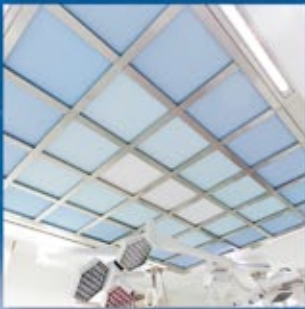


# *Operating Theatre Controller*

*The key for an efficient and safe environment*



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**FläktWoods**

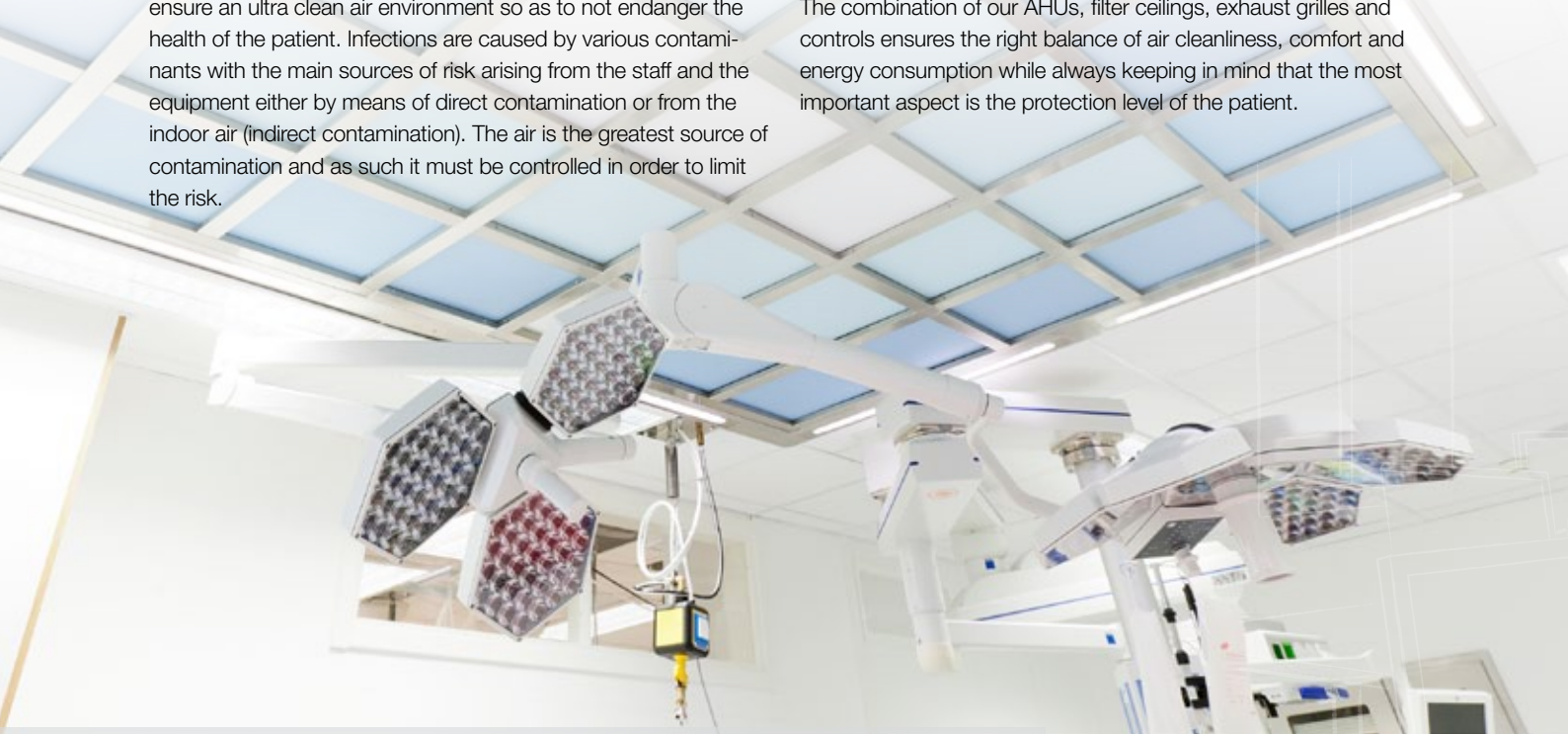
# OT controller presentation

## When hygiene is crucial

The operating room is the most critical zone in the hospital and as such the operating theatre must be a clean room in order to protect the patient. The ventilation and the filtration system must ensure an ultra clean air environment so as to not endanger the health of the patient. Infections are caused by various contaminants with the main sources of risk arising from the staff and the equipment either by means of direct contamination or from the indoor air (indirect contamination). The air is the greatest source of contamination and as such it must be controlled in order to limit the risk.

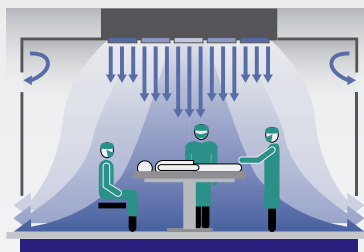
## OT controller

The OT controller developed by Fläkt Woods guarantees a safe environment in the OT. It manages the parameters that have an influence on air and controls the handling and diffusion of air. The combination of our AHUs, filter ceilings, exhaust grilles and controls ensures the right balance of air cleanliness, comfort and energy consumption while always keeping in mind that the most important aspect is the protection level of the patient.



## DIF-OT, the optimized laminar airflow for high clean rooms classification

Differential flow velocities decrease from the centre towards the system's perimeter to provide a dynamic barrier between the operating table and the outer zone. These differential flow velocities optimize the air treatment and the air cleaning in different operating areas: surgery bed (most critical area), surgical staff area and the outer area (rest of the staff and equipment).



- **Benefits of laminar airflow:**
  - ISO5 class at rest (acc. SWK199-3)
  - Short recovery time
  - No draft in the comfort zone
- **Benefits of differential velocities:**
  - ISO5 class at rest and at operational simulated (acc. SWK199-3)
  - No induced air coming from the room into the unidirectional diffusion, no need for air guide curtains.
  - Less required airflow to achieve ISO5 class than constant velocities (energy savings)
  - ISO4 class over the surgery bed

