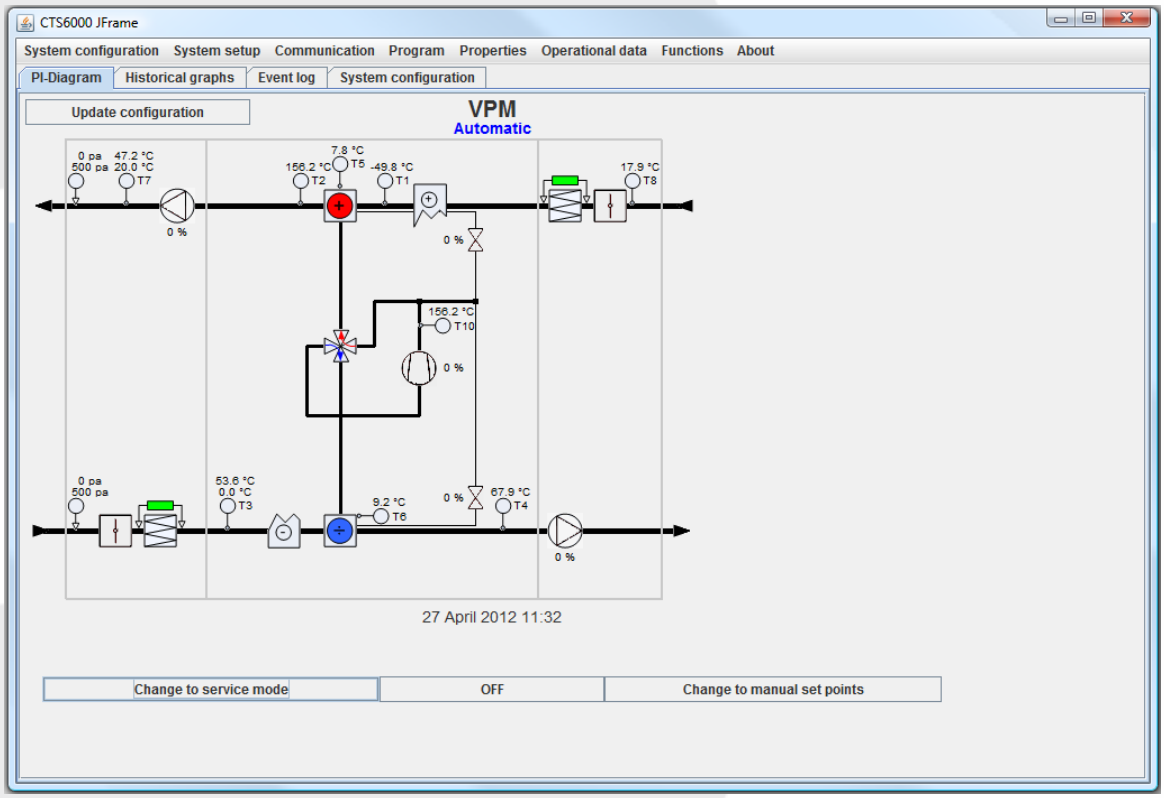
User's Guide

CTS6000 BACnet



Valid for: CTS6000, SW1.0093

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Introduction

Please check that the following documents have been supplied with the unit:
Installation instructions
User's Guide for CTS6000 BACnet (this document)
Wiring diagram
Warranty certificate

The purpose of this guide is to provide a clear, detailed description of the possibilities offered by CTS6000 BACnet.
The guide may contain functions and facilities which are not available on your system.
For technical information on the possibilities provided by CTS6000 BACnet, please refer to "User´s Guide CTS6000 WebControl".

Introduction to CTS6000

CTS6000 is a control unit for commercial ventilation systems supplied by Nilan A/S. CTS6000 was developed in Denmark and is also produced there. CTS6000 is designed to meet future requirements on improving the possibility of optimizing ventilation systems and reducing running costs.
As the name suggests, CTS6000 BACnet is an Internet-based monitoring program. The program is pre-installed in the unit and there is thus no need for software other than an Internet browser capable of running Java applications. If the unit is connected to the Internet, it is possible to log into the system from a PC anywhere in the world.

