Cleanroom, Operations and Safety

Nanotalo (Puumiehenkuja 2 B), rooms 160c-e, Aalto University

https://ltl.tkk.fi/wiki/Clean_Room

What is a cleanroom?

Cleanroom is a room or a closed space that has a very controlled environment inside. Cleanrooms can also control temperature, humidity, sound, lighting, and vibration when necessary.

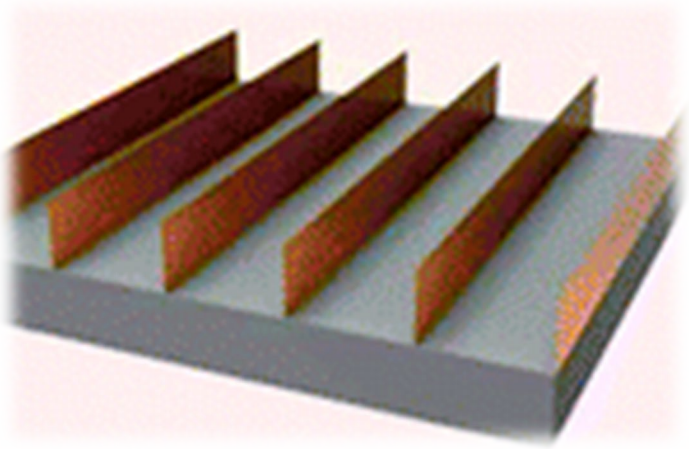
It has a low level of pollutants such as dust, airborne microbes, aerosol particles, and chemical vapors. It is a restricted area. Only people with proper training are allowed inside!

Clean rooms are classified according to the cleanliness level of the air inside the controlled environment.

The clean room classes includes ISO 1, ISO 2, ISO 3, ISO 4, ISO 5, ISO 6, ISO 7, ISO 8 and ISO 9. ISO 1 is the “cleanest” class and ISO 9 is the “dirtiest” class.

ISO Class	Maximum Particles/m^3					
	≥0.1µm	≥0.2µm	≥0.3µm	≥0.5µm	≥1µm	≥5µm
ISO 1	10					
ISO 2	100	24	10			
ISO 3	1,000	237	102	35		
ISO 4	10,000	2,370	1,020	352	83	
ISO 5	100,000	23,700	1,020	352	832	29
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO 7				352,000	83,200	2,930
ISO 8				3,520,000	832,000	29,300
ISO 9				35,200,000	8,320,000	293,000

Why are cleanroom fabrications needed?

