

**M+P** | Member of  
Müller-BBM group  
*The solution people*



# CoMeT

## CoMeT Close Proximity CPX System

# Background

The Close Proximity CPX method is a means of assessing road surface properties with respect to their influence on traffic noise. Rolling noise is recorded using microphones that are installed close to test tyres in a special testing trailer. Measurements can be performed on designated or arbitrary sections of road. CPX is applicable for conditions where tyre-road noise dominates.

CoMeT CPX is designed in compliance with ISO 11819-2 "Acoustics – Measurement of the influence of road surfaces on traffic noise – Part 2: The close-proximity method" from March 2017.

Based on ISO 11819-2, we have created a practical and reliable measurement system. Our system benefits from the experience we have gained by performing more than 4000 CPX measurements using our own CoMeT CPX-systems. Our vast practical knowledge allows us to constantly improve both our hardware and software.

We have built more than 25 fully equipped CoMeT CPX trailers which are operational worldwide. Some companies also use specific hardware or software components from CoMeT CPX.

M+P is a world leading developer of CPX measurement solutions. M+P has contributed significantly to the development of a measurement method that complies with the framework of ISO WG 33. M+P has led full scale round-robin measurements for CPX-based equipment in 1997, 2003, 2008, 2011 and 2017.

The most recent version of our CoMeT CPX-system incorporates the latest findings from WG 33 (as laid down in the International Standard ISO 11819-2) as well as results from round robin tests.



# CoMeT CPX system

## Properties

Using our experiences with CPX measurements since 1997, we have identified what is important in a CPX system. We developed CoMeT CPX with the following characteristics in mind:

- **All-in-one:** integrated measurement system delivers that final results on-site
- **Practical:** CoMeT CPX trailer utilises an easily accessible acoustic enclosure that shields the measurements from wind and traffic noise.
- **High-end equipment:** complies with all applicable measurement standards
- **Flexible:** modular design of CoMeT allows client-specific requirements to be integrated into the system
- **Reliable:** CoMeT has been tried and tested in applications throughout the world for more than two decades.

## Applications

CoMeT CPX has been used successfully for the following applications:

- CPX-measurements according to ISO 11819-2 standard
- Acoustic conformity of production assessment of road surfaces shortly after construction
- Monitoring of noise reduction on road surfaces over time
- Development of new types of noise reducing pavements
- Measurement platform for comparing acoustic properties of different tyres (passenger cars and trucks)

## CoMeT CPX Trailer

The CoMeT CPX-trailer is a two-wheeled trailer with each wheel having its own separate acoustic chamber. This two-wheel concept allows both the left and right wheel tracks to be measured simultaneously. Due to the small dimensions and the enclosure of the trailer it can be used in all kinds of traffic situations. The trailer is equipped with various features to make CPX measurements as easy as possible.

## Technical Data

There are five versions of the CoMeT CPX-trailer available. The standard CoMeT CPX-trailer has a total weight of  $700 \pm 20$  kg. This includes extra mass as stipulated by ISO 11819-2 for correct tyre loading.

The dimensions of the trailer enclosure are 1.7 m x 2.4 m x 1 m (LxWxH). For transportation to and from measurement sites, the left and right covers of the trailer can be placed upright. The total width is then 2.1 m which allows for easier driving through narrow streets.

The trailer is not equipped with a braking system to avoid unnecessary wear of the measurement tyres and eliminate disturbances from brake squeal noise.

The CoMeT CPX trailer meets Dutch requirements for trailers up to 750 kg and its structural properties have been tested and approved by Dutch authorities. The trailer includes an official document that can be used for national approvals.

The system fulfils the requirements stated in ISO 11819-2 with broad margins.



Wind tunnel testing of the CoMeT CPX-trailer

# Specifications

The CoMeT CPX system is a turnkey system consisting of a CPX trailer and a measurement and analysis system.