Reading instructions

This instruction manual contains five main sections.
"Quick startup" describes the log-in procedure and how to start the unit for the first time.
"CTS6000 WebControl settings" describes the functions associated with the monitoring program.
Appendices can be found at the end of the manual.
Figures are numbered consecutively throughout the manual.
Function location is given as shown in the following example: "System setup -> Filter guard", where "System setup" is an option in the main options bar along the top of the window and "Filter guard" is an option in the "System setup" menu, see Figure 1.

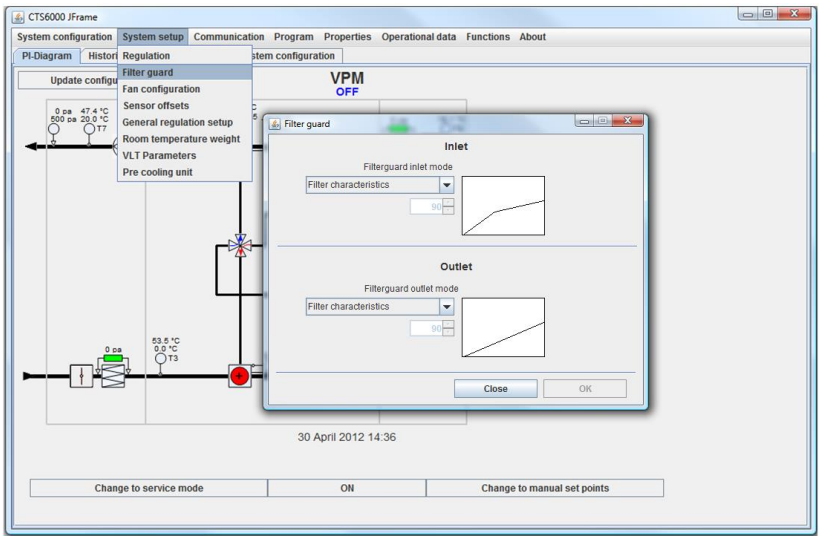


Figure 1 Example of menu options

Quick startup

CTS6000 WebControl is an Internet-based monitoring program designed as a Java application. It must therefore be possible to run Java applications on the computer used to log into the system.

If this is not possible, Java can be downloaded via: http://www.java.com/en/download/index.jsp
To allow direct communication with the unit, the computer's IP address must be 10.1.10.xxx. (where xxx is a number between 0 and 255 which differs from the last part of the unit's IP address). See details on changing your PC's network settings.
The computer must be connected to the control unit via a crossover patch cable (supplied with CTS6000).
The control unit is equipped with a port for the cable on the PCB located in the ventilation unit's electrical panel. The small PCB raised above the larger one contains an RJ45 port, see Figure 2 bottom left.

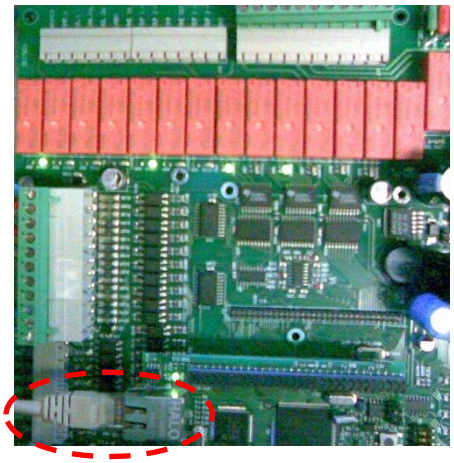


Figure 2 CTS6000 PCB with network port

Open a browser, e.g. Internet Explorer, and enter the control unit's IP address in the address field. Unless otherwise stated, the address is "10.1.10.240". The computer will begin to retrieve data from the control unit. A dialogue box with three fields will then open, see Figure 3.

