

# **Protocol description**

## **Nilan CTS602Light Modbus version 20**

517210

## Table of Contents

1.	Revision history .....	2
2.	Connection .....	2
3.	Setup.....	4
4.	Supported functions.....	4
5.	Register layout .....	5
5.1	Register groups .....	5
5.2	Input registers.....	6
5.2.1	Display .....	9
5.3	Holding registers .....	11
5.3.1	Display.....	15
6.	Communication example.....	18

## I. Revision history

Version	Software	Date	Description
20	1.1.19.0	08-03-2019	Breakup from CTS602 1.6.21.0. This version includes only Modbus registers which are implemented in CTS602 Light version 1.1.19.0

“Version” refers to the protocol data item named “Bus.Version”.

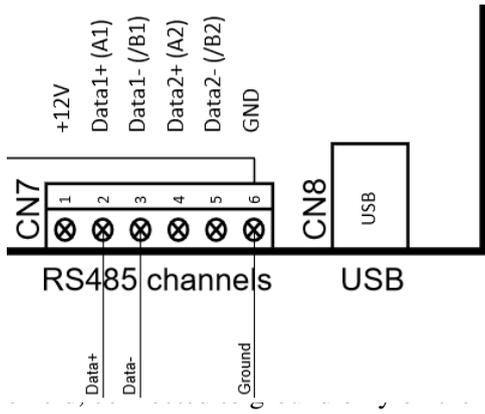
## 2. Connection

The Modbus is wired to PIN 2,3,6 on connector CN 7 located next to the USB plug on the CTS 602 board.

Pin 1	12 VDC output
<b>Pin 2</b>	<b>COM1 - RS 485 Data+ (A) - Modbus</b>
<b>Pin 3</b>	<b>COM1 - RS 485 Data- (/B) - Modbus</b>
Pin 4	COM2 - RS 485 Data+ (A) - User panel
Pin 5	COM2 - RS 485 Data- (/B) - User panel
<b>Pin 6</b>	<b>Ground</b>

**CTS 602 Modbus connector:**

**Point to point bus wiring:**



master side.

Max 200 m cable length.  
 Characteristic impedance 100 - 130 Ohm.  
 Shunt capacitance < 100 pF/m.  
 AWG 24 / 0,25 mm<sup>2</sup>.

Suggested types: Belden 941/942 or  
 Multicable LIYCY-P 2\*2\*0,25 mm<sup>2</sup>.

**Common ground:**

All network nodes must share a common ground connection as the bus signals shall refer to the same voltage potential.

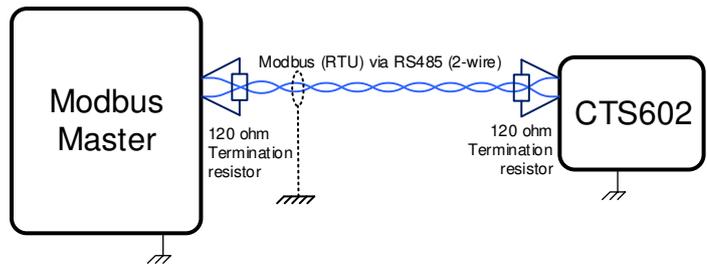
There is no opto-isolation on the CTS602.

