. If not needed, you may leave Alarm unset.

[Alarm] herein means that the system issues an alert when detecting response beyond the range of set conditions. [Abort] means that test operation is stopped (signal output stops) at that point.

If not needed, you may leave lower limit of Check level unset.

Note that Alarm and Abort check levels have to satisfy following relations.

- Alarm check level Upper limit \leq Abort check level Upper limit
- Alarm check level Lower limit \geq Abort check level Lower limit

In order to enable input of lower limit level of Alarm check level and Abort check level, place a check mark in each box.

2.2.4 Dwell time

(1) Meaning

Set excitation time of each resonance point (Time is counted only during fixing resonance). Excitation stops when Dwell time is over. If there is more than one resonance definition, excitation is executed one by one: excitation at one of resonance points stops, then, excitation at other resonance point follows.

2.2.5 Test time

(1) Meaning

Set Repeat times of a defined resonance series.

1. Once

Test is over after executing a defined resonance series only one time,

2. By repeat times

Test is over after executing a defined resonance series repeatedly in accordance with the registered Repeat times.

2.2.6 Repeat pause time

(1) Meaning

Set signal output stop time that is assigned to Sweep turnover point of a resonance series. Excitation stops for a specified period of Repeat pause time at Sweep turnover point of a resonance series.

This function is enabled when setting of Repeat times is "Infinite" or "By repeat times"

2.2.7 Phase difference (Resonance search mode: Phase search only)

(1) Meaning

Set Phase difference between Base channel and Resonance search channel.

2.2.8 Max. resonance dwelling rate (Resonance search mode: Phase search only)

(1) Meaning

Set Change ratio of excitation frequency per loop in dwelling.

2.3 Resonance Limit Condition

This is to control the change of transmissibility and resonance frequency during each dwelling operation. Exceeding the limit registered in Resonance limit condition stops resonance dwelling and terminates a current test operation itself.

2.3.1 Transmissibility

(1) Meaning

Set Minimum and Maximum ratio of amplitude in excitation at each resonance point. Exceeding the specified range stops excitation. (disabled during dwelling)

2.3.2 Frequency (Resonance search mode: Amplitude search (normal) and (high-speed), Phase search)

(1) Meaning

Set Minimum and Maximum resonance frequency at each resonance point. Exceeding the specified range stops excitation. (disabled during dwelling)

2.4 Resonance Search Condition

2.4.1 Shift judging of resonance frequency (Resonance search mode: Amplitude search (common))

(1) Meaning

Set conditions for resonance re-searching and re-setting. Specify either time or change ratio of amplitude ratio for setting.

2.4.1.1 Re-searching time

(1) Meaning

If Re-searching time is registered, the system performs resonance re-searching and resetting every time the specified time is over after starting excitation at a resonance point.

2.4.1.2 Transmissibility ratio

(1) Meaning

Set Lower and Upper change ratio to reference transmissibility. Exceeding the specified range automatically starts resonance re-searching and re-setting. Reference transmissibility is set based on Sweep results. The default is a transmissibility given when each resonance point is defined. Reference transmissibility is updated with excitation transmissibility measured every time resonance re-searching and re-setting are executed.

2.4.2 Frequency step size

(1) Meaning

Set Sweep rate (Hz/sec) for resonance re-searching.

2.4.3 Resonance frequency search range (Resonance search mode: Amplitude search (normal) only)

(1) Meaning

Set Sweep range for re-searching. Specify one of Transmissibility, Change ratio of transmissibility, Frequency and Change ratio of frequency for setting.

2.4.3.1 Transmissibility

(1) Meaning

Searching range is set with Minimum transmissibility. In Resonance search ready, sweep is performed toward low frequencies until transmissibility is lower than a specified value and a frequency lowest in the searching range is determined. At this time, Δ freq (= "previous resonance frequency" – "lowest frequency") is calculated, and a frequency highest in the searching range is determined using an equation Highest frequency = "previous resonance frequency" + " Δ freq" in order to specify the searching range.