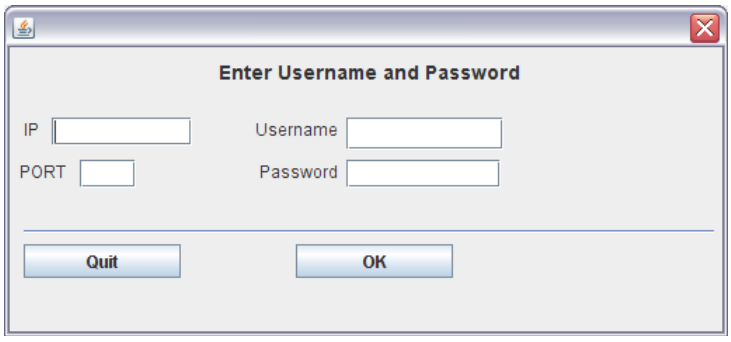


Figure 3 Log-in window

It is possible to log in on various levels. Enter the control unit's IP address in the uppermost left field. Enter the username and password and click OK to log in. A logging-in dialogue box will then appear. The "Port" field is used if several units have the same IP address.

Java GUI Settings

For BACnet system control Java GUI not older than 1.48

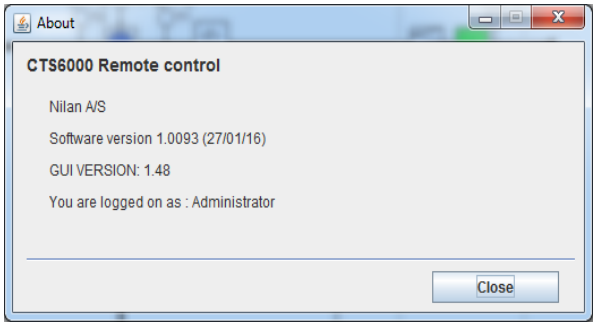


Figure 4 SW version

In order to select BACnet control enter Communication → External control menu.

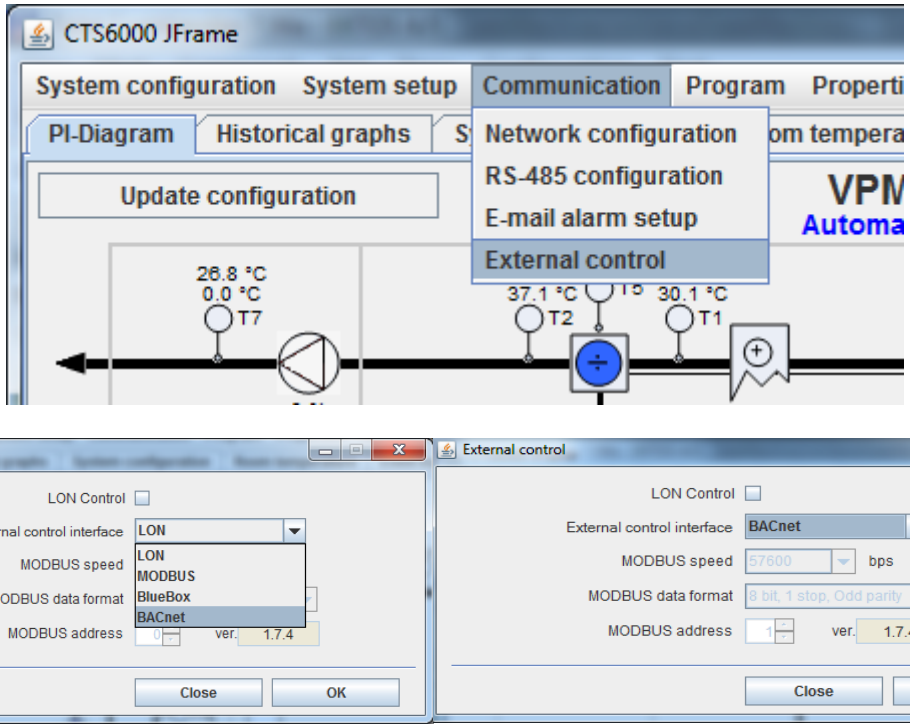
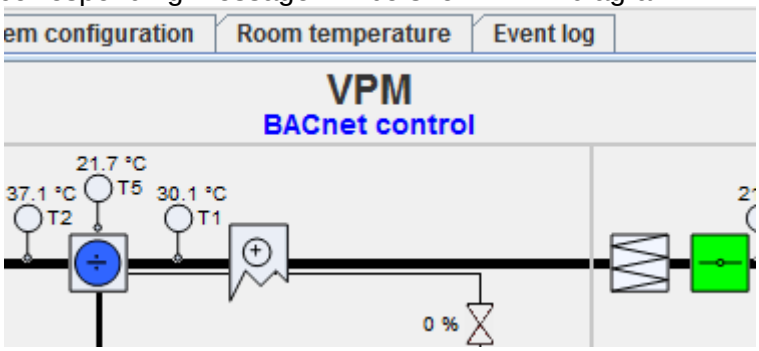


Figure 5 External control

When selected, the corresponding message will be shown in PI-diagram.