# Advantages

## Simplicity

The OT controller has been developed to be easy to plan, install and use and therefore an eQ air handling unit with a factory installed control system is a practical solution for consultants, installation engineers and end users. The integrated control equipment is supplied programmed, configured and tested, together with all the necessary field components. The control system conforms to EU directives (MD, EMD and LVD) and is CE marked. The OT controller is the perfect solution for both small installations with straightforward control functions and also for large installations with data communication requirements.

## Communication

The OT controller supports communication via open standard protocols, which allows its simple and cost effective integration with building automation systems. Connection to other systems is carried out by the system integrator.

## Quick installation

Not only is time saved on project design but also on installation. The OT controller is self-contained and requires no major on-site electrical installation. The control equipment is ready to go as soon as the unit is installed.

## High Quality

Installing a control system for a high quality air handling unit requires experience and expertise of air handling. The OT controller has been designed by the same team that designed the eQ and eQ PLUS, with a focus on design details that give good insulation, minimum leakage and low noise. The production of the OT controller is characterized by a rigorous quality assurance system to ensure an approved and electrically safe product. Naturally the standardized design is also a guarantee of cost effectiveness, reliability and high quality.



## eQ Plus AHU

When providing environmental comfort and ventilation for a facility, an air handling unit simultaneously performs several functions including the intake of outside air to meet ventilation air requirements, thermal mixing of this air with recirculated air from the occupied zones, thermal conditioning, moisture control, filtration to protect equipment and to remove contaminants, and attenuation of fan generated noise to control ambient levels in occupied spaces. The design of an air handling unit should minimize water and dirt accumulation, resist corrosion and permit adequate access for inspection and maintenance. With our extensive experience in manufacturing of AHUs, Fläkt Woods has designed a system that takes into account every minute detail required to ensure a hygienic environment.