**Network termination:**

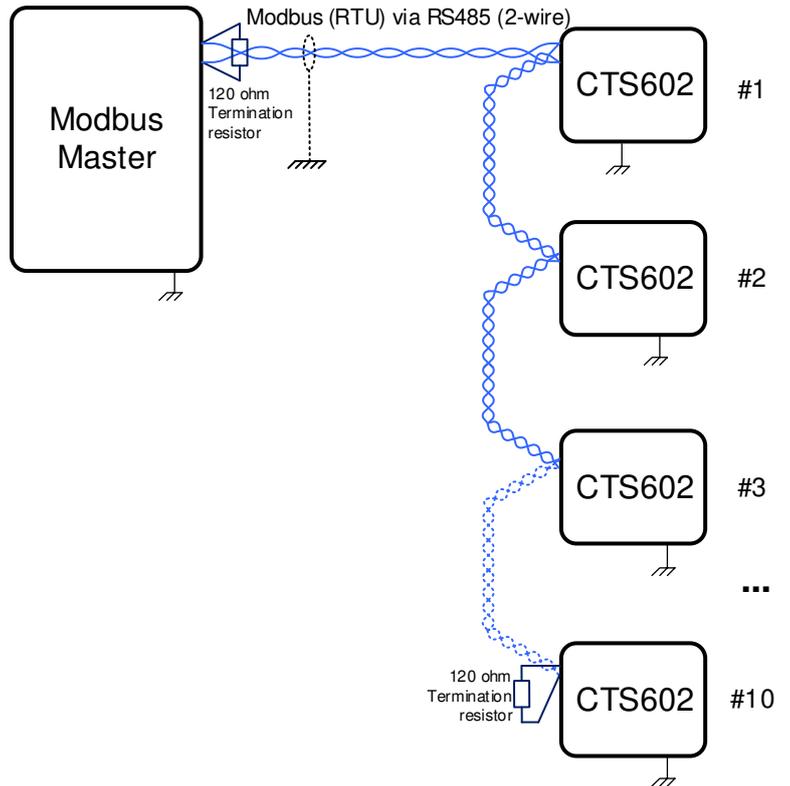
120 Ohm resistors shall be connected between the two RS485 signal wires at each end-point of the bus wire.

The resistor value shall match the characteristic impedance of the cable.

Receiver impedance >= 12 kOhm.



**Linear bus wiring:**



### 3. Setup

Protocol	Modbus (RTU mode), see <a href="http://www.modbus.org/specs.php">http://www.modbus.org/specs.php</a>
Node address	Default 30, Address is selectable between 1 and 247
Device type	CTS 602 Light is a Modbus slave
Baud rate	19.200
Databits	8
Stopbits	1
Parity	Even
Packet size	Max. 255 bytes

Communication speed and parameters cannot be changed, except for the node address.

### 4. Supported functions

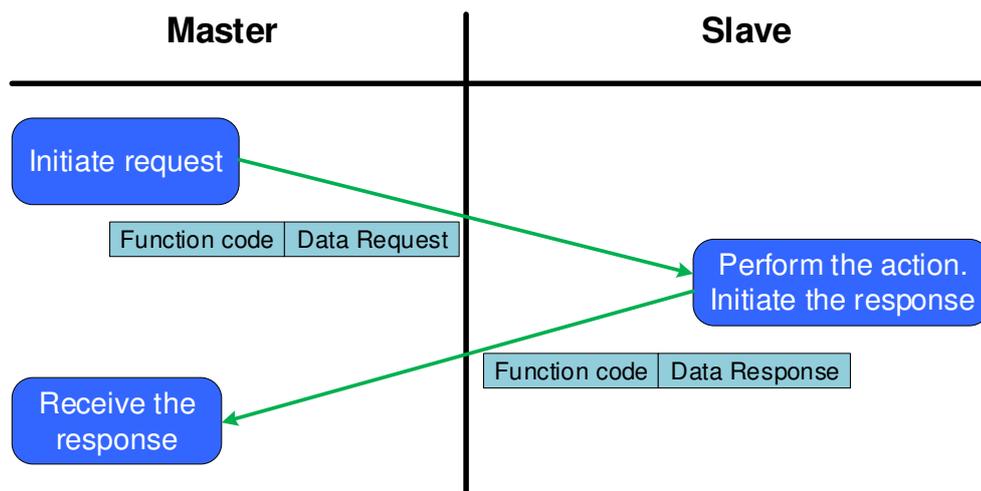
Input and holding registers are supported.

Unless otherwise specified, all registers are 16 bit size.

The controller will respond to the below listed Modbus message functions only.

Please note that no other function codes are supported.

Function	Name	Description
03	Read Holding Registers	Read one or more holding registers
04	Read Input Registers	Read one or more input registers
16	Preset Multiple Registers	Write one or more holding registers



## 5. Register layout

Register addresses are given in decimal notation.

Input registers are located in the range 30001..39999.

Holding registers are located in the range 40001..49999.

### NOTE:

In the tables below we list the register addresses as used in Modbus messages without the global offset. That means if you read input register 100 with function code 04, you get the global address 30101.

### NOTE:

All input registers can also be read as type holding register with function code 03 by adding the offset value 10000 to the register address. No writes will be accepted in this range.