References

1. BACNet Integration Description

20150929-MIS-30030016_BacNet_Integration_Description_3.odt

2. Visual Test Shell

http://sourceforge.net/projects/vts/

3. BACnet Stack Implementation

http://bacnet.sourceforge.net/

Abbreviations and Terms

Abbreviation/term	Description
BACnet	**B**uilding **A**utomation and **C**ontrol **net**work
NPDU	**N**etwork layer **P**rotocol **D**ata **U**nit
VTS	**V**isual **T**est **S**hell for BACnet
GUI	**G**raphical **U**ser **I**nterface
BMS	**B**uilding **M**anagement **S**ystem

Introduction

This document describes BACnet usage in CTS6000 system.

Connection and basics of data communication are described.

Installation

BACnet protocol support multiple physical level implementations.

In CTS6000 system BACnet over IP is used. This means that connection is done via Ethernet port. As Ethernet port is an integral part of the system no additional HW is required.

Not all CTS6000 SW version support BACnet communication.

Now only one version supports BACnet – 1.0093.

Same IP address is used as for other types of communication (Web-access, GUI access).

CTS6000 BACnet implementation uses these settings for connection:

Protocol	UDP
Port	0xBAC0

The stated settings are standard ones and in most cases don't need to be changed.

It's compatible with BACnet SW and was tested with Visual Test Shell.

BACnet Supported Requests and Properties

These standard requests are implemented and ca be used by BMS

```
UNCONFIRMED_WHO_IS
UNCONFIRMED_WHO_HAS
CONFIRMED_READ_PROPERTY
CONFIRMED_READ_PROP_MULTIPLE
```

CONFIRMED_WRITE_PROPERTY

CONFIRMED_WRITE_PROP_MULTIPLE

CONFIRMED_READ_RANGE

All the CTS6000 parameters can be requested using value types:

- Analog_in
- Analog_value
- Multistate_value
- Binary_value.

Several functions are defined for work with parameters:

- get present value returning current parameter value;
- set present value allowing to change current parameter value;
- value name returning friendly description of the parameter.

Parameters Description

CTS6000 Outputs

Analogue Inputs

Parameter	Description	Formula
T1	Outdoor air temperature after heat pipe.	Temperature = recorded value/ 100
T2	Inlet air temperature after heat pump.	Temperature = recorded value/ 100
T3	Exhaust air temperature	Temperature = recorded value/ 100
T4	Outlet air temperature	Temperature = recorded value/ 100
T5	Temperature evaporator / condenser.	Temperature = recorded value/ 100
T6	Temperature evaporator / condenser.	Temperature = recorded value/ 100
T7	Inlet air temperature.	Temperature = recorded value/ 100
T8	Out door air temperature.	Temperature = recorded value/ 100
T9	Temperature of aux. heater.	Temperature = recorded value/ 100
T10	Compressor 1 hot gas temperature.	Temperature = recorded value/ 100
T11	Compressor 2 hot gas temperature.	Temperature = recorded value/ 100
T12	Compressor 3 hot gas temperature.	Temperature = recorded value/ 100

Parameter	Description	Formula
T13	Unused / Shared compressor hot gas temperature cooling unit	Temperature = recorded value/ 100
T14	Unused / Temperature AUX. heater return water	Temperature = recorded value/ 100
T15	Unused / Evaporator pre cooling unit	Temperature = recorded value/ 100
T16	Unused / Condenser pre cooling unit	Temperature = recorded value/ 100
Tpanel	Unused / User panel temperature	Temperature = recorded value/ 100
High pressure cool	Contains the pressure level at the high pressure side of the compressor (cooling)	Pressure (bar) = (recorded value) / 100000
Low pressure cool	Contains the pressure level at the low pressure side of the compressor (cooling)	Pressure (bar) = (recorded value) / 100000
High pressure heat	Contains the pressure level at the high pressure side of the compressor (heating)	Pressure (bar) = (recorded value) / 100000
Low pressure cool	Contains the pressure level at the low pressure side of the compressor (heating)	Pressure (bar) = (recorded value) / 100000
Pressure drop over inlet filter	Contains the pressure drop over the inlet filter.	Pressure (Pa) = (recorded value)
Pressure drop over outlet filter	Contains the pressure drop over the outlet filter.	Pressure (Pa) = (recorded value)
Pressure inlet duct	Contains the actual pressure level in the inlet duct.	Pressure (Pa) = (recorded value)
Pressure outlet duct	Contains the actual pressure level in the outlet duct.	Pressure (Pa) = (recorded value)