### Hygienic features:

- The door locks are fitted into the door frame to allow unobstructed airflow and prevent dirt accumulation
- Non-metallic material is microbially inert
- Panel joints internally sealed with antifungal sealant, no visible internal framework for easy cleaning
- Large inspection sections
- Coil with pull-out tray
- T2/TB2 version available

### For high risk zones

#### we recommend:

- 3 stages of filtration ending with HEPA-filters
- Stainless steel panels
- Run around coils heat recovery to avoid any contamination
- Coils Fin pitch with at least 2,5 mm and covered with Epoxy
- Plug fan with EC or IE1 motors

# Functions

The following functions are available:

- Temperature control
- Humidity control
- Control of energy recovery (Econet or Ecoterm)
- Constant air flow
- Selection of 3 different air flows
- Constant over pressure of the room
- Night cooling option
- Night heating option
- Communication via TCP/IP, Modbus, LONworks, and BACnet as option



The OT panel installed in the Operating theatre displays the relevant information for the surgery team.

- The Time
- Temperature
- Hygrometry
- Selected mode
- Alarms in progress (for instance: overpressure not sufficient)
- Time left before next operation

When an operating mode is selected after the standby mode, a count down of 15 min will be displayed on the screen – This will ensure that the ISO class is recovered and the room is ready for operation.

From the control panel in the operating theater room, the surgery team is able to set:

- Temperature
- Hygrometry
- Screen brightness
- Requested mode

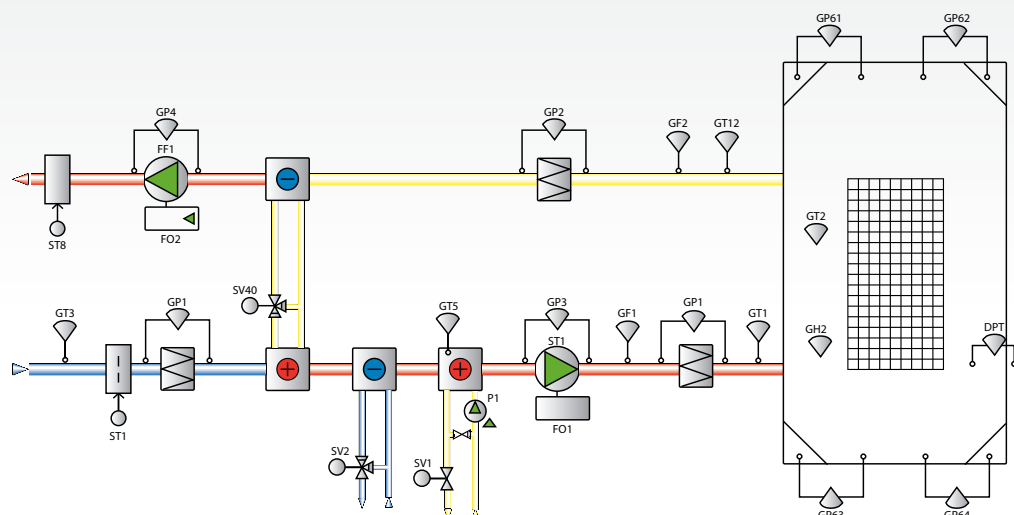
## Operating mode

The system is preconfigured with three different operating modes:

- **ISO 5** For critical surgeries  
High Air Flow
- **ISO 7** For less critical surgeries  
Medium Air Flow
- **Stand-by** Empty OT  
Minimum Airflow to guarantee the overpressure

Two other modes are available :

- **Off** The unit is shut down
- **Maintenance** Manual mode





### **Temperature control**

Room temperature is controlled by means of GT2 with a dead zone between the heating and cooling steps.

In surgery mode (ISO 5-7) the supply air temperature is always maintained below the measured room temperature in order to maintain a laminar and controlled airflow.

In stand-by mode the supply temperature is maintained between 16 and 25°C.