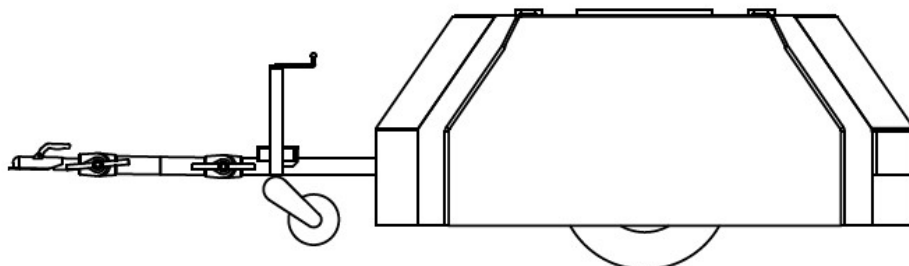
Besides five different versions of the trailer, we can also provide the trailer without the signal acquisition and data processing components, so you can use your own data acquisition system.

The CPXInspector software is also available separately.

## CoMeT CPX Trailer

The CoMeT CPX- trailer without any signal acquisition and data processing components consists of the following components:

- CoMeT CPX trailer with:
  - Transportation tyres for transport to and from measurement site
  - Absorbing material including a spare plate
  - Correct tyre load
  - Lifting device for easily and quickly changing tyres
  - Equipment for mounting tyres
  - Microphone framework for mounting microphones
  - Microphone cables (BNC)The trailer will be painted in a single RAL colour of your choice.
- Calibration report as required for analysis of measurement results and defining conditions for CPX measurements.
- Aligning device for checking microphone positions (height and distance).
- Official document in English with structural properties of CoMeT CPX trailer. This document can be used for type approval.
- Delivery of CoMeT CPX trailer to you at our office in Vught, Netherlands.
- Two reference tyres of type Uniroyal Tigerpaw (SRTT) 225/60-R16 including rim. This reference tyre is specified in ISO/TS 11819-3 "Acoustics – Measurements of the influence of road surfaces on traffic noise – Part 3: Reference tyres".



## Turnkey CoMeT CPX System

The turnkey configuration consists of the following components:

- CoMeT CPX-trailer with:
  - Transportation tyres for transport to and from a measurement site
  - Absorbing material including a spare plate
  - Correct tyre load
  - Lifting device for easily and quickly changing tyres
  - Equipment for mounting tyres
  - Microphone framework for mounting microphones
  - Microphone cables (BNC)The trailer will be painted in a single RAL colour of your choice.
- Two reference tyres type Uniroyal Tigerpaw (SRTT) 225/60-R16 including rim. This reference tyre is specified in ISO/TS 11819-3 "Acoustics - Measurements of the influence of road surfaces on traffic noise - Part 3: Reference tyres".
- Calibration report as required for analysis of the measurement results and defining conditions for CPX measurements.
- PAK MKII (2-slot) multi-channel data acquisition and analysis system suitable for performing CPX-measurements. The system includes a GPS module. PAK MKII can also be configured for other (sound) measurements beyond CPX applications. You can order extra modules to extend the number of measurement channels. PAK MKII system is developed by Müller-BBM VibroAkustik Systeme GmbH in Munich, Germany.
- PAK software
- PAK software set up for CPX-measurements with four microphone signals, speed signal, trigger signal and GPS signal.
- User manual "How to Perform CPX Measurements in PAK".
- Four microphones, four preamplifiers and sound pressure calibrator, all class I. Calibration certificates are included.
- Aligning device for checking microphone positions (height and distance).
- Manual triggering device for marking begin and end of test sections as well as specific test positions.
- CPXInspector software for analysing the PAK data according to ISO 11819-2.
- User manual "CPXInspector Software" on how to process CPX data.
- Two-day training at our office in Vught, Netherlands:
  - How to perform CPX measurements with your own system
  - How to present CPX measurement data in data sheets
  - Calibration of CoMeT CPX trailer
- Official document in English with structural properties of CoMeT CPX trailer. This document can be used for type approval.
- Delivery of CoMeT CPX system to you at our office in Vught, Netherlands.