Analogue Values

Parameter	Description	Formula
Heat Out Primary	Heat output primary, %	
Heat Out Secondary	Heat output secondary, %	
Cool Out	Cool output, %	
Econ out	Econ output, %	
Fan Out	Total fan output, %	
Outlet fan capacity	This value contains the actual capacity of the outlet fan	This value contains the actual capacity of the outlet fan
Inlet fan capacity	This value contains the actual capacity of the inlet fan	Capacity in % = (recorded value) / 2
Water valve capacity	This value contains the actual capacity of the water valve	Capacity in % = (recorded value) / 2
Capacity of capacity regulated compressor	This value contains the actual capacity of the outlet fan	Capacity in % = (recorded value) / 2

Binary Value

Parameter	Description
Compressor 1	Compressor 1 (1 = On ; 0 = Off)
Compressor 2	Compressor 2 (1 = On ; 0 = Off)
Compressor 3	Compressor 3 (1 = On ; 0 = Off)
Bypass valve heat	Bypass valve heat (1 = Open ; 0 = Closed)
4-way valve	4-way valve (0 = Heat mode ; 1 = Cooling mode)
Electric heater st. 1	Electric heater step 1 (1 = On ; 0 = Off)
Electric heater st. 2	Electric heater step 2 (1 = On ; 0 = Off)
Electric heater st. 3	Electric heater step 3 (1 = On ; 0 = Off)
Pump status	Pump status for water heating element (1 = On ; 0 = Off)
Active cooling	Active cooling (1 = the unit is running active cool ; 0 = the unit is running in heat mode)
Common alarm	Common Alarm (1 = there is no alarms ; 0 = there is an alarm on the unit)
Ex. fan st 1	Exhaust fan step 1 (1 = On ; 0 = Off)
Ex. fan st 2	Exhaust fan step 2 (1 = On ; 0 = Off)
In fan st 1	Inlet fan step 1 (1 = On ; 0 = Off)
In fan st 2	Inlet fan step 2 (1 = On ; 0 = Off)
Bypass valve cooling	Bypass valve Cooling (1 = Open ; 0 = Closed)

Multi-state Values

Parameter	Description
Mode	System status with listed states: 1 - HVAC_AUTO 2 - HVAC_HEAT 3 - HVAC_MRNG_WARMUP 4 - HVAC_COOL 5 - HVAC_NIGHT_PURGE 6 - HVAC_OFF 7 - HVAC_FAN_ONLY 8 - HVAC_FREE_COOL
Alarm	Current active alarm

CTS6000 Inputs

Analogue Values

Parameter	Description	Formula
Setpoint	Contains the temperature setpoint, i.e. the required temperature.	Value = Temperature * 100 If a temperature of 21.0°C is wanted, then the value written to 40257 must be 21.00 *100 = dec2100 ➔ 834 hex Setpoint must be set, if"Controlling sensor" (265) is changed.
Set point offset	Contains the temperature offset value of the controlling temperature sensor.	Value = Temperature offset * 100
Min. inlet temperature summer	Contains value for Min. inlet summer	Value = Temperature * 100
Min. inlet temperature winter	Contains value for Min. inlet winter	Value = Temperature * 100
Max. inlet temperature	Contains value for Max. inlet temperature	Temperature = Temperature * 100 Max. inlet specifies the maximum permissible value.
Pressure set point outlet duct.	Contains the pressure set point for the outlet duct if a pressure transmitter is connected to the unit.	Value = Pressure set point
Pressure set point inlet duct.	Contains the pressure set point for the inlet duct if a pressure transmitter is connected to the unit.	Value = Pressure set point
Outlet fan speed	Contains the fan speed set point for the outlet fan if the fans is VLT controlled or fixed speed fans.	Value = Fan speed
Inlet fan speed	Contains the fan speed set point for the inlet fan if the fans is VLT controlled or fixed speed fans.	Value = Fan speed