### 5.1 Register groups

The protocol data is grouped into the following address ranges with 100 registers in each group. This applies to both input and holding register types:

Name	Address	Description	VPM	VPL	VP	VGU	COMF
Device	000	Protocol and controller setup	x	x	x	x	x
Discrete I/O	100	Input / output bits (on/off)	x	x	x	x	x
Analog I/O	200	Input / output words	x	x	x	x	x
Time	300	Clock and calendar	x	x	x	x	x
Alarm	400	Alarm and message handling	x	x	x	x	x
Week program	500	Calendar based programming	x	x	x	x	x
User functions	600	User input function selection	x	x	x	x	x
Data log	700	Data, alarm and event logging	x	x	x	x	x
--	800	--					
--	900	--					
Control	1000	System control and status	x	x	x	x	x
AirFlow	1100	Ventilation control	x	x	x	x	x
AirTemp	1200	Room temperature control	x	x	x		x
AirBypass	1300	Exchanger bypass control			x		x
AirHeat	1400	Inlet air heater control	x	x			x
Compressor	1500	Compressor operation control	x	x	x	x	
Defrost	1600	Defrosting control	x	x	x	x	x
HotWater	1700	Hot water control			x	x	
CentHeat	1800	Central heating control (EK)			x	x	
AirQual	1900	Air quality control (RH, CO2)	x	x	x	x	x
User panel	2000	Display and keyboard	x	x	x	x	x
PreHeat	2100	Intake air preheat / earth tube			x		x
DPT	2200	Difference pressure transducer	x				
Display – Input reg.	3000..3199	Input registers for display uses	--	--	--	--	--
Display – Holding reg.	4000..4199	Holding registers for display uses	--	--	--	--	--

## 5.2 Input registers

Name	Address	Scale	Unit	Description
Bus.Version	000			Protocol version number
App.VersionMajor	001	text		Software version - major (2 character ascii text)
App.VersionMinor	002	text		Software version - minor (2 character ascii text)
App.VersionRelease	003	text		Software version - release (2 character ascii text)
Input.UserFunc	100			User function
Input.AirFilter	101			Air filter alarm
Input.Smoke	103			Smoke alarm
Input.Frost_Overht	105			Heating surface frost / overheat
Input.UserFunc_2	113			User function 2
Input.DamperClosed	114			Air damper closed position switch
Input.DamperOpened	115			Air damper opened position switch
Input.T0_Controller	200	100	°C	Controller board temperature
Input.T3_Exhaust	203	100	°C	Room exhaust temperature
Input.T4_Outlet	204	100	°C	Outlet temperature
Input.T7_Inlet	207	100	°C	Inlet temperature (after heater)
Input.T8_Outdoor	208	100	°C	Outdoor temperature
Input.T9_Heater	209	100	°C	Heating surface temperature
AirQual.RH	221	100	%	Humidity sensor value
AirQual.CO2	222		ppm	Carbon dioxide sensor value

Name	Address	Scale	Unit	Description
Alarm.Status	400			Alarm state bit mask 0x80 : Active alarm(s) are present 0x03 : Number of alarms listed
Alarm.List_1_ID	401			Alarm 1 - Code 0x80 : (reserved future use) 0x7F : Display code 1..99
Alarm.List_1_Date	402			Alarm 1 - Date Bit word packed in DOS date format Year 0 = 1980 15 8 7 0 YYYYYYM MMMDDDD
Alarm.List_1_Time	403			Alarm 1 - Time Bit word packed in DOS time format Seconds are in scale 2 (0..29 = 0..58 seconds) 15 8 7 0 HHHHHMM MMMSSSS
Alarm.List_2_ID	404			Alarm 2 - Code
Alarm.List_2_Date	405			Alarm 2 - Date
Alarm.List_2_Time	406			Alarm 2 - Time
Alarm.List_3_ID	407			Alarm 3 - Code
Alarm.List_3_Date	408			Alarm 3 - Date
Alarm.List_3_Time	409			Alarm 3 - Time
Control.RunAct	1000			Actual on/off state 0 : Off 1 : On
Control.ModeAct	1001			Actual operation mode 0 : Off 1 : Heat 2 : Cool 3 : Auto 4 : Service
Control.StateDisplay	1002			Actual control state 0 : Off 1 : Shift 2 : Stop 3 : Start 4 : Standby 5 : Ventilation stop 6 : Ventilation 7 : Heating 8 : Cooling 9 : Hot water 10 : Legionella 11 : Cooling + hot water 12 : Central heating 13 : Defrost 14 : Frost sequire 15 : Service 16 : Alarm 17 : Heating + hot water
Control.SecInState	1003		Sec	Actual time in state
AirFlow.VentSet	1100		Step	Actual ventilation step set point 0 : Off 1..4 : Step number
AirFlow.InletAct	1101		Step	Actual inlet fan speed step 0 : Off 1..4 : Step number
AirFlow.ExhaustAct	1102		Step	Actual exhaust fan speed step 0 : Off 1..4 : Step number
AirFlow.SinceFiltDay	1103		Days	Days since last air filter change alarm One day is measured as 24 hours of active running time
AirFlow.ToFiltDay	1104		Days	Days to next air filter change alarm One day is measured as 24 hours of active running time

