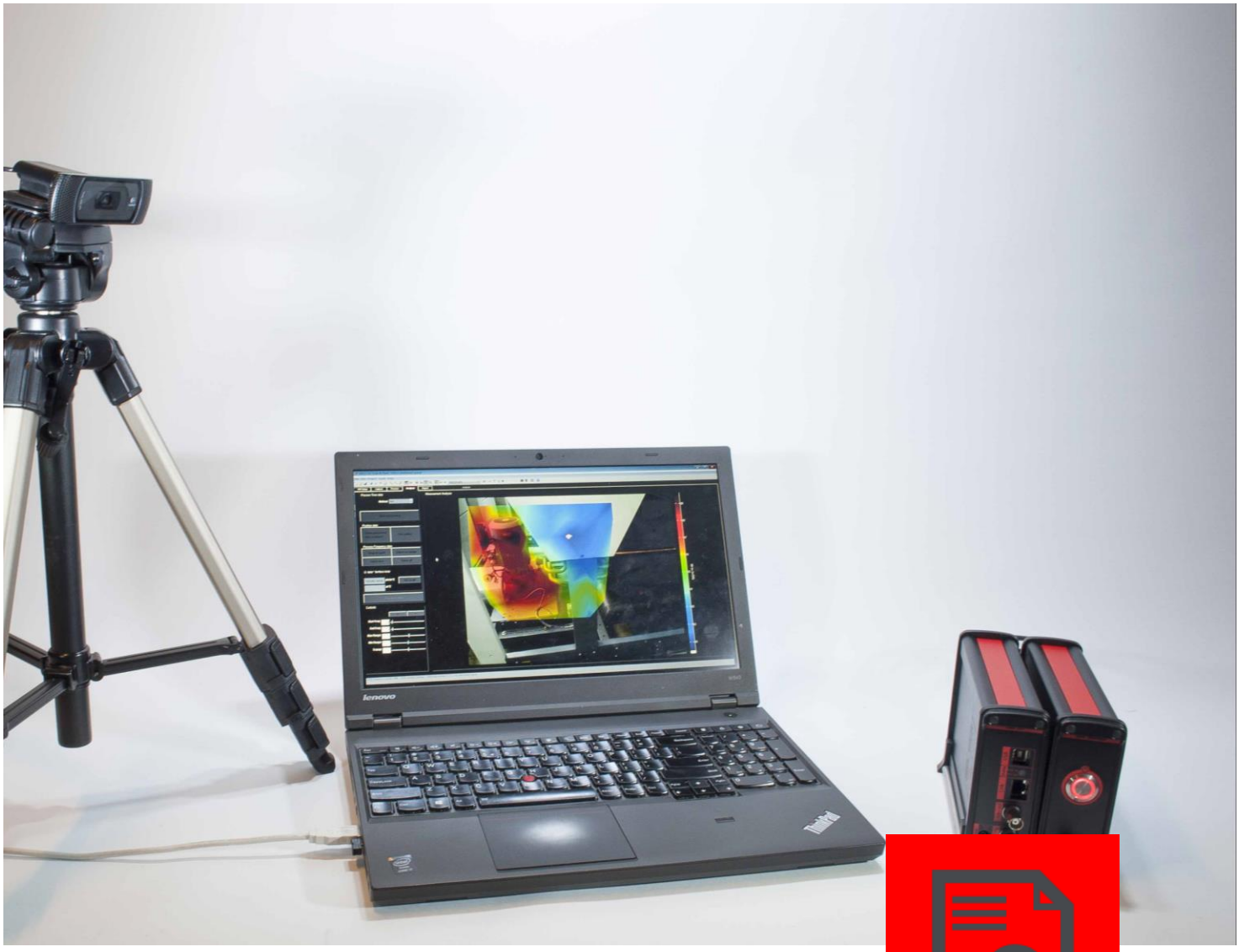
Microflown Technologies
Charting sound fields



Datasheet

Scan & Paint VPA SETUP

VPA-PA-PR/PM/PI-SCT2

SCAN & PAINT VPA SETUP

Single sensor beamforming solution.

Stationary sound source localization and characterization from the acoustic sound field far field.