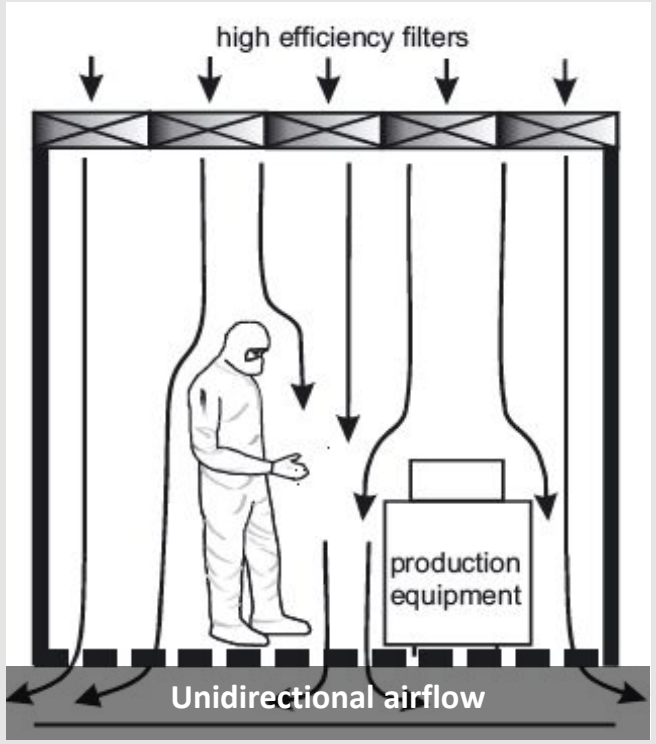


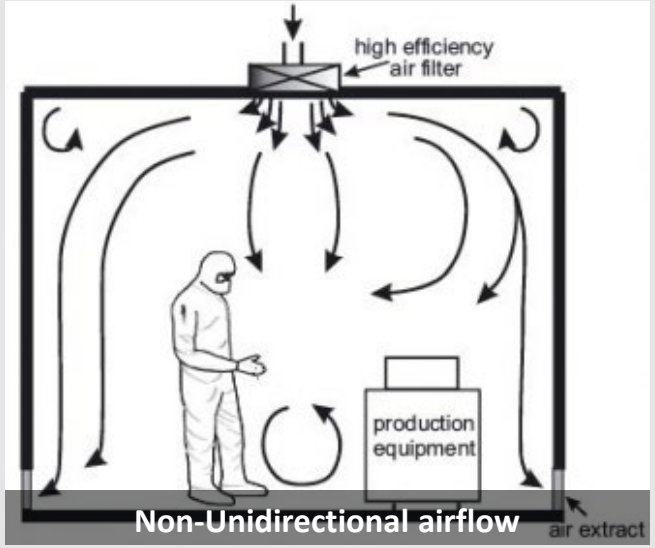
It is typically used in manufacturing or scientific research where small particles can adversely affect the manufacturing process. Maximizing product yield, improving quality control and ensuring safety are common reasons to use a cleanroom.

In micro- and nano- fabrication processes, devices or components range from few nanometers (1nm = 0.001 µm) to few micrometers. Thus, it is necessary to keep the fabrication environment clean to avoid any contamination, from the air particulate matter, that may ruin the devices functionality or quality.

Human hair ≈ 70±20 µm**, Smoke** ≈ 1 µm, ≈ 1 - 25 µm, **Bacteria** ≈ 2 µm, and **Human skin cell** ≈ 25 µm.

How is the environment maintained?



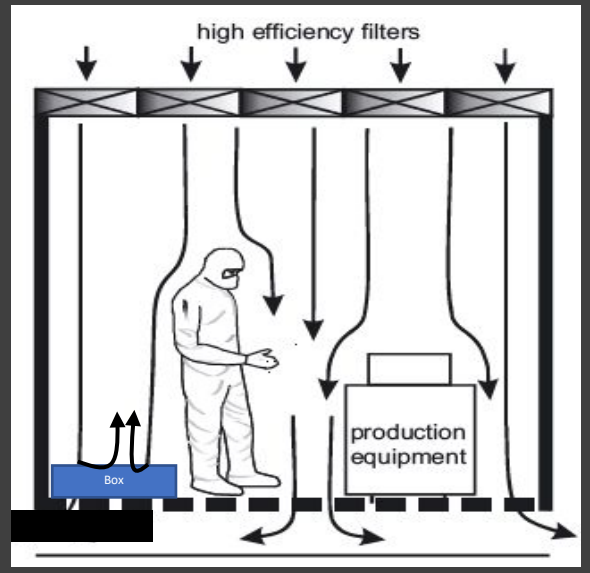


- Air inside a cleanroom is continuously purged in laminar or unidirectional flow and the pressure, humidity, and temperature is maintained constant.
- High Efficiency Particulate Air (HEPA) filter is used to trap particles that are 0.3 micron and larger in size.
- All the air delivered to a cleanroom passes through HEPA filters, and in some cases where stringent cleanliness performance is necessary, Ultra Low Particulate Air (ULPA) filters are used.

Processes or Activities that can affect the Cleanroom environment

Blockage

- Blocking air-returns reduces flushing dirt away
- Blocking air to flight hardware increases the chance of contamination