Sweep is executed backward until transmissibility is lower than specified value.

2.4.3.2 Transmissibility ratio

(1) Meaning

Minimum transmissibility is determined by specifying a proper change ratio (%) in negative (–) direction so that Minimum transmissibility dips from reference transmissibility (set based on Sweep results). Based on the determined Minimum transmissibility, specify the searching range by determining the lowest and highest frequencies of the searching \perp range as with "2.3.1 Transmissibility".



Sweep is executed backward until transmissibility is lower than specified value.

2.4.3.3 Frequency

(1) Meaning

Specify the lowest and highest frequencies to set the searching range.



2.4.3.4 Frequency ratio

(1) Meaning

Set the searching range by specifying a proper frequency change ratio (%) in both directions (+ and –) from the previous resonance frequency to determine the lowest and highest frequencies.



2.4.3.5 Searching range segment

	Frequency range(Hz)	Searching range multiplier	OK
			Cancel
			Delete(D)
		-	
requ	ency	<==> Hz	

(1) Meaning

If the registered frequency range contains resonance point, the searching range is increased and degreased at a specified magnification.

New searching range = "specified magnification" × "current searching range"

2.4.4 Resonance frequency search range (Resonance search mode: Amplitude search (high-speed) only)

(1) Meaning

Set Sweep range for re-searching and conditions for detecting a new resonance point.

2.4.4.1 Maximum search range

(1) Meaning

Set Maximum search range. When search goes beyond the Maximum search range, the system stops excitation, assuming that detection of a new resonance point is unsuccessful. Maximum search range = "previous resonance frequency" × "frequency ratio (%)"

2.4.4.2 Slope check range

(1) Meaning

Check Slope in order to predict whether a new resonance point is in the low-frequency side or in the high-frequency side of the previous resonance point. For this purpose, set the range within which excitation frequency is slightly increased toward high-frequency side. Slope check range = "previous resonance frequency" × "frequency ratio (%)"

2.4.4.3 Peak estimation condition

(1) Meaning

Set Peak estimation condition to detect a new resonance point. when a decrement from the peak value detected during re-searching goes beyond Peak amplitude hysteresis (= "previous resonance transmissibility" × "peak amplitude hysteresis ratio (%)"), the detected peak value is judged as a new resonance point.

2.5 Q Factor

(1) Meaning

Define the equation to calculate Q factor for excitation at each resonance point. By default, the Q factor definition equation is " $Q = \sqrt{A^2 - 1}$ " (A: transmissibility). "1" of "A² - 1" in $\sqrt{-1}$ is a factor. You may assign a proper value to the factor.

Especially for viscoelastic materials, it is difficult to identify Q factor, so this factor can be changed for adjustment.

Reference book: Handbook of Viscoelastic Vibration Damping (by David I. G. Jones)

2.6 Graph/Data save condition

This function is for setting of each item for displaying the graph and saving to the hard disc the data measured in a test operation.

When select "Save", Control response, Transmissibility (amplitude), Transmissibility (phase), Q-value, Frequency and Monitor response data of time series are saved automatically in a binary files (*.vdf).

Graph/Data save cor	ndition	×
🔾 Save 🔘) Not save	
Specify destinati	on folder	
	Re	fer
Save the test file n	ame as a prefix.	
Sequence number		
Beginning value	1	
Min. digits number	3 *	
Save at testing co	mpletion.	
Max. time	1 Hour	
Time interval	1 ▲ Sec	
	ОК Са	ancel

2.6.1 Max time

(1) Meaning

It is imperative to be set even if not want to save data to the file automatically. The maximum time displayed on the graph and saved in a file is specified. At the time over this time, the graphs are cleared and then started to draw anew. Additionally if set to save to a file automatically, the data is saved in a new file.

2.6.2 Time interval

(1) Meaning

It is imperative to be set even if not want to save data to the file automatically. The time interval of the graph and data is specified.

2.6.3 Time interval

(1) Meaning

In principle, data save conditions of the Resonance Dwell system are the same as those for the standard Sine tests.