## Basic CoMeT CPX System

The basic configuration consists of the following components:

- CoMeT CPX-trailer with:
  - Transportation tyres for transport to and from a measurement location
  - Correct tyre load
  - Lifting device for easily and quickly changing tyresThe trailer will be painted in a single RAL colour of your choice.
- PAK MKII (2-slot) multi-channel data acquisition and analysis system suitable for performing CPX-measurements. The system includes a GPS module. PAK MKII can also be configured for other (sound) measurements beyond CPX applications. You can order extra modules to extend the number of measurement channels. PAK MKII system is developed by Müller-BBM VibroAkustik Systeme GmbH in Munich, Germany.
- PAK software
- PAK software set up for CPX-measurements with four microphone signals, speed signal, trigger signal and GPS signal.
- User manual "How to Perform CPX Measurements in PAK".
- CPXInspector software for analysing PAK data according to ISO 11819-2.
- User manual "CPXInspector Software" on how to process CPX-measurements.
- One-day training at our office in Vught, Netherlands:
  - How to perform CPX measurements with your own system
  - How to present CPX measurement data in data sheets
- Official document in English with structural properties of CoMeT CPX trailer. This document can be used for type approval.
- Delivery of CoMeT CPX system to you at our office in Vught, Netherlands.



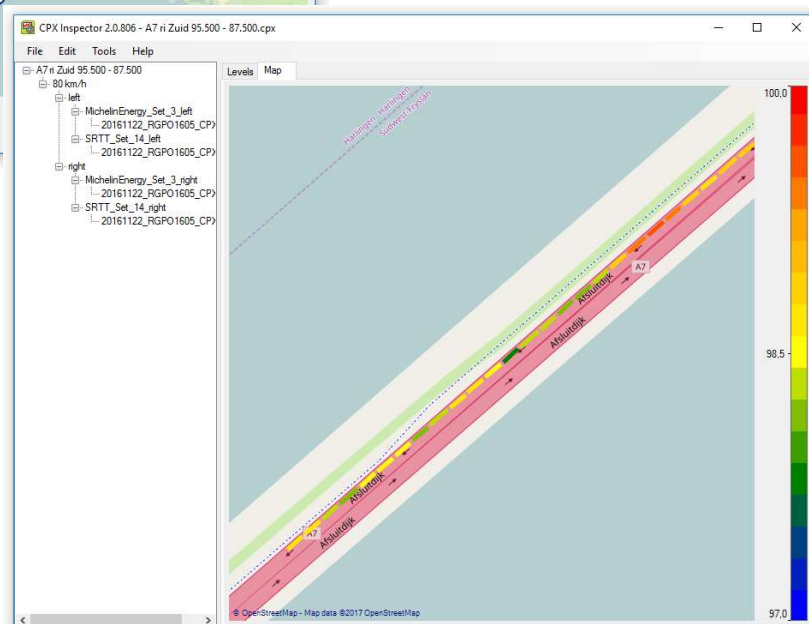
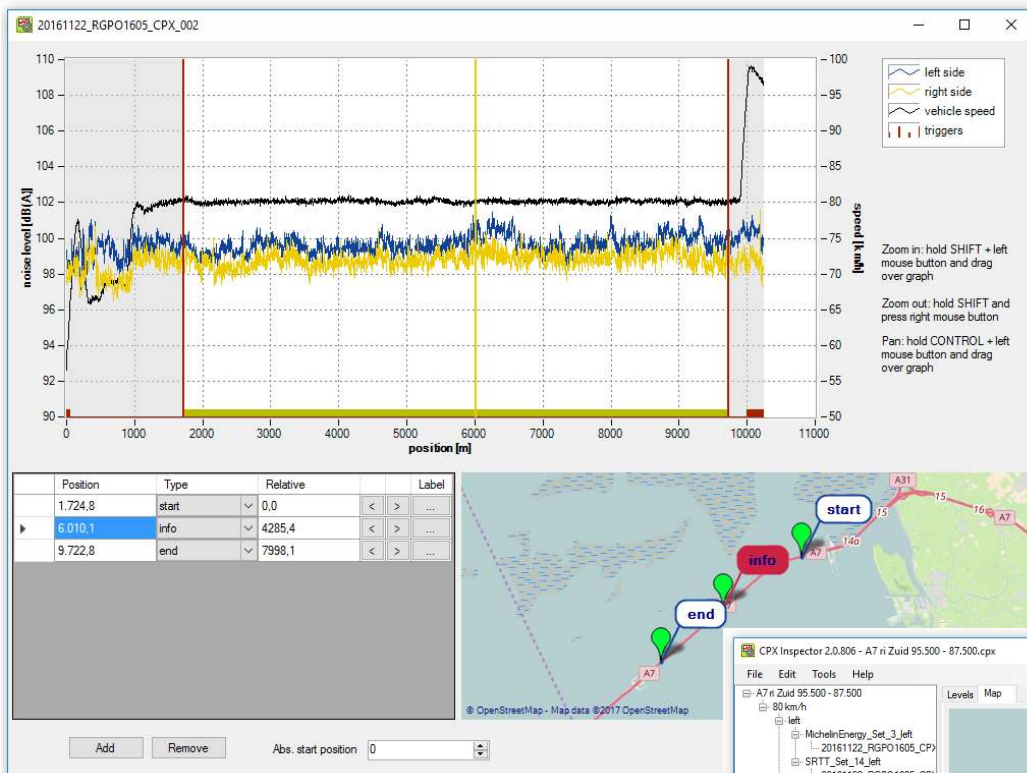
PAK MKII (2-slot)  
dimensions 300x300x60 mm