Activity

- Limit vigorous actions

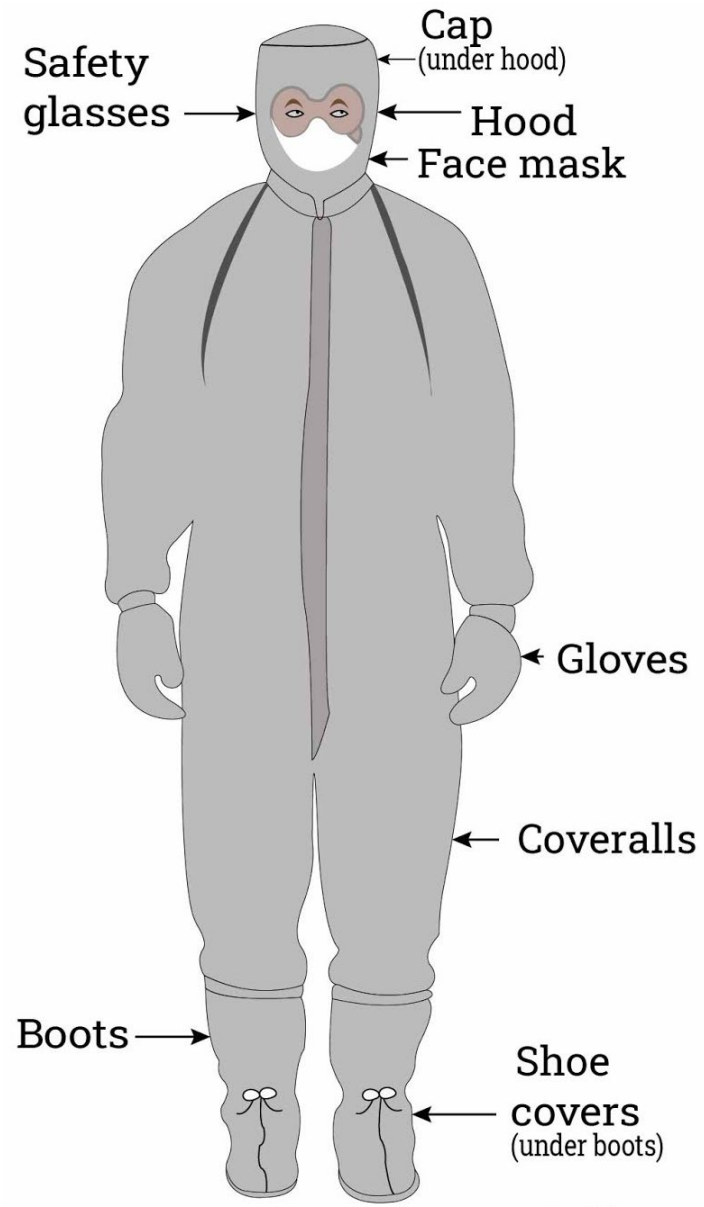
- Bring only clean items into the clean room
- Limit all activities that may create large amount of particulate matter such as soldering, drilling, etc.
- Use only house or HEPA filtered vacuum.

General – Cleanroom rules

- No entry for unauthorized personnel in new clean room.
- Proper dressing to the clean room is required.
- No shorts or skirts are allowed. Long pants must be always worn.
- Leather or synthetic closed toe shoes are required.
- No sandals or flip-flops are allowed.
- No extra garments or personal items are allowed in the Change Room or Cleanroom such as Umbrellas, Jackets, Bags or Purses.
- No eating or drinking is allowed in the cleanroom or gowning room areas.
- Clean up behind you (also, don't leave any special settings on the machines)
- Don't leave your stuff lying around. There are storage boxes.
- If something breaks, please, inform the person in charge of the device.

Garments

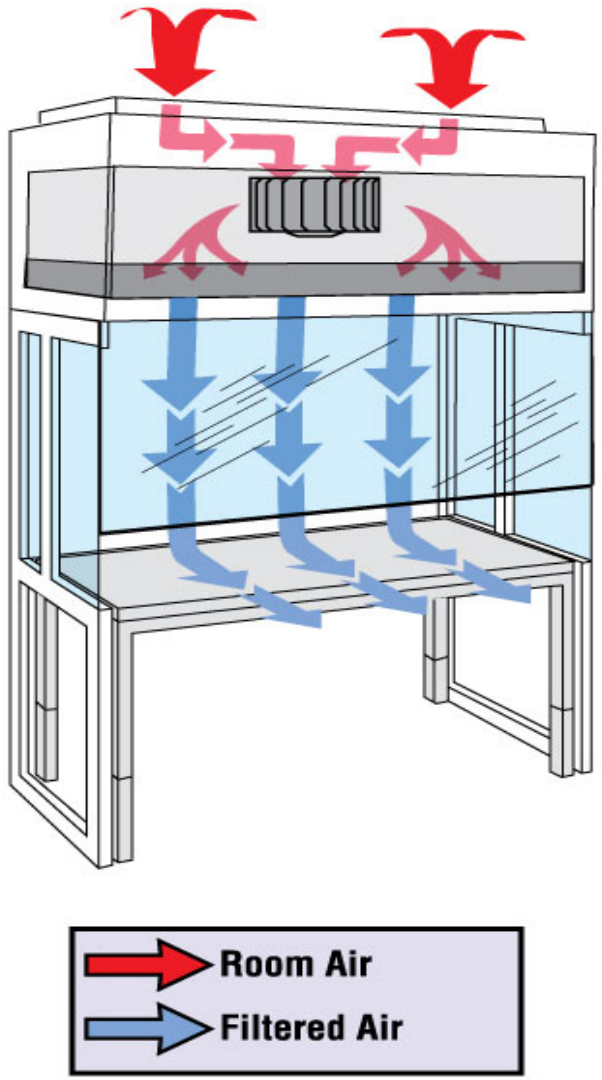
- Garments control contamination –They confine it inside or –They direct it to the floor
- Wear proper garments
- Wear garments properly