For details of each setting item, refer to "4.7 Data Save Condition" of the K2/SINE Instruction Manual.

2.7 Operation Status

(1) Meaning

Information involved in excitation operation is displayed.

By selecting "Window - Operation status" in the menu bar, Operation status appears.

<Items of display>

[1] Current status

Message showing the current system status: "In excitation", "Pause", "Excitation Completion" (stopped by operator), etc.

- [2] Frequency Current excitation frequency
- [3] Reference Current control reference level
- [4] Response Current response level
- [5] Transmissibility

Amplitude and phase of current transmissibility (calculation of transmissibility uses a tracking value.)

[6] Q factorCurrent Q value (Status on display: Display is active during fixing resonance and dwelling)

[7] Drive

Actual drive output voltage currently being output

[8] Elapsed time

Elapsed time from start of excitation up to now

• Amplitude search (normal) and Amplitude search (high speed):

Total time spent on excitation at resonance frequency (Status on display: Fixing resonance) is displayed. (the period of time while Status on display is "In preparation", "Resonance search ready", "Resonance search" or "Reference frequency shift" is not included in Elapsed time.) Repeated times and Repeat pause time of resonance series are displayed as well.

• Phase search:

The time of excitation at resonance frequency (Status on display: Dwelling) is displayed.

• Frequency fixing:

The time of excitation at resonance frequency (Status on display: Fixing resonance) is displayed.

[9] Resonance search mode

• Amplitude search (normal)

The system executes resonance frequency dwelling while automatically performing resonance re-search from transmissibility according to specified conditions.

• Amplitude search (high speed)

The system executes resonance frequency dwelling while automatically performing resonance re-search from transmissibility according to specified conditions. Prior to re-search, the system estimates whether a new resonance point is in low-frequency side of or high-frequency side of the current excitation frequency based on the slope of transmissibility. By doing so, the search path can be shorter and the search processing speed is faster than that of Amplitude search mode (normal).

• Phase search

The system executes resonance frequency dwelling while adjusting the excitation frequency, according to specified conditions, in such a way that phase difference between the base channel and resonance search channel is maintained.

• Frequency fixing

Excitation is executed at a peak frequency detected through Pre-sweep.

[10] Current resonance status

Messages showing current system status are as follows.

"Resonance fixing", "In preparation", "Resonance search ready", "Resonance search", "Reference frequency shift" and "Dwelling (Resonance search mode: Phase search only)"

[11] Resonance element

Resonance point currently in excitation and the time of dwelling on the resonance point are displayed.

[12] Base channel

Signal input channel of response point that is reference point.

[13] Resonance search channel

Signal input channel of resonance search point that is reference point.

[14] Check result (total)

Check result is "OK" when all of Alarm check and Abort check conditions registered in Test definition are satisfied and "NG" when not satisfied.

[15] Real-time processing CPU load factor Current CPU load factor

[16] Reference / Response data

Values of Reference level and Response level in the current control loop are displayed. In principle, the level is displayed definition by definition. If controlled variable is any of Acceleration, Velocity and Displacement, all of Acceleration, Velocity and Displacement are displayed.

Result of checking Tolerance of response level that is defined relative to the control reference is displayed. "OK" is displayed when all are satisfied. "Alarm" and "Abort" are displayed respectively when inconsistent with Alarm check and when inconsistent with Abort check.

[17] Input channel data

Amplitude and phase of each input channel data in the current control loop are displayed. In principle, amplitude is expressed in observed physical quantity of input channel and displayed in a level format. If controlled variable is any of Acceleration, Velocity and Displacement and observed physical quantity is Acceleration / Velocity / Displacement, all of Acceleration, Velocity and Displacement are displayed.

[18] Drive output data

Output voltage of each output channel data in the current control loop is displayed. Ratio to voltage that can be output is displayed as well.