## CPXInspector Software

The CPXInspector software analyses CPX measurement data according to the ISO 11819-2. Together with speed data and optional GPS, air temperature, road surface temperature and tyre temperature data, the measured sound levels are transformed into standard CPX results per 20 meters. All results can be exported to standard spreadsheet software for reports or further analysis.

CPXInspector can import various CPX data formats. The following software data formats are currently supported:

- PAK software from Müller BBM Vibro Akustik Systeme GmbH with a prescribed text-based export format
- SAMURAI software from SINUS MessTechnik GmbH with a defined output format for spreadsheet software like Microsoft Excel.



# Options

- Additional Uniroyal Tigerpaw (SRTT) 225/60-R16 tyre including rim.
- Equipment for measuring air, road and tyre surface temperatures in compliance with ISO 11819-2 with storage in PAK MKII system.
- Additional microphone and preamplifier (Class I).
- Equipment to measure rubber hardness of the tyres.
- Dashcam with GPS for taking video images of the road section during CPX measurements.
- A non-contact optical velocity sensor. The sensor is mounted on the CoMeT CPX trailer and all data will be stored and analysed in PAK MKII. The accuracy of the sensor fulfils the requirements of ISO 11819-2.
- Calibration of CoMeT CPX trailer. The calibration results will be presented in a trailer calibration report. The CoMeT CPXInspector software will be updated with the new calibration results. On-site calibration lasts one day. The total trailer calibration must be performed once every two years.
- On-site support / training.





# Options

Besides the standard CoMeT CPX-trailer, we can also provide the "CPX+", "CPX-XS", "CPX-XL" and "CPX-XXL" version of the trailer.

## CoMeT CPX+ trailer

The CPX+ trailer is designed especially for performing tyre noise measurements with different tyres. The CPX+ trailer has the possibility of easily adjust the tyre load.

Specifications are:

- Tyre load: 250 – 425 kg per tyre
- Rim size: 14 – 20"
- Tyre width: 125 – 255 mm
- Tyre diameter: 600 – 800 mm

## CoMeT CPX-XS trailer

The CPX-XS trailer is the standard CoMeT CPX-trailer with a total width of 2.0 m instead of 2.4 m.

## CoMeT CPX-XL trailer

The CPX-XL trailer is designed to make it possible to measure also on the front and rear optional microphone positions (pos. nr. 4 and 5) according to ISO 11819-2.

