

MiniCTA and Multichannel CTA

Compact CTA Systems for accurate flow investigations



The Multichannel CTA (top) and the MiniCTA (below)

Introduction

The MiniCTA and Multichannel CTA systems are solutions for educational and industrial use. They can be used for applications in air (up to 100 m/s) and in water (up to 2 m/s) and can be used with both wire and fiber/film probes depending on the application. They are especially suited for multipoint measurements in boundary layer investigations or in studies of coherent structures.

Key benefits

- Bandwidth ~10 kHz for wire probes in air
- Up to 20 m cables can be used
- Easy to use and easy to learn software – calibration, data acquisition, traversing, data reduction, database and graphical display in a single platform
- Velocity and directional calibration of probes
- Various Calibration Systems ensuring high accuracy

CTA and its application areas

Constant Temperature Anemometer (CTA) technology is a well-established technique with commercial systems available since 1958. The measurement principle is based on the cooling of small sensors placed in a flow.

The temperature (resistance) of the sensor is kept constant by an advanced feedback control loop that contains an electronic bridge circuit. This way, the anemometer produces a continuous voltage that is directly related to the instantaneous flow velocity. The output signal is sampled with high enough resolution to analyze the fluctuations in the frequency domain.

Even though CTA technique is intrusive and non-linear in response, it is still the best instrument for the accurate determination of high frequency flow fluctuations, turbulence investigations, boundary layer diagnostics, and simultaneous multi-point velocity and temperature measurements.

MiniCTA and Multichannel CTA Solutions

The MiniCTA and Multichannel CTA systems offer cost-effective solutions for measurement of flow and turbulence in air applications with up to 100 m/s velocities and up to 10 kHz fluctuation frequencies, or water applications up to 2 m/s.

Both platforms contain the same circuit board and therefore share the same specifications for velocity channels. The MiniCTA system is the single-channel version and is ideal for new CTA users and for more experienced users needing mobility. The MiniCTA system is also well suited for demonstration of CTA in undergraduate fluid dynamics laboratory classes.

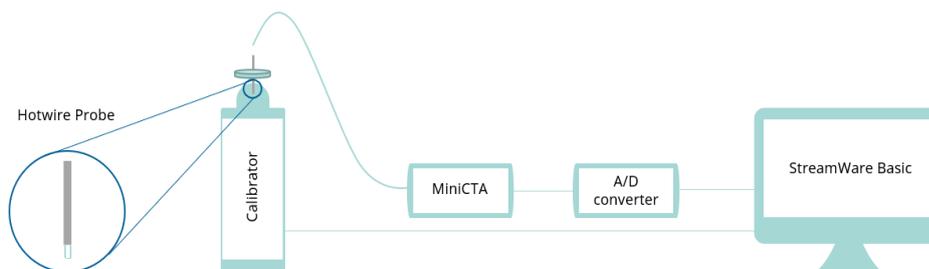
Multichannel CTA systems offer more functionality than their single-channel counterparts. They are normally configured with a number of velocity channels and a temperature channel, allowing for temperature corrected velocity measurements. Both systems are operated by the StreamWare Basic software, which supports set-up, probe calibration (both velocity and directional calibration), data acquisition, data conversion and data reduction.

MiniCTA

MiniCTA is a single channel anemometer optimized for measurements in air up to 100m/s and in water up to 2m/s. The frequency bandwidth reaches above 10 kHz at 50 m/s in air. The unit is also designed for use with probes suited for water applications.