When heating demand increases, control takes place using the following sequence:

- Cooling valve SV2 closes to decrease cooling if the dehumidification is not active
- Valve SV40 opens to increase heat recovery
- Heating valve SV1 opens to increase heating

### **Dehumidification control**

The humidity sensor GH2 overrides the cooling valve if dehumidification is needed.

### **Return water control**

AHU in operation:

If the return water temperature, GT5, goes below a set point the return water controller will take over modulation of the heating valve, to prevent the freeze protection thermostat from tripping.

### **AHU shut down:**

The return water controller will modulate the heating valve in order to maintain the desired return water temperature, GT5.

### **Cooling recovery**

Please see the Econet technical documentation.

### **Frosting-up protection**

Is done by means of the Econet controller.

### **Flow control**

- Supply air flow is controlled by GF1 by means of controlling the supply air fan speed.
- Extract air flow is controlled by GF2 by means of controlling the extract fans speed.
- The DPT pressure sensor overrides the EF (exhaust fan) speed in order to maintain the right differential pressure in the operation theatre.

### **Night cooling (optional)**

Night cooling starts if the indoor temperature exceeds a set starting limit and the following conditions are satisfied:

Outdoor temperature is a minimum of 2°C lower than the indoor temperature.

- The outdoor temperature is above limit.
- The standby mode is active.
- The unit is not in ISO 5 or ISO 7 modes.

Night cooling stops when the indoor temperature has dropped to 4°C below the set starting limit, or any other operating conditions has/have ceased to apply.

The air handling unit in operation high airflow, heating and cooling valves are closed and heat recovery is shut off.

To avoid re-heating after night cooling has been in operation, the supply air temperature is limited so as not to exceed the indoor air temperature for a period of 6 hours after the night cooling time channel has shut off.

### **Night heating (optional)**

- Night heating starts if the room temperature goes below set value for start and following conditions are set :
- Winter operation
- The standby mode is active

The night heating stops when the indoor temperature goes above the set hysteresis or if one of the other start conditions are off.

The air handling unit in operation, supply air temperature is regulated towards setpoint via control of heating valve and maximum heat recovery. High flow operation is used.

### **Alarm**

3 different kinds of alarm are available.

- Alarm A (The AHU unit shuts down in the event of an occurrence that is either detrimental to the AHU or to occupants of the building. These include but are not limited to fire, smoke, freeze protection requirement, etc.)
- Alarm B
- Alarm C

# General information

## Location

As standard, the air handling unit's electrical cabinet is located in a fixed panel next to one fan, except for the 005-011 unit where it is located on the roof for reasons of space. As an alternative the electrical cabinet can be located on an empty section anywhere on the unit (option).

All incoming cables are connected to the electrical cabinet either from above or below. For outdoor units connection from below is recommended. Cable routing in double deck casings is internal, while for single deck casings the wiring is done externally. Cable ducts made of injection moulded aluminium are available as an accessory.

## Lighting in the Air Handling Unit

The light fittings are connected in the air handling unit at the factory, and cable is ready routed through the panels to the outside. The power supply and connection of the lighting for the air handling unit must be carried out by a qualified electrician.

## Technical data

- Control circuit for pumps, 1-phase or 3-phase, max. 3A
- Auxiliary transformer for 24 VAC
- Speed-controlled or direct started motors
- EC motor, integral motor, frequency converter for fan operation
- Speed controller for regulating the speed of the heat exchanger rotor

The terminal block for incoming supply is rated for:

- Max 16 mm<sup>2</sup> cable for power distribution up to 16 A/fan. (2.5mm<sup>2</sup> motor cable internally)
- Max 25 mm<sup>2</sup> cable for power distribution up to 31 A/fan. (6mm<sup>2</sup> for motor cable internally)

## External fuse protection

External fuse protection must always be carried out to conform to the legislation of each country. In order to calculate maximum power consumption, the currents of the fans are aggregated with other loads. The latter are internally protected by one 10 A fuse.

## Testing

The unit is supplied fully connected internally. The insulation and performance of controls for each unit are tested prior to delivery. In addition, a factory setting is made for as many parameters as possible.