Name	Address	Scale	Unit	Description
AirTemp.IsSummer	1200			Summer state 0 : Off 1 : On
AirTemp.TempInletSet	1201	100	°C	Inlet temperature request (T7 setpoint)
AirTemp.TempControl	1202	100	°C	Actual value for controlled temperature
AirTemp.TempRoom	1203	100	°C	Actual room temperature (T15 or T10)
AirTemp.EffPct	1204	100	%	Passive heat exchanger efficiency calculation
AirTemp.CapSet	1205	100	%	Requested capacity
AirTemp.CapAct	1206	100	%	Actual capacity

## 5.2.1 Diplay

Name	Address	Scale	Unit	Description
AirBypass.IsOpen	3000			Bypass damper 0: Closed 1: Open
Output.AirHeatCap	3001	100	%	After heating element 0.00 – 100.00%
AirQual.CO2_Enable	3003			CO2 sensor present in the system or not 0: Off 1: On
AirFlow.RoomReduce	3004			Stop at low room temperature 0-4
AirFlow.LastTestDay	3005			Date for last air damper self-test Runtime hours is counted and formatted to days 0 - 65535
AirFlow.SinceFiltDay	3006			Days since last air filter change One day is measured as 24 hours of active running time. 0-9999
AirFlow.WinterReduce	3007			Low fan speed at low outdoor temperature Level 0-4
AirTemp.TempSet	3008	100	°C	Actual resulting set-point for room temperature 5.00°C - 50.00°C
AirTemp.TempControl	3009	100	°C	Master sensor for the controlled temperature (room / inlet) -40.00°C – 99.00°C
Alarm.LogEventID	3050			Event log ID (alarm code) 0 – 255
Alarm.LogDate	3051	DATE_DOS		Date of actual indexed event log
Alarm.LogTime	3052	TIME_DOS		Time of actual indexed event log
Alarm.LogT1	3053		°C	Log item temperatures -127 - 127
Alarm.LogT3	3054			
Alarm.LogT4	3055			
Alarm.LogT5	3056			
Alarm.LogT6	3057			
Alarm.LogT7	3058			
Alarm.LogT8	3059			
Alarm.LogT9	3060			
Alarm.LogT10	3061			
Alarm.LogT11	3062			
Alarm.LogT12	3063			
Alarm.LogT13	3064			
Alarm.LogT14	3065			
Alarm.LogT15	3066			