MiniCTA



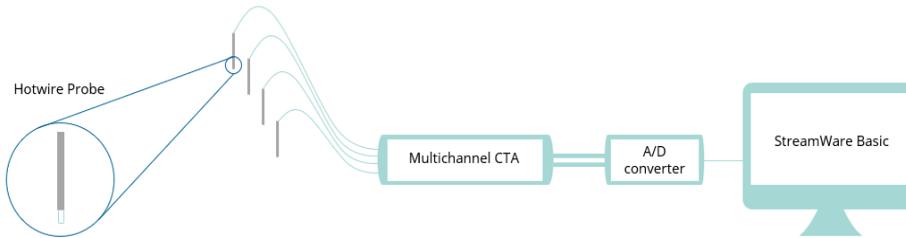
MiniCTA system shown with Calibrator and Directional Calibrator

Multichannel CTA

The multiple-channel versions of the MiniCTA offer a cost-effective solution for multiple-sensor measurements. Multichannel CTA systems are available in three different versions: with 4, 6 and 8 channels. The 4-channel, and the 8-channel versions contain just velocity channels. The 6-channel version contains 6 velocity channels, a temperature channel used with a thermistor probe for temperature correction and a channel for an optional reference velocity for in-situ calibrations in wind tunnels.



Multichannel CTA



Multichannel CTA system. A calibrator can be added for calibrating one probe at a time.

Probes

Our standard hot-wire and hot-film probes are supported by the MiniCTA and Multichannel CTA systems, and cover most applications in flow measurements. Additionally, special probe and support designs for unique flow situations in accordance with customer's specifications can be offered upon request. Contact your Dantec Dynamics representative for more details.



Hot-wire and hot-film probes

Probe supports, mounting tubes and cables

Probe supports connect the probe electrically to the CTA module while supporting it mechanically. They are available for all standard probes in straight and right-angle configurations. Mounting tubes made of stainless steel can extend the reach and stiffness of the probe support.

A/D Converter

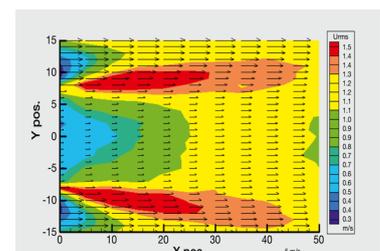
The output voltage from the CTA channel must be converted to a digital value for analysis in the software.

A 4-channel USB A/D converter with max. 100 kS/s simultaneous sampling is used with up to 4 MiniCTA channels or MiniCTA Temperature Module. With USB interface for the A/D converter, the system can be operated from a laptop.

For the Multichannel CTA, both USB and PCI board A/D converters are available.

Software

StreamWare Basic is a complete software package running in a Windows environment that helps the user to design, organize and document the measurements as well as post process the results. The complete system can be controlled by StreamWare Basic, which supports probe calibration, data acquisition, conversion and reduction. Raw and reduced data can be presented in StreamWare Basic or exported to other applications (e.g. Excel® and Tecplot®) for further analysis.



Velocity field in the wake of a cylinder. Data exported from StreamWare Basic to Tecplot.

Database for organised measurements and results

StreamWare Basic organizes the measurement setups and stores them in a dedicated database. The complete measurement task from configuration and experiment layout to acquiring, reducing and storing data is performed in an intuitive way. The user can go back to a data set and see the instrument configuration, electronic settings, measurement chain, and analysis sequence as an on-line notebook.

Default set-up parameters related to the actual probe are stored in dedicated libraries, as are drivers for a number of A/D converters and a traverse system. StreamWare Basic can communicate with the automatic calibrator and a traverse system via USB (or LAN), while analog data are being acquired via an A/D converter.

All set-ups, calibrations, experiment layouts and raw and reduced data are saved by the StreamWare Basic project manager, which puts you in full control and ensures traceability of results.

Turbulence Diagnostics in StreamWare Basic

CTA is the preferred technique for investigation of turbulence due to its unmatched frequency response. In the frequency domain, power spectra can be computed for analysis of the fluctuating flow characteristics.

System Computer

The MiniCTA and MultichannelCTA systems can be delivered with a system computer, a portable or a desktop version, which is preconfigured, tested and ready to use. All necessary hardware and software installation is performed before delivery.

System Test

All Dantec Dynamics systems with system computers have to pass a detailed system test procedure before shipment where the test data is recorded on the system computer. The system test procedure ensures a smooth installation of the system on site and a quick start to actual research activities.