🔛 New test definition - K2/ResonanceDwell	
File(F) Operation(P) Edit(E) View(V) Window(W) Option(O) Help(H)	
New Open Test save Data save Correct Print Preview Open start Start Retry Stop Pause Retry	
Frequency Reference Response Drive Elapsed time Peak Number 10.40 20.0 19.9246 1561.8 0:00:05 1 / 1 Fixing frequency Drive Limit Alarm A Hz m/3*0* m/3*0* m/0*2 m/	bot
Operation status Response graph	
Operation status	×
In excitation	<u>^</u>
Frequency 10.40 Hz 2013/07/25 7:46:21 PM Ref.(m/s² 0 _P) Resp.(m/s² 0 _P) Drive(mV) 20.0 19:9246 1561.8	
Trans. amp.((m/s²)/(m/s²)) Trans. phase(degree) Q-value 0.8411 1.32 0.0	
Resonance search mode frequency fixing Fixing frequency	
Base channel Ch1 (000-Ch1) Resonance search channel Ch2 (000-Ch2) Elapsed time 0.00.05 Resonance element 1/1 0.00.05 60 cvcle	E
Check result Alarm OK Abort OK	
Real-time processing CPU load factor 0.95 %	
Reference/Response data	
Acceleration Velocity Displacement	
(m/s ²) (m/s) (mm)	
Ref. 20.0 0.3061 9.3677	
Resp. 19.9246 0.3049 9.3324	
Input channel data	
Peak estimationAcceleration Velocity Displacement Phase	
(m/s [°]) (m/s) (mm) (degree)	
Ch1 (000-Ch1)	
KMI5" 13.3249 U.3049 9.3324 Average 17.5055 0.9670 9.1002	
Average 17.0000 U.2013 0.1333	*
Fixing frequency NUIV	1 7/25/2013 7:46:21 PM

2.8 Set Up

(1) Meaning

Set unit of display of transmissibility and data save condition.

In principle, the setting items are the same as those of the standard Sine system.

Here, only the setting items specific to Resonance Dwell are explained.

For details of each setting item, refer to "6.2 Set Up" of the K2/SINE Instruction Manual.

Set up X							
Transmissibility display unit							
Response data save							
Periodic save intervals by second							
Operation status Input channel data Normal 🗸							
Store the display status for operation Store the display config Store the graph scale							
Clear history							
Data save							
OK Cancel							

<Response data save>

Control response, Transmissibility (amplitude), Transmissibility (phase), Q-value, Frequency and Monitor response data, in time series order, are saved in CSV files. The names of CSV files to be created are as follows.

Test file name XXX.CSV

XXX: Serial number is assigned every time test is executed.

The format of CSV file to be created is as follows.

Column 1	Column 2	Column 5		Column 5	Column 0		••••
Time	Response	Transmiss	Transmiss	Q-value,	Frequenc	Monitor	
[sec],	[unit],	ibility	ibility		y [Hz],	response	
		(amplitud	(phase)			1 [unit],	
		e) [unit],	[unit],				
*** ***,	*** ***,	*** ***,	***.**,	*** **,	***.**,	*** **,	
*** ***,	*** ***,	*** ***,	***.**,	*** **,	***.**,	***.**,	
*** ***,	*** ***,	*** ***,	***.**,	*** **,	***.**,	*** **,	
	•••		:		:	•	:
*** ***,	***.***,	***.***,	***.**,	***.**,	***.**,	***.**,	

Column 1 Column 2 Column 3 Column 4 Column 5 Column 6 Column 7

- Italic characters are fixed characters.
- Unit of data is given in [unit].
- Time data are substituted in Column 1.
- Data of Control response, Transmissibility (amplitude), Transmissibility (phase), Q-value, Frequency and Monitor* are substituted respectively in Column 2 and after. [* Acceleration only]
- Unit of Transmissibility (amplitude) reflects that of Transmissibility displayed in Test definition status. If the unit of Transmissibility is changed during Test execution status, the unit of Transmissibility (amplitude) in CSV file does not reflect the change.
- < Operation status >

'Input channel data'

This item is for selecting the amount of information of the displayed input channel data in Operation status.