Multi-state Values

Parameter	Description
Controlling sensor	Contains the value who decides which sensor is the controlling sensor. 0 – T7 1 - T3
Application mode (Start / stop).	1 - HVAC_AUTO 2 - HVAC_HEAT 3 - HVAC_MRNG_WARMUP 4 - HVAC_COOL 5 - HVAC_NIGHT_PURGE 6 - HVAC_OFF 7 - HVAC_FAN_ONLY 8 – HVAC_FREE_COOL To start the HVAC unit write value 0 at address 40270 byte 1 for automatic operation. To stop the HVAC unit write value 6 at address 40270 byte 1.

Binary Value

Parameter	Description
Alarm reset	Resets the alarm flag and marks an alarm as action taken. State : 0 inactive, 1 = active Setting : 0 = OFF, 200 = ON
Auxiliary heat	Allows the AUX. heater to be active. Value = 1,200,0 = ON : 0,0,0 = OFF (see Alarm reset) This variable indicates whether auxiliary heat has been enabled or disabled. If auxiliary heat is enabled, it is allowed in the heating mode.

Appendix A. List of Supported Features

Services

Service	State
AcknowledgeAlarm	Unsupported
ConfirmedCOVNotification	Unsupported
ConfirmedEventNotification	Unsupported
GetAlarmSummary	Unsupported
GetEnrollmentSummary	Unsupported
SubscribeCOV	Unsupported
AtomicReadFile	Unsupported
AtomicWriteFile	Unsupported
AddListElement	Unsupported
RemoveListElement	Unsupported
CreateObject	Unsupported
DeleteObject	Unsupported
ReadProperty	Supported
ReadPropertyConditional	Unsupported
ReadPropertyMultiple	Supported
WriteProperty	Supported
WritePropertyMultiple	Supported
DeviceCommunicationControl	Unsupported
ConfirmedPrivateTransfer	Unsupported
ConfirmedTextMessage	Unsupported
ReinitializeDevice	Unsupported
VT-Open	Unsupported
VT-Close	Unsupported
VT-Data	Unsupported
Authenticate	Unsupported
RequestKey	Unsupported
I-Am	Unsupported
I-Have	Unsupported
UnconfirmedCOVNotification	Unsupported

Service	State
UnconfirmedEventNotification	Unsupported
UnconfirmedPrivateTransfer	Unsupported
UnconfirmedTextMessage	Unsupported
TimeSynchronization	Unsupported
Who-Has	Supported
Who-Is	Supported
ReadRange	Supported
UtcTimeSynchronization	Unsupported
LifeSafetyOperation	Unsupported
SubscribeCOVProperty	Unsupported
GetEventInformation	Unsupported

Object Types

Object Type	State
analog-input	Implemented
analog-output	Implemented
analog-value	Implemented
binary-input	Implemented
binary-output	Implemented
binary-value	Implemented
calendar	Not Implemented
command	Not Implemented
device	Implemented
event-enrollment	Not Implemented
file	Not Implemented
group	Not Implemented
loop	Not Implemented
multi-state-input	Implemented
multi-state-output	Implemented
notification-class	Not Implemented
program	Not Implemented
schedule	Not Implemented
averaging	Not Implemented
multi-state-value	Implemented
trend-log	Not Implemented
life-safety-point	Not Implemented
life-safety-zone	Not Implemented
accumulator	Not Implemented

Object Type	State
pulse-converter	Not Implemented
event-log	Not Implemented
global-group	Not Implemented
trend-log-multiple	Not Implemented
load-control	Not Implemented
structured-view	Not Implemented
access-door	Not Implemented
objtype-31	Not Implemented
access-credential	Not Implemented
access-point	Not Implemented
access-rights	Not Implemented
access-user	Not Implemented
access-zone	Not Implemented
credential-data-input	Not Implemented
network-security	Not Implemented
bitstring-value	Not Implemented
characterstring-value	Not Implemented
date-pattern-value	Not Implemented
date-value	Not Implemented
datetime-pattern-value	Not Implemented
datetime-value	Not Implemented
integer-value	Not Implemented
large-analog-value	Not Implemented
octetstring-value	Not Implemented
positive-integer-value	Not Implemented
time-pattern-value	Not Implemented
time-value	Not Implemented