Options

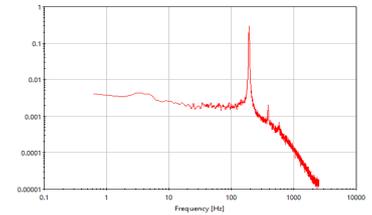
MiniCTA temperature module

A compact thermistor and amplifier package is available for measurement of slow temperature changes. With this package one can perform temperature correction to improve measurement accuracy in flows with temperature variations. The package is especially useful for stand-alone MiniCTA- (single-channel) and MultichannelCTA systems without temperature channels (4-channel and 8-channel versions).

Velocity calibration

As the sensor response depends on many external factors other than velocity, a calibration is often required for accurate CTA measurements. We offer calibrators for velocity calibration in air to assure high accuracy at all times.

Calibrators are available in manual and automatic versions. Both calibrators are designed for calibration of wire and fiber-film probes in air at velocities from a few cm/s up to > 300 m/s. The probe is placed in a free jet with a flat, low-turbulent velocity profile during calibration. The automatic calibrator is connected to a computer via USB or Ethernet and the calibration process is controlled from StreamWare Basic software. The manual calibrator supports a two-point as well as a multi-point calibration scheme. Both calibrators are supported in the StreamWare Basic software.



Block-averaged Power Spectral Density in the wake of a 10 mm diameter cylinder at 10 m/s.



The system computer is from an international manufacturer with worldwide presence.



Hotwire Calibrator for manual velocity calibration.

The calibrators are delivered with certificates including the calibration data of the internal transducers (traceable to accredited laboratories) and a verification of the jet velocity in three points over the velocity range. For further details on the calibrators, please refer to the data sheets available at our website.

Directional calibration

Hotwire sensors have velocity, temperature and directional sensitivity. Multiple sensor probes are used to perform 2- & 3- component velocity measurements using the directional sensitivity. For accurate measurements, a directional calibration should be performed using an optional manual Pitch/Yaw/Roll Manipulator or Automatic Directional Calibrator. Both types of directional calibrators fit to both types of velocity calibrators.

Individual velocity and directional calibrations improve the accuracy of the measurement compared to experiments using standard pitch & yaw factors.

For further details on the directional calibrators, please refer to the data sheets available at our website.

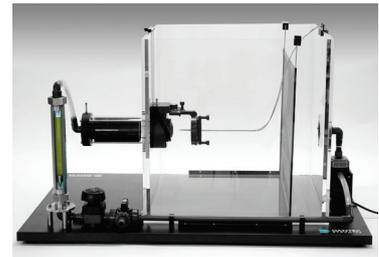


Manual Directional Calibrator mounted on top of an automatic calibrator. It allows probe rotation around two axes.

Calibrator for water velocity

The water calibrator is a recirculating water tunnel with a submerged jet in a water reservoir in front of the jet. It covers velocities from 0.005 to 2 m/s. The velocity is calculated on the basis of a flowmeter reading.

For further details on the water calibrator, please refer to the data sheet available at our website.



Water calibrator for hot-film probes, shown with the optional pitch/yaw/roll manipulator.

Traversing systems

We offer traversing systems that can move the probe in one, two or three directions with high accuracy. The traverse may be equipped with a probe rotation unit that also allows probes to be rotated. The rotation may be needed in order to obtain proper alignment of the probe with respect to the flow, or for obtaining three velocity components from single slanted wire probes or x-probes. For further details on the traversing systems, please refer to the data sheet available at our website.



Probe rotation unit

Technical Specifications

Specifications	MiniCTA (54T42)	Multichannel CTA (54N82)	Multichannel CTA (54N81)	Multichannel CTA (54N80)
Velocity channels	1	4	6	8
Temperature channels	-	-	1	-
Max. output Voltage	0.05 - 7 Volt			
Max. probe current	400 mA			
Operating resistance range	4 - 36 Ohm			
Freq. response	10 kHz			
Equivalent input noise	Typ. 3nV/ $\sqrt{\text{Hz}}$ > 1 kHz			
DC Offset	0.9 - 2.2 Volt			
DC Gain	2 - 5 Volt cont.			
Max. probe cable length	20 m			