The virtual phased arrays, or shortly called VPA, brings the power of the Scan & Paint measurement technique into the acoustic far field. VPA allows creating a large array of sensors based on one single moving transducer and a video camera. The audio and video data are recorded and synchronized by means of probe position tracking. By adding an additional static microphone during the acquisition process, the relative phase field is also characterized. Once the data measured by the moving transducer (PU probe) and static reference sensor (microphone) is combined, it is possible to conform and reconstruct the data matrix needed for beamforming.
CBF (Common beamforming) is applied to the data to obtain the sound source location and strength estimation.
At a later stage, deconvolution methods such as ISCA can be applied, in order to reduce side lobes and possible ghost noise sources, which result from intrinsic characteristics of the employed mathematical operations.

The algorithms, provided within the software will allow you to carry out near and far-field beamforming calculations. The near-field beamforming tends to be more accurate then the far-field technique. Furthermore, it allows to calculate, not only the source location, but also source strength estimation.

The VPA as a solution is especially interesting for stationary environmental noise and industry noise problems, allowing for sound source localization based on only 2 transducers. Additionally, it can be used as a supplement to the Scan & Paint system, especially in situations where the noise source cannot be accessed, or if the noise source is located in a windy area.

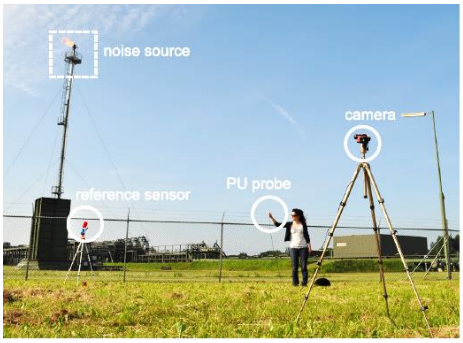
I. SCAN & PAINT VPA DATA PROCESS

MEASUREMENT

Measurement process is quasi-identical to the Scan & Paint methodology, with the distinction that in this case, the measurement plane is not in the vicinity of the noise source, but defined arbitrarily in the space to characterize. Furthermore, a pressure transducer is positioned in the measurement plane, in order to obtain the relative phase information within the scanned area.

ARRAY CREATION

Once the data is acquired, the sensor position is extracted for every video frame, obtaining the path that has been measured during the acquisition step. The system creates a grid on the measured plane, in which all data, acquired per grid cell area, is used to simulate a virtual transducer. Combining this information with the reference transducer position, the phase and amplitude information is reconstructed.



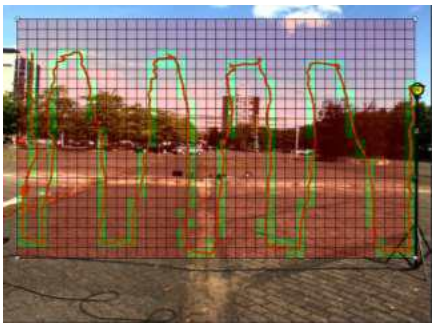


Figure 1: Measurement process and required items; Figure2: Red Line: tracked positions: red/green squares: obtained virtual transducers; Yellow sphere: reference pressure position

ANALYSIS METHOD SELECTION

• Far field beamforming: this method is to be applied to problems with unknown geometry. The source strength is assessed by the product of the received signal and the radiation pattern of the array.

• Near field beamforming: The problem geometry is known, and there for the actual source radiation can be estimated.

RESULT DECONVOLUTION

ISCA deconvolution method enhances the measurement result dynamic range and the accuracy of the beamformer. This method is computer-resources demanding and therefor used to refine the regions of interest.