Fume Hoods / Flow Box

- Air is drawn in from the front of the cabinet and expelled outside the building.
- On the other hand, a flow box is designed to provide an area with lower particle contamination than in the ambient air.
- It draws in air from the clean room, filters it, and than circulate it back into the room.
- Therefore, all processes involving solvents or creating hazardous fumes must be carried out in one of the fume hoods and **not** in the flow box.

Fume hood



Flow box

Use Fume Hoods

Handling chemicals with inhalation hazards: toxic particles or powders, or compounds of unknown toxicity

Performing operations that may result in toxic aerosols

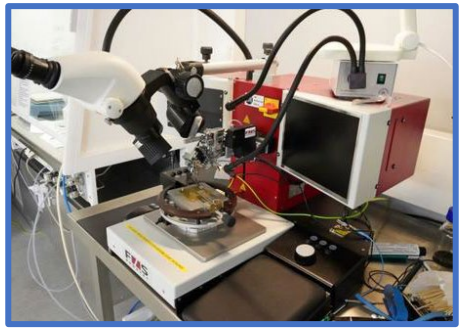
Carrying out experiments with hazardous exothermic reactions

Handling chemicals with ignitable vapors or with significant pressure

LTL MICRO- AND NANOFABRICATION AND TESTING FACILITIES

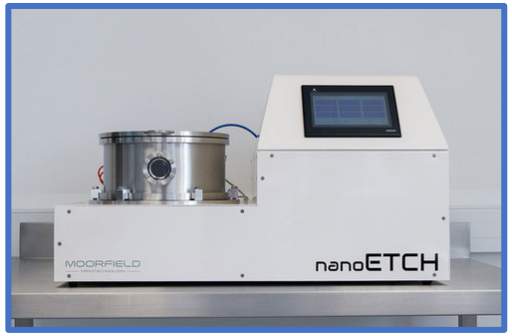
https://infrabooking.aalto.fi/onlinekalenteri/ltl/