2.9 Graph Kind Selection

(1) Meaning

Select a time-series graph (Control response, Transmissibility (amplitude), Transmissibility (phase), Q-value, Frequency and Monitor) to display.

No picture and the second s	OK
Transmissibility (amplitude) Transmissibility (phase) Q-value Frequency Monitor	Cancel
Displayed unit	
Acceleration	
Velocity	

2.10 Graph Data Save

(1) Meaning

If it is necessary to save graph data during excitation, select "File – Graph data save" to save the data.



INDEX

А	
	Alarm / Abort level
	Amplitude search 1-2, 2-2, 2-3, 2-7, 2-8, 2-11, 2-13, 2-14
В	
	Base channel 1-6, 1-18, 1-29, 1-39, 2-1, 2-14
С	
	Channel setting
D	
	Dwell time 1-1, 1-3, 1-7, 1-15, 1-19, 1-26, 1-30, 1-36, 1-40, 2-6
Е	
	Elapsed time
F	•
	Fixing resonance
	Frequency 1-1, 1-2, 1-3, 1-4, 1-6, 1-8, 1-15, 1-16, 1-18, 1-20, 1-26, 1-27, 1-29, 1-36, 1-37.
	1-39, 2-7, 2-8, 2-9, 2-10, 2-13, 2-14, 2-18
	Frequency fixing
	Frequency ratio $1-3, 1-15, 2-10$
	Frequency step size $1-3$ $1-8$ $1-15$ $1-20$ $2-8$
G	
0	Graph data save
	Graph kind selection 2-18
	Graph/Data save condition $1-10$ $1-22$ $1-32$ $1-42$ $2-12$
м	
1.1	May resonance dwelling rate $1-26$ $1-30$ $2-6$
\cap	
0	Operation status
D	
T	Deck frequency $1-2$ $1-6$ $1-7$ $1-12$ $1-15$ $1-18$ $1-10$ $1-25$ $1-26$ $1-20$ $1-20$ $1-25$ $1-26$
	1-40 1-45 2-1 2-9
	1-40, 1-40, 2-1, 2-2
	Phase difference 1.2 1.20 1.20 2.2 2.4 2.6 2.7 2.12 2.14
0	rnase search 1-2, 1-20, 1-29, 2-2, 2-4, 2-0, 2-7, 2-13, 2-14
Q	
D	Q factor
R	
	Reference frequency shift
	Repeat pause time
	Ke-searching time
	Kesonance dwell 1-1, 1-2, 1-3, 1-7, 1-15, 1-19, 1-26, 1-30, 1-36, 1-40, 2-1

Resonance fixing
Resonance judgment criteria1-2, 1-5, 1-6, 1-17, 1-18, 1-28, 1-29, 1-38, 1-39, 2-2
Resonance limit condition 2-7
Resonance reference definition
Resonance reference level
Resonance search 1-1, 1-2, 1-3, 1-5, 1-7, 1-15, 1-17, 1-19, 1-26, 1-28, 1-30, 1-36, 1-38,
1-40, 2-2, 2-7, 2-13, 2-14
Resonance search channel
Resonance search condition
Resonance search ready 2-8, 2-13, 2-14
Resonance survey 1-1, 1-2, 1-3, 1-4, 1-5, 1-15, 1-16, 1-17, 1-26, 1-27, 1-28, 1-36, 1-37, 1-38
S
Searching range segment
Selection of sweep test file
Shift judging of resonance frequency 1-3, 1-3, 1-8, 1-13, 1-15, 1-20, 1-25, 2-7
Т
Test target element 1-7, 1-19, 1-30, 1-40, 2-5
Test time 1-3, 1-4, 1-7, 1-13, 1-15, 1-16, 1-19, 1-25, 1-26, 1-27, 1-30, 1-36, 1-37, 1-40, 2-6
Transmissibility 1-6, 1-18, 1-29, 1-39, 2-1, 2-2, 2-7, 2-8, 2-9, 2-11, 2-13, 2-16, 2-18
Transmissibility ratio