II. COMPATIBLE PROBES

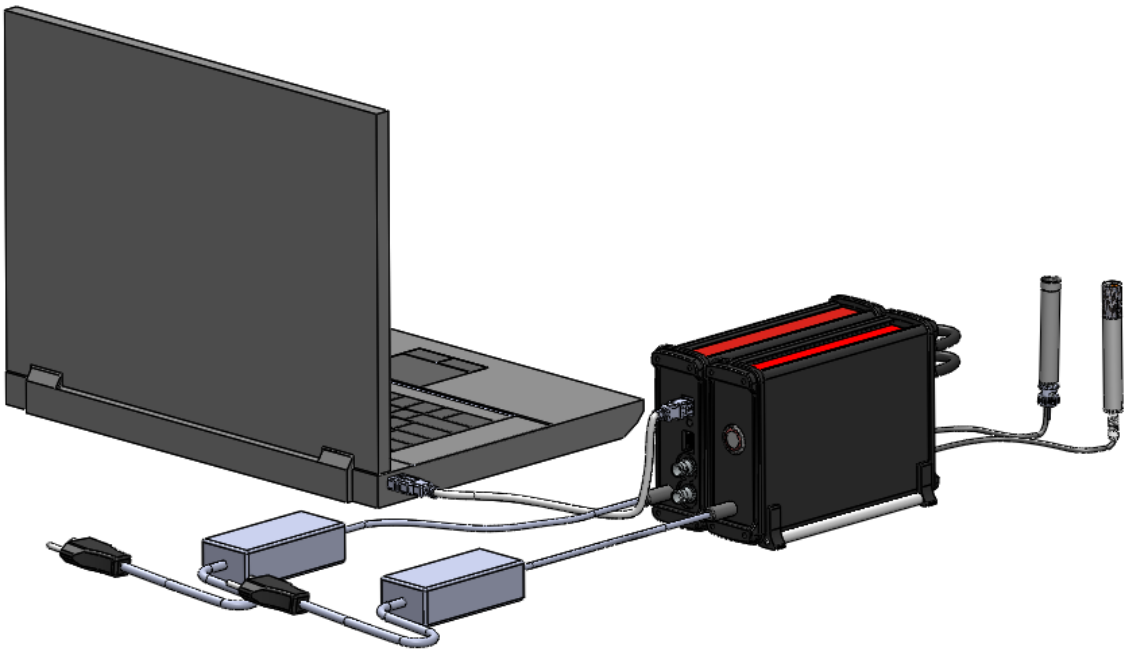
Probe type	Diameter	Maximum level range		Temperature range
		Pressure	Velocity	
PU regular	12.7 mm	110 dB	125 dB	-17 to 63

More specifications can be found on the probes datasheets.

III. COMPATIBLE FRONTENDS

Frontend	Nr. Channels		Max Fs (KHz)	Bits	IEPE
	Input	Output			
Scout422	4 analog inputs 1 tachometer input 1 trigger input	1 amplified output 1 analog output	52	24	Yes
DIC24	24 input, expandable		350 Hz to 50 kHz	24 bits	yes

IV. CONFIGURATIONS & CONNECTIONS



V. SYSTEM COMPONENTS

SENSORs	
PU PROBE	1x PR
REFERENCE MICROPHONE	GRAS P TRANSDUCER
CONDITIONER	1x MFPA-2
FRONTEND	1x Scout V2
CAMERA	Logitech B-910
ACCESSORIES	
Tripod	1x
Feet	1x (for Scout and MFPA)
CABLES	
Probe-Conditioner	1x CAB-LEMO-10-77
Scout-MFPA	2x BNC
Scout-PC	1x USB cable (white)
Camera-PC	integrated in camera
POWER SUPPLIES	
MFPA	1x19V
Scout	1x19V
FILES	
Calibration report	1x printed and USB (...:\Calibration*Serial.pdf)
Product manual	1x USB (...:\Software\Microflown SW)
PELICAN CASE	1x

VI. ACCESSORIES

- MICROFLOWN TECHNOLOGIES REMOTE HANDLE (MF-RH): for easy operation, the Scan & Paint measurement process can be managed from the remote handle, thus removing the need to operate the system from the PC.
- BATTERY PACK: New PowerGorilla battery pack is made compatible with Microflown equipment in order to make it more portable.
- WIND SCREEN: for enhanced outdoor performance.

Please consult our sales department (info@microflown.com) for suitable accessories and add-ons for your measurement setup.

VII. F.A.Q

WHAT ARE THE FREQUENCY LIMITS FOR SOURCE LOCALIZATION?

They depend on the array configuration:

- Lower frequency limit: size of array
- Higher frequency limit: cell size

These parameters are adjustable in post-processing stage.