SEM and E-beam Lithography

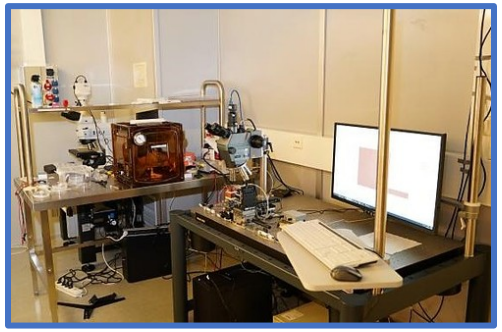


Wire Bonder

Micro Raman



Nano-ETCH



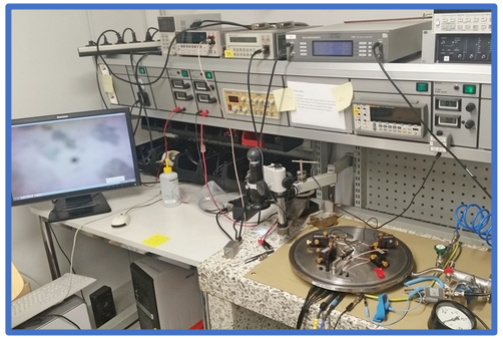
Transfer and Stamping Setup

E-beam Evaporator

DCA Sputter

CVD reactor

IR Heating System



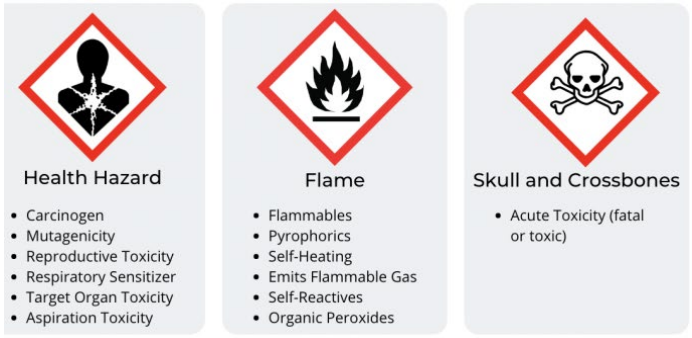
Probe Station

Safety instructions

- When you first enter the clean room make sure you know where the emergency exits, safety showers and eye wash stations of the clean room are located.
- For more safety instructions please visit the following link https://wiki.aalto.fi/pages/viewpage.action?spaceKey=TFYintra&title=Safety+matters

Know The Hazards: Symbols and Classification

Read the materials safety data sheet (MSDS) before.



Health Hazard

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

Flame

- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides

Skull and Crossbones

- Acute Toxicity (fatal or toxic)

Exploding Bomb

- Explosives
- Self-Reactives
- Organic Peroxides

Flames Over Circle

- Oxidizers

Exclamation Mark

- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer

Corrosion

- Eye Damage
- Skin Corrosion/Burns
- Corrosive to Metals

Environment (Non-Mandatory)

- Aquatic Toxicity

Gas Cylinder

- Gasses Under Pressure

Read the labels

- Avoid working alone when working with hazardous chemicals or processes!

Properly Store Chemicals

- **Do not segregate incompatible chemicals.**
- **Acetone should not be stored in a chemical store which houses bromine, chlorine, nitric acid, sulfuric acid, or hydrogen peroxide.**
- **Acids should be separated from bases**
- **Flammables should be stored in a flammable storage cabinet.**

Housekeeping

Keep work areas clean and free from potential hazards.

Properly dispose off old or expired chemicals.

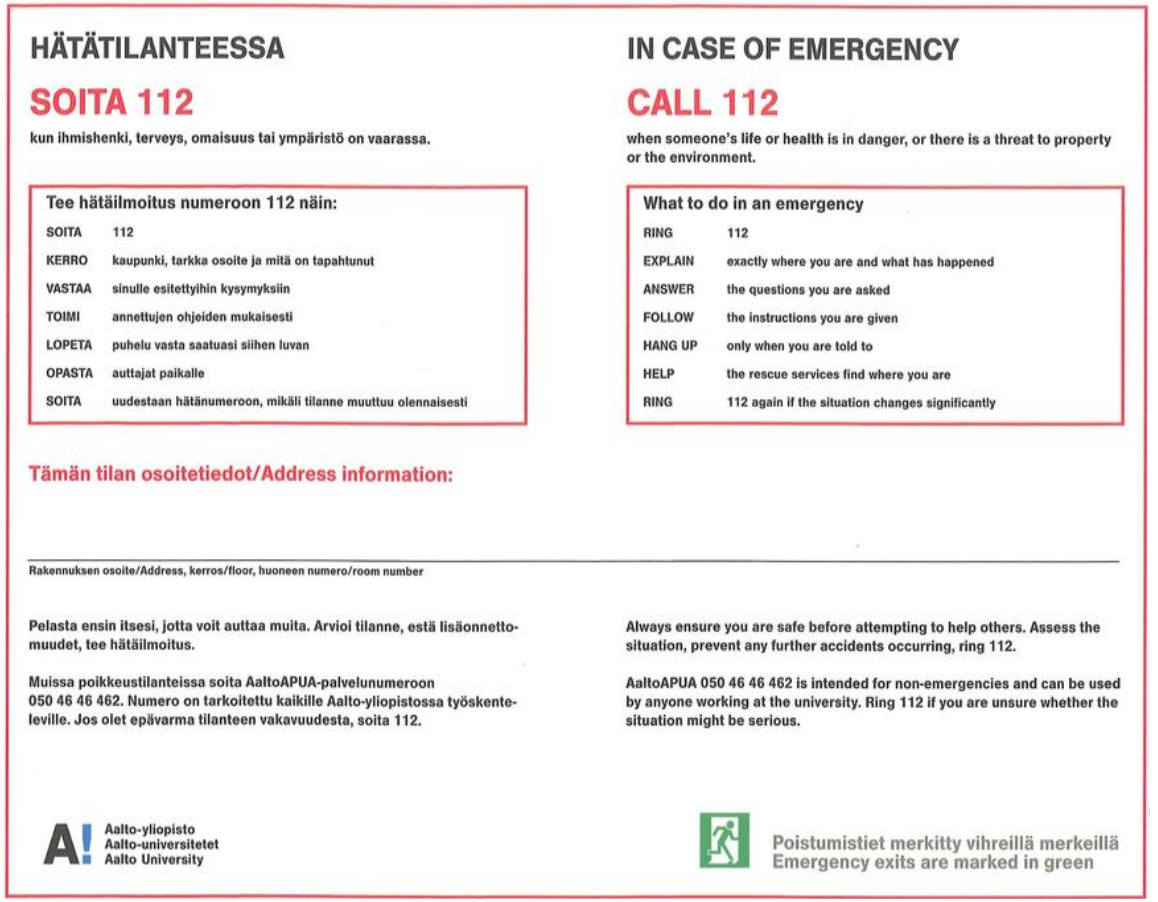
Cleanup spill immediately using cleanroom tissues or absorbers.