This trailer is 450 mm longer than the standard CoMeT CPX-trailer.

## CoMeT CPX-XXL trailer

The CPX-XXL trailer makes it possible to measure on all mandatory and optional microphone positions according to ISO 11819-2.

This trailer is 600 mm longer than the standard CoMeT CPX-trailer.



CoMeT CPX+ trailer



# Options

## FLaSH|M

FLaSH|M is a mobile texture measurement system that measures a single line road profile with high accuracy. FLaSH|M is ideal for applications like:

- Road maintenance monitoring
- Efficient and detailed information on the acoustic performance of the pavement, combined with our CoMeT CPX system
- Performing R&D on road pavements for acoustics and fuel consumption
- Characterisation and certification of automotive test tracks

FLaSH|M records the road texture at one sample per millimetre. During recording, the operator can monitor the signal quality and determine whether the recorded profile data is plausible. After recording, the acquired data is fed into the TextureInspector software for further analysis.

FLaSH|M complies with ISO 13473 standards. The main FLaSH|M components are a fast, laser-based displacement sensor, an optical velocity sensor and M+P's TextureRecorder and TextureInspector software.



# Conditions

## Delivery time

CoMeT CPX system will be delivered approximately 4 months after ordering. We will provide you with an exact delivery date when you place your order.

## Support

### CoMeT CPX-trailer

The CoMeT CPX trailer is a design that has been in use since 1997. Minor damage can occur when the trailer is used extensively. Since only widely available standard components are used, repairs can be easily performed by local mechanics. This also applies to the absorption material used inside the CoMeT CPX trailer. Some spare samples are included with the trailer on delivery for minor repairs to the cladding.

### PAK MKII hardware

The PAK MKII system is currently used throughout the world for measurement applications by many companies. Should there be a fault in the PAK MKII system, simply send the entire system or defective component back to M+P. The repaired system or component will usually be returned within a few days.

### Software

The standard support period for the software is one year subsequent to delivery. During this period you will receive free access to the M+P support desk and you will receive free software updates. After this year you can extend the support period by ordering a software maintenance contract.

## Warranty

### Hardware

The manufacturer's warranty applies for the CoMeT CPX hardware. The time of warranty for most equipment is 12 months.

### Software

The warranty of the PAK software and CPXInspector software is described in the license agreements that you receive on delivery. We guarantee to rectify any software problems within 12 months of delivery.

## Maintenance

ISO 11819-2 stipulates a number of items to be inspected annually or regularly and/or to be replaced after a period of time. These include mainly:

- Microphones and preamplifiers are to be inspected at least once every two years. This must be performed by a laboratory authorised to perform calibrations traceable to the appropriate standards.
- The sound pressure calibrator must be verified annually.
- The acoustic performance of the sound absorbing material must be re-evaluated annually or earlier if the absorbing material seems to have accumulated a lot of dirt.
- The rubber hardness of the tyres shall be measured after the tyre has been run-in and at least every three months during the period when they are used for measurements.

The entire trailer must be calibrated once every two years.

# About M+P

Since 1972, we have studied and developed solutions relating to noise, vibration and air quality. With our expertise and communicative approach, we are a respected consultancy firm that is always open to our customer's specific needs. Based in the Netherlands, our team of 40 professionals are trained in a range of fields to serve our clients. We are backed up by more than 1200 specialists in the Müller-BBM companies. M+P is a member of the Müller-BBM Group.