Name	Address	Scale	Unit	Description
Alarm.LogDI_1_8i	3067			Log item digital input 1-8: bit 0 = input 1 bit 8 = input 8
Alarm.LogDI_9_16	3068			Log item digital input 9-16: bit 0 = input 9 bit 8 = input 16
Alarm.LogDO_1_8	3069			Log item digital output 1-8: bit 0 = output 1 bit 8 = output 8
Alarm.LogDO_9_16	3070			Log item digital output 9-16: bit 0 = output 9 bit 8 = output 16
Alarm.LogAO_1	3071		%	Log item analoge output 1 0 - 100
Alarm.LogAO_2	3072		%	Log item analoge output 2 0 - 100
Alarm.LogAO_3	3073		%	Log item analoge output 3 0 - 100
Alarm.LogAO_4	3074		%	Log item analoge output 4 0 - 100
Alarm.LogCtrState	3075			Operation states for Control module 0: OFF 1: SHIFTING 2: STOPPING 3: STARTING 4: STANDBY 5: VENT_STOP 6: AIR_EXCH 7: AIR_HEAT 8: AIR_COOL 9: HOTWATER 10: LEGIONELLA 11: AIR_COOL_HOT_WATER 12: CENT_HEAT 13: DEFROST 14: FROST 15: SERVICE 16: ALARM_SHUTDOWN 17: AIR_HEAT_HOT_WATER
AirQual.RH_Avg	3100	100	%	Humidity average value. Range: 0..100.00
Opt9_1.BoardId	3101			If expansion I/O board is present the value must be 12.
AirFlow.VentState	3102			Ventilation state 0: OFF 1: NORMAL 2: LOW_HUMIDITY 3: HIGH_HUMIDITY 4: HIGH_CO2 5: LOW_ROOM_TEMP 6: LOW_OUTDOOR_TEMP

### 5.3 Holding registers

Name	Address	Scale	Unit	Description
Bus.Address	0			Protocol node address (default = 30)
Output.AirFlap	100			Air flap
Output.SmokeFlap	101			Smoke flap
Output.BypassOpen	102			Bypass flap open
Output.BypassClose	103			Bypass flap close
Output.AirCircPump	104			Air heat circulation pump
Output.AirHeatAllow	105			Air heating selected
Output.CenHeatExt	122			External radiator heat
Output.AlarmRelay	126			Alarm relay state
Output.ExhaustSpeed	200	100	%	Exhaust fan speed
Output.InletSpeed	201	100	%	Inlet fan speed
Output.AirHeatCap	202	100	%	Air heater capacity

Name	Address	Scale	Unit	Description
Time.Second	300		ss	Second
Time.Minute	301		nn	Minute
Time.Hour	302		hh	Hour
Time.Day	303		dd	Day
Time.Month	304		mm	Month
Time.Year	305		yyyy	Year
Alarm.Reset	400			Clear one specific alarm code or all 0 : No command 1..99 : (reserved internal commands) 101..199 : Clear alarm display code 1..99 255 : Clear all alarms
Program.Select	500			Week program nb. select 0 : None 1 : Program 1 2 : Program 2 3 : Program 3 4 : Erase
Program.UserFuncAct	600			User function active (See "UserFuncSet")
Program.UserFuncSet	601			User function select 0 : None 1 : Extend 2 : Inlet 3 : Exhaust 4 : External heater offset 5 : Ventilate 6 : Cooker Hood
Program.UserTimeSet	602		Min	User function period
Program.UserVentSet	603		Step	User function ventilation step select 0 : Off 1..4 : Step number
Program.UserTempSet	604		°C	User function temperature (Extend function only)
Program.UserOffsSet	605		°C	User function temperature offset (Offset function only)
Program.User2FuncAct	610			Same as user function 1 above
Program.User2FuncSet	611			--
Program.User2TimeSet	612			--
Program.User2VentSet	613			--
Program.User2TempSet	614			--
Program.User2OffsSet	615			--
Log.Interval	700		Min	Periodic data log interval select 0: Off 1..120: Time between periodic loggings

Name	Address	Scale	Unit	Description
Control.Type	1000			Machine type select (factory setting)
Control.RunSet	1001			User on / off select (equal to ON/OFF keys) 0 : Off (user input functions can still activate operation) 1 : On
Control.ModeSet	1002			User operation mode select 0 : Off 1 : Heat (no cooling active) 2 : Cool (no heating active) 3 : Auto 4 : Service (readonly - write to register 1005)
Control.VentSet	1003		Step	User ventilation step select 0 : Off 1..4 : Step number
Control.TempSet	1004	100	°C	User temperature setpoint
Control.ServiceMode	1005			Service mode select 0 : Off 1 : Defrost 2 : Flaps 3 : Inlet 4 : Exhaust 5 : Compressor 6 : Heating 7 : Hot water 8 : Central heat
Control.ServicePct	1006	100	%	Service mode capacity setpoint
Control.Preset	1007			Request preset to default settings 0 : Ready 1 : Standard (to factory defaults) 2 : Backup (to user file) 3 : Restore (from user file)
AirFlow.TestSelect	1102			Select a day for weekly air damper position self-test The test runs at 10 in the morning on the selected day Once enabled, the function cannot be deactivated 0: Off 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday 7: Sunday
AirFlow.LastTestDay	1103			Date of last air damper position test Bit word packed in DOS date format (see IR 402 format)
AirFlow.TestState	1104			Actual air damper position test state 0: Off 1: Standby 2: Start (Set to Start to run manual test) 3: Closing 4: Opening 5: OK 6: Error