Appendices

Description of alarms

Alarm name	Description	Remedy
Door open ID 32 Level - 4	Door to fans is open. Ventilation unit stops in order to prevent personal injury.	Close door and reset alarm.
Fire alarm ID 33 Level - 4	The unit is equipped with two fire thermostats: one in the inlet duct, the other in the exhaust duct. If temperature becomes excessive, the thermostats are activated.	Reset fire thermostats in unit and reset alarm.
Smoke alarm ID 30 Level - 4	Smoke detectors can be fitted in the unit. One of these smoke detectors has sensed smoke.	Check smoke detector and reset alarm.
Thermal relay ID 34 Level - 4	Motor protector has cut out; Klixon in compressor motor or fan motor has cut out; or error has occurred in frequency converter.	Reset motor protector or remedy error in frequency converter and reset alarm.
High pressure alarm ID 2 Level - 4	A high pressure alarm can be activated if there is insufficient air flow through the unit. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.
Low pressure alarm 1 ID 3 – 6 Level - 2	Low pressure alarm 1 can be activated if there is insufficient air flow through the unit. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	The controls stop the compressor itself until the pressure switch is reset. Max. 5 times an hour, however.
Condenser high pressure ID 8 – 11 Level - 4	Upper limit(2) for cooling circuit pressure set under "Pressure limits" has been exceeded. The alarm can be activated by insufficient air flow through the unit. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.
Evaporator low pressure 1 ID 9 – 12 Level - 3	Lower limit(2) for cooling circuit pressure, which is set under "Pressure limits", has been exceeded. The alarm can be activated by insufficient air flow through the unit. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	The controls stop the compressor until pressure is regained. Max. 5 times an hour, however.
Evaporator low pressure 2 ID 10–13 Level - 4	Evaporator low pressure 2 is activated if Evaporator low pressure 1 has been activated 5 times within the last hour.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.
Condenser overheated ID 20 Level - 4	Condenser temperature (T5) setting under "Pressure limits" too high. The alarm can be activated by insufficient air flow through the unit. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.
Evaporator too cold ID 21 Level - 4	Evaporator temperature (T6) setting under "Pressure limits" too low. The alarm can be activated by insufficient air flow through the unit. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.

Alarm name	Description	Remedy
Timeout for prevention function ID 42–43 Level - 4	The prevention function for high or low pressure alarms has run for more than 20 minutes but pressure is still outside the limits. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.
Frost alarm ID 35 Level - 2	Temperature of hydraulic after-heating coil too low.	The controls open the water valve and start the pump to keep the heating coil free of ice.
Fatal frost alarm ID 29-39 Level - 4	Temperature of hydraulic after-heating coil remains too low despite prevention attempts.	The unit is stopped. Check the after-heating coil.
Flow alarm ID 36 Level - 2	Insufficient air flow across electric after-heating coil for coil to cut in. This may be caused by blocked filters, loose V-belts or dampers which have not opened.	Reset alarm. If the alarm repeatedly occurs for no apparent reason, call service.
Compressor starts ID 40 Level - 2	A compressor has started 12 times within one hour.	Set compressor minimum off time to at least 5 minutes and reset the alarm.
VLT compressor starts ID 41 Level - 2	A VLT compressor has started 11 times within one hour.	Set compressor minimum off time to at least 6 minutes and reset the alarm.
Pressure pipe temperature T10/11/12/13 ID 50 - 51 - 52 – 53 Level - 2	Pressure pipe temperature on compressor 1/2/3/4 has exceeded 125°C.	The controls stop the compressor and do not allow it to restart before the temperature has dropped below 50°C.
Pressure pipe temperature ID 54 Level - 4	Compressor is overheated. Alarm is activated if T11, T12, T13 (ID 51-53) happen 5 times during 24 hours.	The unit stops. Reset alarm. If the alarm repeatedly occurs, call service.
VLT x has not responded to the 5 latest requests ID 111 Level - 4	A communication error has occurred between the control unit and the VLTs.	The unit stops. Reset alarm. If the alarm repeatedly occurs, call service.
Netavent unit x has not responded to the last 5 requests ID 110 Level - 2	A communication error has occurred between the control unit and the Netavents.	Reset alarm. If the alarm repeatedly occurs, call service.
T3 is set as the controlling sensor ID 112 Level - 1	If a Netavent unit has been selected as the controlling sensor, but communication with the unit concerned cannot be established, the control unit switches instead to T3 (exhaust temperature).	Reset alarm.
Defrost alarm ID 25 Level - 3 ID 26 Level - 4	Defrost signal within the first 15 minutes after power up, or defrosting not finished within 2 hours in spite of defrosting attempts.	Compressor–Stop for appliance with heater = heater ON System – Stop for appliance with no heater.
Filter Alarm ID 31–38 Level - 2	Filter time out – 90days	Clean filter and reset Alarm
Alarm time / date ID120-121Level - 4	Wrong time or date	Set date and time