## The Solution People

At M+P, we use a four-pillar approach to projects:

- **There is always a solution:** When doing business with us, you will notice our dedication. Your project becomes our project. From environmental permits, reports, complex calculation models to policy advice, we always work with you to find a solution and how to achieve it. Our path to the solution may be fast and direct, or it could be winding and filled with new discoveries. And should we discover that a new path should instead be pursued, we will always inform you about what we have learned.
- **If it doesn't exist, we'll invent it:** We love to be at the forefront and we employ state-of-the-art technology in our work. And we never shy away from new approaches when the situation demands it. Is it something that's never been done? We won't hesitate to try our hand at it. Where possible, we contribute to the behind-the-scenes development of new standards and methods. We actively participate in ISO, national and European committees. This way, we can help boost developments that are beneficial to all parties in the industry. And we are the first to apply these innovations in practice.
- **Versatile and agile:** Although we conduct large (government) projects, we are and always will be a small-scale enterprise with a personal approach: direct communication with no intermediates, clear reports, and tangible results. We are a pool of experts specialising not only in measurement technology and services but also in the development of instruments, software and geographic information systems. We have the team that your project needs.
- **We will step into your world:** We are eager to understand your work so that we can find the solutions you need. It makes no difference whether or not you are knowledgeable in the area of acoustics, vibration, or air quality. We will work with you to find the best way of accomplishing your goals.

For more on M+P, visit us at [www.mplusp.eu](http://www.mplusp.eu) and for more on the Müller-BBM Group, visit [www.mbbm.com](http://www.mbbm.com)

# References

## Overview of customers

Austrian Institute of Technology  
Flemish government  
Belgian Road Research Centre  
Research Institute of Highway  
Cerema  
IFTA  
Bundesanstalt für Straßenwesen  
Müller-BBM  
Akustikforschung Dresden  
JARI  
Hyundai Motor Company  
Korea Expressway Corporation  
Nexen tire  
Poinix  
Vilnius Gediminas Technical University  
Staten Vegvesen  
CEDEX  
Skanska  
Müller-BBM Schweiz  
Grolimund + Partner  
SINUS Engineering AG

Research and Technology  
Public Roads Administration  
Research and Technology  
Ministry of Transport  
Ministry of Transport and Infrastructure  
Engineering company  
Federal Highway Research Institute  
Engineering company  
Engineering company  
Research and Technology  
Car manufacturer  
National Road Infrastructure  
Tyre manufacturer  
Road constructor  
Technical University  
Public Roads Administration  
Ministry of Transport and Infrastructure  
Road constructor  
Engineering company  
Engineering company  
Engineering company

Austria  
Belgium  
Belgium  
China  
France  
Germany  
Germany  
Germany  
Germany  
Japan  
Korea  
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Korea  
Lithuania  
Norway  
Spain  
Sweden  
Switzerland  
Switzerland  
Switzerland



# References

Below are some pictures of CoMeT CPX trailers in use



CoMeT CPX trailer delivered to Müller-BBM GmbH in Munich, Germany. Müller-BBM currently has 3 CoMeT CPX trailers in operation.



CoMeT CPX trailer delivered to CEDEX in Madrid, Spain. CEDEX is part of the Ministry of Transport and Infrastructure.

CoMeT CPX trailer delivered to Statens Vegvesen in Trondheim, Norway. Statens Vegvesen is the Norwegian Public Roads Administration.





CoMeT CPX trailer delivered to the Flemish Public Roads Administration in Brussels, Belgium.



CoMeT CPX trailer delivered to Belgian Road Research Centre (BRR) in Sterrebeek, Belgium.

CoMeT CPX trailer delivered to Grolimund + Partner AG in Bern, Switzerland. At the moment Grolimund + Partner has 2 CoMeT CPX trailers in operation.





One of three CoMeT CPX trailers used by M+P.



CoMeT CPX trailer delivered to Akustikforschung Dresden mbH in Germany.

CoMeT CPX trailer delivered to Research Institute of Highway in Beijing, China. The Research Institute of Highway is part of the Ministry of Transport.







CoMeT CPX-XL trailer delivered to POINIX Inc. in Korea.



CoMeT CPX trailer with mobile laser texture measurement system FLaSH|M delivered to Vilnius Gediminas Technical University in Lithuania.

CoMeT CPX trailer delivered to Bundesanstalt für Straßenwesen (BASt) in Bergisch Gladbach, Germany. BASt is part of the German Public Roads Administration.



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