

ECC3

Environment Controlled Chamber System

(Temperature and Humidity)

for use in

**weighing particulate matter filters
and other sensitive micro samples**

with

ultra micro balances

**in automotive, electronics,
chemical & pharmaceutical
R&D and industrial
production**



**The ECC2, 3 and 4
Environment
Controlled
Chamber Systems**

**for the
Weighing Accuracy
Performance Level**

1 μ g

The picture shows:

- The Weighing Chamber on the left hand side;
- The Technical Air Conditioning Components Box on the right side;
- The Control System (including Monitoring)
- **For harsh testing and production environment**

Made in Switzerland

ECC3 Specifications and description

System objective and description

Clients require precision weighing at a level of accuracy of approximately **1 micro gram (1 µg)**. This is usually carried out using either Mettler Toledo or Sartorius *ultra micro balances*, which typically offer a read-out accuracy of 0.1 µg, a reference repeatability of 0.25 µg and a sample weighing accuracy of about 0.5 µg – under *nearly ideal conditions*, implying practically no perturbations from any external factors such as vibration, temperature, humidity or pressure variability, and excluding drafts, electrostatic and other factors which might affect a specific sample-weighing operation. These also include major disturbances due to the operator's own presence and handling (heat and operational effects).

The **ECC3 Chamber System** aims to provide the **best technical and most cost-efficient environment** for ultra micro balance operations, including flexible **options for future weighing robotics** (probably two generations, 2009 / 2011). The chamber-controlled environment, with a range of client-specific weighing support and efficiency improvement options is intended to ensure *optimal real conditions* for typical tasks and applications (10 – 150 or more weighing per day) in the following areas:

- **automotive industry:**
particulate matter filter weighing
(in compliance with new diesel engine emission regulations tier 4 US EPA / stage IV, V EU Directives)
- **chemical, medical and pharmaceutical industry:**
micro samples and drugs weighing (air purity, temperature and humidity-sensitive)
- **research, test and calibration centers:**
for all types of sensitive micro samples (see above)

The design of the **ECC2** (2006) modular system solution was based on 10 years of experience of environmentally controlled precision measurement in a US company and on the international product experience acquired by the Swiss company IKT (IKT AG, International Know-how Transfer and Trading, Winterthur/Zurich), in close cooperation with many European technology, research and production partners. The **ECC3** (2008) is the result of a product improvement. The new IKT control system can be used for standard and for ultra high stability T and RH control. The **ECC4** (2009) is a client specific version with larger chamber dimensions (e.g. for larger weighing robotics systems). The main **technology and supply partners of IKT** are following: Mettler Toledo (CH/USA), Vaisala (SF/D), Thermo Scientific Fisher (USA/D/CH), CAS Clean Air Services AG (CH,A,D), Driestem (USA/UK/CH), VEAB (S), Falk AG (D/CH), Vector Control GmbH (CH/China), Sepp Oberholzer AG, Schiltknecht AG and the Zurich University of Applied Science (CH). Special co-operations with clients include FPT IVECO Motorenforschung AG (Arbon, CH).

The system comprises the environmentally controlled chamber (mainly temperature and humidity), the technical air conditioning components box and the control system with standardized data monitoring (**ECC-CM**). Weighing support software and an automated weighing robotics option is also available. The system is easy to install and the minimal maintenance and servicing required can be undertaken by the clients themselves, whatever their location may be worldwide (a.o. South America, China and Russia).

Technical - commercial specifications. The client alternatives and the ECC3 benefits.

The **ECC3 "Weighing Chamber System"** aims to provide controlled environmental conditions for ultra-precision weighing (micro gram accuracy), representing a **cost-efficient alternative to the expensive room-based** solutions. The Chamber System's technical design focuses on smaller total volume, lower cost, higher flexibility and ease of operation in harsh industrial production environments. In contrast to total "weighing room solutions", the Chamber System is also easy to install, relocate and maintain, and includes an optional robotics upgrade enabling more than 150 weighing per day with a filter weighing accuracy of $\leq 2.5 \mu\text{g}$.

Today, the automotive clients have a third, extremely low price alternative, the "box solution". These solutions have definitely no robotics integration potential and they often have too small space for the practical work.

We estimate the total financial savings with the "chamber" versus the "room" solutions at about 50%.



Our approach in reaching this goal is focused on managing only a smaller chamber volume, thereby excluding as far as possible perturbations due to the physical presence of the operator whose involvement is limited to handling via the chamber weighing window. Special attention was given to the mechanically robust stability. The technical design and selection of subsystems and components was determined following successful application by **American, European and International industrial and research clients**, and in view of compliance with specific **emission regulations** (e.g. regarding diesel engine particulate matter).

Main technical systems specifications (more detailed specifications available on request)

1 Admissible ambient conditions

Temperature:	15 – 26 °C (288 – 299 K)
Humidity:	30 – 60 % RH
Pressure/Altitude:	0 – 3000 m.a.s.

2 Environmental chamber-controlled climate conditions

Temperature:	Set point range	20 - 26 °C
	Control accuracy (steady state)	+/- 1.0 °C for max/min peaks ≤ 0.4 °C std. deviation
Humidity: (dew point)	Set point range	8 -14 °C
	Control accuracy (steady state)	+/- 1.0 °C (max/min) ≤ 0.4 °C std. deviation
Humidity: (relative humidity)	Set point range	40 - 50 % RH
	Control accuracy (steady state)	+/- 5 % RH (max/min). ≤ 1 % RH std. deviation

Note : the decisive control accuracy (steady state) is reached after a relatively short start-up period with automatic check and visual indication to the user (green/red lights). Higher accuracies upon request.

3 Other environmental chamber characteristics

Atmospheric pressure (add-on option)	measured and monitored, +/- 1 hPa
Airflow / draft around the micro balance	≤ 0.15 m/s (or client specific value)
Clean room class specification:	class 5 - 8 acc. with ISO 14644 (client specific)
Working area: (ECC4 larger, on request)	150 x 90 x 75 cm ³
Dimensions: (ECC4 larger, on request)	180 x 110 x 180; 200 x 80 x 200 cm ³
Required installation area / total weight:	25 m ² / 1200 kg
Practical weighing accuracy	(e.g. with the Mettler UMX series)
Metal reference repeatability:	0.5 µg std deviation (see note below)
Particulate reference filter repeatability:	≤ 2.5 µg std deviation (see note below)
Applicable international / national standards	USA EPA, 40 CFR 1065 for the US market and diesel emission regulatory framework EU/Intl Euro IV / V stage regulation , directive 2004/26/EC ff. of emission regulations ISO 14644-1 for CR performance
Electrical power supply:	400 VAC / 30 A / 50-60 Hz; P ~ 6 kW
Note: The micro balance supplier is finally responsible for guaranteeing a defined weighing accuracy.	

Recommended VVE analysis for financial project risk reduction (USD 100 – 500,000)

Prior to any weighing chamber or even room installation project we recommend an initial **analysis** be carried out **of current measurable vibrational perturbations and their effect on the micro balance** at the proposed site or location. IKT will assist you with our high-tech measurement experience and equipment, including any **geo-technical construction planning proposal** which might be required to ensure the long-term reliability and success of your micro balance environment project. (VVE = Vibrational Weighing Environment).



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