## The control system conforms to the following standards and regulations:

- Machinery Directive 2006/42/EC, Electrical equipment of machines, EN 60204-1.
- EMC Directive 2004/108/EC, Adjustable speed electrical power drive systems EN 61800-3, EMC EN 61000-6-3:2001 (emissions) and EN 61000-6-2:2001 (immunity).
- Low Voltage Directive 206/95/EC [DF2], Electronic equipment EN 50178.

## Connection data

The control system can be supplied for the following supply voltages. The power supply cable must be fitted with an external load interrupter, which can cut the power to the entire unit. The load interrupter is available as an accessory.

- 3 x 230 ±10% VAC, 50 Hz, 4-conductor system (Norway).
- 3 x 400 ±10% VAC, 50 Hz, 5-conductor system.

# Component technical data

## HMI Touch panel

Using touch panels offer big advantages to hospital users.

- Very silent since there is no revolving disk and no fan
- Reduces the maintenance cost, e.g. no moving parts, no ventilation holes that can be clogged
- No data is stored on the device, no need for data back-up
- Quick deployment on site

## Technical characteristic

### Element:

Processor : ULVCeleron M Ghz, secondary memory cache 512 KB  
RAM: 1 GB  
Ethernet TCP/IP link: 10/100 Base-T  
USB ports: 3 x USB 2.0 (bottom side)  
Storage: Compact flash 4 GB, SLC type  
Operating system: Windows XP Embedded  
Software: Internet Explorer  
Dimensions (WxHxD): 372 x 292 x 60,6 mm

## Display Characteristics :

Graphics: XGA active matrix (1024 x 768 pixels)  
Number of colors: 16 194 277 colors  
Brightness: 283.2 – 296 cd/m<sup>2</sup>  
Brightness control: 4 level of adjustment  
View angle: left 60°, right 60°, above 60°, below 60°  
Touch sensitive screen: Five wire analog resistive film  
Backlight: CFL – Life span > 50 000 h at 25°C

## DC Power supply requirements

Input voltage: 19 – 24 VDC

Maximum Output Power: 28W

## AC Power supply

Input Voltage: 100 – 240 VAC

## Compliance standards

Directive 2006/95/EC (Low Voltage)

Directive 2004/108/EC (EMC)

EMI : (EN55022 (Class B)/IEC/EN 61000-3-2, IEC/EN 610003-3, IEC/EN 61000-6-3

EMC : EN 61000-6-2

IEC/EN 60950, Information Technology Equipment

## Differential pressure transmitter air 0-10V for filter pressure drop

The differential pressure transmitter is used for the monitoring of filters installed on the exhaust grilles.

It is an electronic differential pressure transmitter that converts the measured differential pressure into an electric 0-10Vsignal.

## Differential pressure transmitter for OT room

This pressure transmitter is designed to measure the difference of pressure between the OT room and the adjacent environment.

The range of the transmitter is -50 Pa - + 50 Pa.

This accessory offers a possibility to set different damping (time constant). At delivery the damping is set to 1,5 seconds damping. Setting is adjusted with the miniature switch.