Name	Address	Scale	Unit	Description
AirFlow.FiltAlmType	1105			Air filter monitoring alarm type and period select 0: Pressure guard (input) 1: 30 days 2: 90 days 3: 180 days 4: 360 days 5: 70 days and pressure guard
AirTemp.CoolSet	1200			Cooling temperature setpoint select 0 : Off (No cooling allowed) 1 : Set + 0 °C (User setpoint plus 0 degrees) 2 : Set + 1 °C 3 : Set + 2 °C 4 : Set + 3 °C 5 : Set + 4 °C 6 : Set + 5 °C 7 : Set + 7 °C 8 : Set + 10 °C
AirTemp.TempMinSum	1201	100	°C	Inlet temp. min. summer
AirTemp.TempMinWin	1202	100	°C	Inlet temp. min. winter
AirTemp.TempMaxSum	1203	100	°C	Inlet temp. max. summer
AirTemp.TempMaxWin	1204	100	°C	Inlet temp. max. winter
AirTemp.TempSummer	1205	100	°C	Summer/winter limit
AirTemp.NightDayLim	1206	100	°C	Outdoor day temperature for night cooling activation [0:Off, 20..40]
AirTemp.NightSet	1207	100	°C	Free energy night cooling room setpoint [10..30]
CentralHeat.HeatExtern	1800	100	°C	External heating offset from room temperature setpoint
AirQual.RH_VentLo	1910		Step	Humidity low winter step select
AirQual.RH_VentHi	1911		Step	Humidity high step select
AirQual.RH_LimLo	1912	100	%	Humidity limit for low ventilation
AirQual.RH_TimeOut	1913		min	Humidity max. time on high ventilation
AirQual.CO2_VentHi	1920		Step	CO2 high step select
AirQual.CO2_LimLo	1921		ppm	CO2 limit for normal ventilation
AirQual.CO2_LimHi	1922		ppm	CO2 limit for high ventilation

Name	Address	Scale	Unit	Description
User. UserMenuOpen	2002			Menu is open: 0=Closed, 1=Open, 2=No OFF key
DPT.DoCalibrate	2200		0,1	Calibrate DPT. 1: Start calibration

### 5.3.1 Display

Name	Address	Scale	Unit	Description
CentralHeat.HeatExtern	4000	100	°C	Regulation deadband external room heating -5.00°C – 5.00°C
AirFlow.WinterTemp	4002		°C	Low outdoor temperature -20°C - 10°C
AirFlow.WinerVent	4003			Fan speed at low outdoor temperature 0: OFF 1 - 3: Level
AirFlow.TestSelect	4004			Day for automatic test 0: OFF 1: Mo 2: Tu 3: We 4: Th 5: Fr 6: Sa 7: Su
AirHeat.Type	4005			After heating type 0: No additional heat 1: Electrical 2: Electric on binary relays 3: Water
AirHeat.Delay	4006		min	Delay timer for after-heat activation 0-60 min.
AirTemp.TempMinSum	4007	100	°C	Summer minimum supply air temperature MinSum: 5.00-14.00
AirTemp.TempMaxSum	4008	100	°C	Summer maximum supply air temperature MaxSum: 5.00-25.00
AirTemp.TempMinWin	4009	100	°C	Winter minimum supply air temperature MinWin: 5.00-16.00
AirTemp.TempMaxWin	4010	100	°C	Winter maximum supply air temperature MaxWin: 5.00-35.00
AirTemp.RoomNZ	4011	100		Room temperature regulation deadband 0.20 – 10.00
AirTemp.TempRoomLow	4012	100	°C	Low room temperature for stepwise reduced ventilation 0: OFF 1.00°C – 20.00°C
AirHeat.SelectSet	4013			After heating activation: 0: Off 1: On (No effect is AirHeat.Type (H4005) is 0.)