24 Volt DC supply ID 123 Level - 4	24 Volt DC supply for pressure transmitters is missing.	Check 24 Volt DC supply and reset Alarm
LON communication ID 113 Level - 4 ID 114 Level - 2	No signal from LON = ID113 Wrong LON version = ID114	Check LON connection. Change LON card to right version.

Username and password for CTS6000

Level:	Username:	Password:
User	User	user*

* the password can be changed within the system.

Log-in data for Technician level is given in the test report or diagram.

Description of sensors and components

Sensor/component	Description
Temperature sensor	
T1	Inlet sensor after heat pipe
T2	Inlet sensor after heat pump
T3	Exhaust sensor
T4	Discharge sensor
T5	Upper evaporator/condenser sensor
T6	Lower evaporator/condenser sensor
T7	Inlet sensor after inlet fan and after-heating coil (if any)
T8	Fresh air sensor
T9	Sensor in hydronic after-heating coil
T10	Pressure pipe sensor compressor 1
T11	Pressure pipe sensor compressor 2
T12	Pressure pipe sensor compressor 3
T13	Pressure pipe sensor compressor 4-5-6 (extern cooling unit)
T14	Temperature return water aux. heater
T15	Unused
T16	Unused
Tpanel (T17)	Temperature sensor in control panel
Sensors	
Air flow in	Air flow sensor in inlet duct
Air flow out	Sensor for measuring air flow in exhaust duct
Humidity sensor	Air humidity sensor in ventilated area
Pressure transmitter inlet	Air pressure sensor in inlet duct
Pressure transmitter exhaust	Air pressure sensor in exhaust duct
Pressure transmitter intake filter	Sensor for measuring pressure drop across fresh air intake filter
Pressure transmitter exhaust filter	Sensor for measuring pressure drop across exhaust filter
Pressure transmitter high pressure	Sensor for measuring pressure-side pressure in cooling circuit of main module
Pressure transmitter low pressure	Sensor for measuring suction-side pressure in cooling circuit of main module
Pressure transmitter high pressure cooling module	Sensor for measuring pressure-side pressure in cooling circuit of cooling module
Pressure transmitter low pressure cooling module	Sensor for measuring suction-side pressure in cooling circuit of cooling module
Active components	
Compressors 1-3	Compressors in main unit
Compressors 4-6	Compressors in cooling module
Fan in	Inlet fan
Fan out	Exhaust fan
Bypass valve cooling	Hot gas bypass valve, cooling
Bypass valve heating	Hot gas bypass valve, heating
Modulating hot gas bypass valve	Modulating hot gas bypass valve, in both cooling and heating
Four-way valve	Valve for switching heat pump status between heating and cooling
Electric heating coil	7-step electric after-heating coil
Water valve	Modulating water valve in hydronic after-heating coil
Water pump	Circulation pump for hydronic after-heating coil
Damper in	Shut-off damper in inlet duct
Damper out	Shut-off damper in exhaust duct
Damper recirculation	Damper for exhaust air recirculation
Damper supplementary	Supplementary damper in exhaust duct
Passive components	
Heat pipe	Passive heat recovery