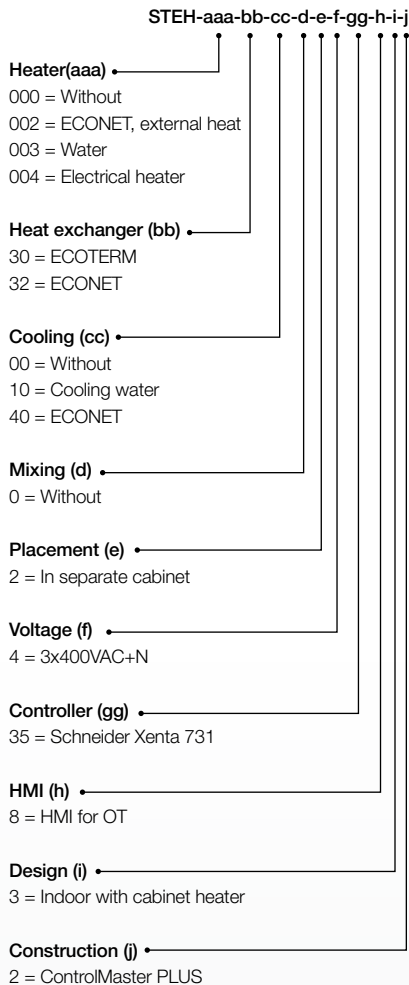
## Room humidity

The transmitter consists of a sensor and amplifier, mounted together in a enclosure.

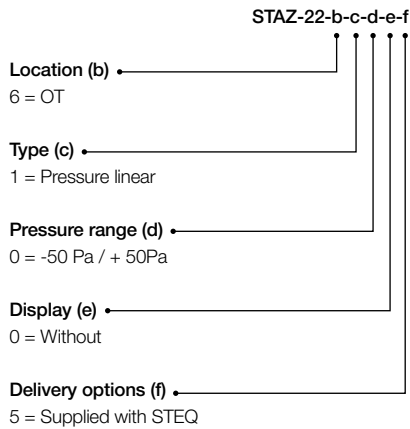
*More information on the sensors and actuators of the Air Handling Unit can be found in the eQ catalogue.*

# Product Code

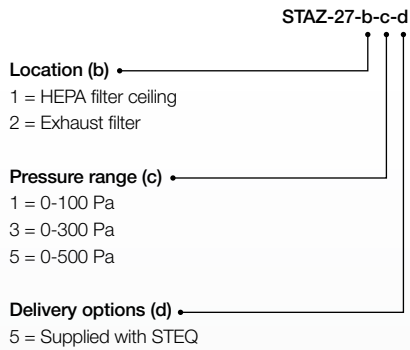
## Control equipment for OT



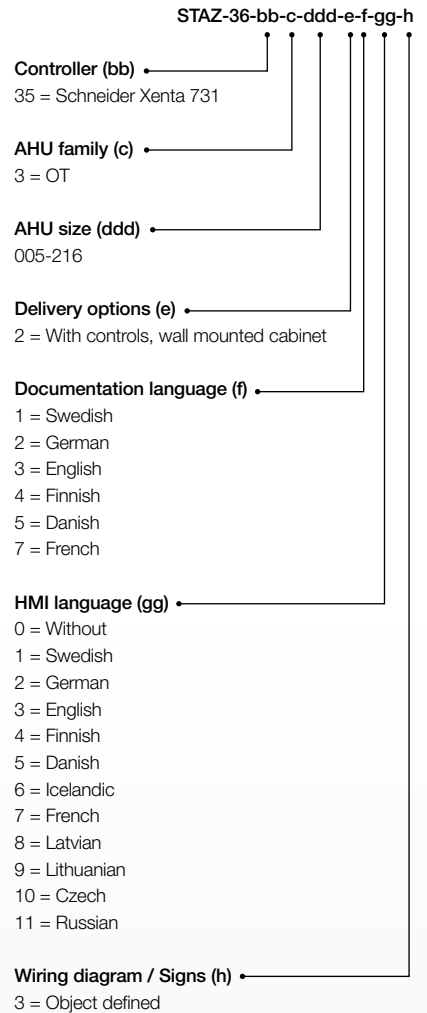
## Pressure/Flow indication



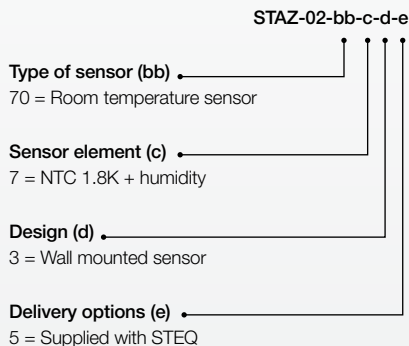
## Filter monitor for OT



## Project management and documentation



## Temperature sensor



## Communication