Name	Address	Scale	Unit	Description
Program.EditIndex	4030			Week program Index: 0-41 (7 days multiply by 6 functions each day)
Program.EditPeriod	4031			Week program Day index: 0-6 (0=Monday..)
Program.EditPeriodNx	4032			Week program Next day index: 0-6 (0=Monday..)
Program.EditFunc	4033			Week program Day function 0-5.
Program.EditTimeStar	4034			Week program Start time: 0000 – 2345: 0800 = 8:00, 1215 = 12:15
Program.EditVent	4035			Week program Fan settings: 0-4 0=Off, 1-4 Level
Program.EditTemp	4036		°C	Week program Temperature: 5°C - 50°C
Control.RestartMode	4040			External fire alarm auto reset 0: OFF 1: HPLP 2: CONTINUE 3: SELF_CLEAR
Control.PowerSave	4041			Enable power saving features 0: OFF 1: ON
Alarm.LogIndex	4050			Alarm log index 0 - 15
AirFlow.InletScale	4098		%	Scaling of inlet fan control voltage for max. air volume Range: 50..100
AirFlow.ExhaustScale	4099		%	Scaling of exhaust fan control voltage for max. air volume Range: 50..100

Name	Address	Scale	Unit	Description
AirFlow.InletSpd_1	4100			Inlet step 1 speed setup Range: 20..100
AirFlow.InletSpd_2	4101			Inlet step 2 speed setup Range: 20..100
AirFlow.InletSpd_3	4102			Inlet step 3 speed setup Range: 20..100
AirFlow.InletSpd_4	4103			Inlet step 4 speed setup Range: 20..100
AirFlow.ExhaustSpd_1	4104			Exhaust step 1 speed setup Range: 20..100
AirFlow.ExhaustSpd_2	4105			Exhaust step 2 speed setup Range: 20..100
AirFlow.ExhaustSpd_3	4106			Exhaust step 3 speed setup Range: 20..100
AirFlow.ExhaustSpd_4	4107			Exhaust step 4 speed setup Range: 20..100
AirQual.Type	4108			Enable Indoor Air Quality (IAQ) control function Range: 0..2 0: OFF, 1: HUMIDITY, 2: HUM+CO2
Control.AnaOutType	4109			Heater output signal type (if not air channel type) Range: 0..4 0: PERIOD 1: 0-10 V 2: 0/5/10 V 3: RELAY 3 4: RELAY 7
AirTemp.RoomResponse	4110			Room temperature controller response type Select predefined or user adjustable parameters Range: 0..3 0: SLOW, 1: NORMAL, 2: FAST, 3: USER

## 6. Communication example

The sample shown below is a general Modbus communication example, and is not specific for this device.

Request: 0b041000000e75a4

Response: 0b041cffff0000095008b0e4a80014000b000108e108f1ffff000f0002fff39f8e

### Request (Input register)

0x0b	Slave addr	1 byte
0x04	Function code	1 byte
0x1000	Start addr	2 bytes
0x000e	Quantity	2 bytes
0x75a4	CRC	2 bytes

### Response

0x0b	Addr	1 byte
0x04	Function code	1 byte
0x1c	NB bytes of data	1 byte
0xffff	Value1	2 bytes
0x0000	Value2	2 bytes
0x0950	Value3	2 bytes
0x08b0	Value4	2 bytes
0xe4a8	Value5	2 bytes
0x0014	Value6	2 bytes
0x000b	Value7	2 bytes
0x0001	Value8	2 bytes
0x08e1	Value9	2 bytes
0x08f1	Value10	2 bytes
0xffff	Value11	2 bytes
0x000f	Value12	2 bytes
0x0002	Value13	2 bytes
0xff3	Value14	2 bytes
0x9f8e	CRC	2 bytes

Request: 0b03200000018f60

Response: 0b030200002045

### Request (Holding register)

0x0b	Slave addr	1 byte
0x03	Function code	1 byte
0x2000	Address	2 bytes
0x0001	Quantity	2 bytes
0x8f60	CRC	2 bytes

### Response

0x0b	Slave addr	1 byte
0x03	Function code	1 byte
0x02	Quantity	1 byte
0x0000	Value1	2 bytes
0x2045	CRC	2 bytes