Emergency call
CALL 112

- **EXPLAIN** what has happened, give the exact address and city.

You will find your exact location (facility number) on the "Emergency procedures" signs located in the facilities.

- **ANSWER** all questions addressed to you.
- **ACT** according to the instructions you receive.
- **DO NOT HANG UP** until you are given permission.
- **GUIDE** the emergency personnel to the location.
- **CALL** the emergency number again if the situation changes significantly.



HÄTÄTILANTEESSA

SOITA 112

kun ihmishenki, terveys, omaisuus tai ympäristö on vaarassa.

Tee hätäilmoitus numeroon 112 näin:

SOITA	112
KERRO	kaupunki, tarkka osoite ja mitä on tapahtunut
VASTAA	sinulle esitettyihin kysymyksiin
TOIMI	annettujen ohjeiden mukaisesti
LOPETA	puhelu vasta saatuasi siihen luvan
OPASTA	auttajat paikalle
SOITA	uudestaan hätänumeroon, mikäli tilanne muuttuu olennaisesti

IN CASE OF EMERGENCY

CALL 112

when someone's life or health is in danger, or there is a threat to property or the environment.

What to do in an emergency

RING	112
EXPLAIN	exactly where you are and what has happened
ANSWER	the questions you are asked
FOLLOW	the instructions you are given
HANG UP	only when you are told to
HELP	the rescue services find where you are
RING	112 again if the situation changes significantly

Tämän tilan osoitetiedot/Address information:

Rakennuksen osoite/Address, kerros/floor, huoneen numero/room number

Pelasta ensin itsesi, jotta voit auttaa muita. Arvioi tilanne, estä lisäonnettomuudet, tee hätäilmoitus.

Muissa poikkeustilanteissa soita AaltoAPUA-palvelunumeroon 050 46 46 462. Numero on tarkoitettu kaikille Aalto-yliopistossa työskenteleville. Jos olet epävarma tilanteen vakavuudesta, soita 112.

Always ensure you are safe before attempting to help others. Assess the situation, prevent any further accidents occurring, ring 112.

AaltoAPUA 050 46 46 462 is intended for non-emergencies and can be used by anyone working at the university. Ring 112 if you are unsure whether the situation might be serious.

Aalto-yliopisto
Aalto-universitetet
Aalto University

Poistumistiet merkitty vihreillä merkeillä
Emergency exits are marked in green

AaltoAPUA 050 46 46 462

You can call the AaltoAPUA helpline 050 46 46 462 whenever in need of assistance. You can also call from abroad, in which case the number is +358 50 46 46 462.
The AaltoAPUA helpline is open 24/7 all year round and provides assistance in Finnish and in English.

Key Contact Information

- **Contact main user of the device for training and additional instructions.**

For other matters contact

Alexander Savin, Senior Scientist
Office: Puumiehenkuja 2 B, 178a
Email: alexander.savin@aalto.fi
Mobile: +358503442752

Or

Tripurari Tripathi, Research Engineer
Office: Puumiehenkuja 2 B, 156c
Email: tripurari.tripathi@aalto.fi
Mobile: +358504497781

In Emergency: Call 112