WHAT IS THE FREQUENCY RESOLUTION OF THE METHOD AND WHAT DOES IT DEPEND ON?

It depends on:

- Analyze parameters: FFT points.
- Length of time series.

Down to few Hertz

WHAT IS THE SPATIAL RESOLUTION OF THE METHOD AND WHAT DOES IT DEPEND ON?

Mainly depends on the distance camera-item.

Results: down to mm up to several cm/m

WHAT SHOULD BE THE DISTANCE BETWEEN MEASURED ITEM AND SCANNED PLANE?

Two methods are available, far field and near field beamforming. With the difference that the second requires knowledge about the distance between noise source-measurement plane.

The maximum distance is determined by the source strength, as long as it can be heard in the measured plane.

WHAT IS THE RECOMMENDED SCANNING SPEED?

The slower scanning the longer time series to analyze.

- 2,5-5 cm /s

WHAT ERRORS CAN OCCUR IN THE RESULT?

- Camera alignment errors can bias sound map projection
- Manipulation noise introduced by the user while moving the probe (detection and filtering tool on post-processing stage)
- Non-stationary disturbances during measurement (Post processing tool to detect and neglect)
- Wind noise in outdoor measurement (Low frequency noise masking)
- Wind affect the propagation path introducing an off-set in outdoor measurements (Drag-Drop tool to correct in result representation)

WHICH BEAMFORMING TECHNIQUE SHOULD BE CHOSEN?

Near field beamformer if distance between noise source-measurement plane is known. Far field beamformer otherwise.

WHY TAKING INTO ACCOUNT THE COHERENCE BETWEEN SCANNING AND FIXED SENSOR?

The calculations rely on the cross spectra between them, the coherence is an indicator of the estimation's quality.

VIII. USAGE AND PRECAUTIONS

- Do not submerge the electronics in water as this will lead to permanent damage.
- Only use the cables supplied with the kit. Any modifications to these cables or the use of cables of a different brand or type may result in permanent damage to the probes or the rest of the electronics.
- The probes must be powered via a Microflown™ signal conditioner, the new MFPA series or the prior MFSC/ Router. Do not power the sensors with any other device; this might cause permanent damage to the system.
- Access exposure to dust/dirt particles could damage the Microflown™ sensor.

IX. TECHNICAL SUPPORT

For any problem or doubt with your equipment, please contact Microflown™ Technologies Customer service:

- Mail: cs@microflown.com

- Skype: cs.microflown
- Telephone: +31(0) 88 001 08 11 Monday to Friday, from 9:00 to 17:00 (UTC+1).

X. WARRANTY POLICY, REPAIRS AND REPLACEMENTS

WARRANTY AND REPLACEMENT OR SUBSTITUTION

During the first two years (24 months) the seller offers a warranty on all its products, except for trading items and third party manufactured items. The seller warrants that all products will be free from defects in materials and workmanship for this period of two years. During this two year period, the seller will repair or replace defect products free of charge. Products damaged by accident, abuse, misuse, natural disaster or by any unauthorized disassembly, repair or modification are not covered by this warranty. The incurred transportation costs of returning the products to seller will be borne by the buyer. The logistical cost for returning the products back to the buyer will be borne by the seller. Several products come with a “VOID if seal is broken” sticker, the warranty is void at all times when this sticker is broken.

GRACE PERIOD (YEAR 3 AND 4)

During the third and fourth year the seller offers a grace period. In the grace period the products purchased at an earlier date can be replaced by completely new state of the art products of the same scope of the original purchase. This applies only for the products known as standard probes and signal conditioners. In the first year of the grace period, (year 3) customers have an option to replace their products for 25 % of the actual ex works end-user price. The full freight and packaging charges apply.

In the second year of the grace period, (year4) customers have an option to replace their products for 50 % of the actual ex works end-user price. The full freight and packaging charges apply.

The new products are accompanied by a new warranty. Both the two years warranty and grace period become applicable again from the date of invoice.

REPAIRS OUTSIDE WARRANTY POLICY

Replaced/repaired parts come with a six month warranty under the same conditions as the two year warranty.