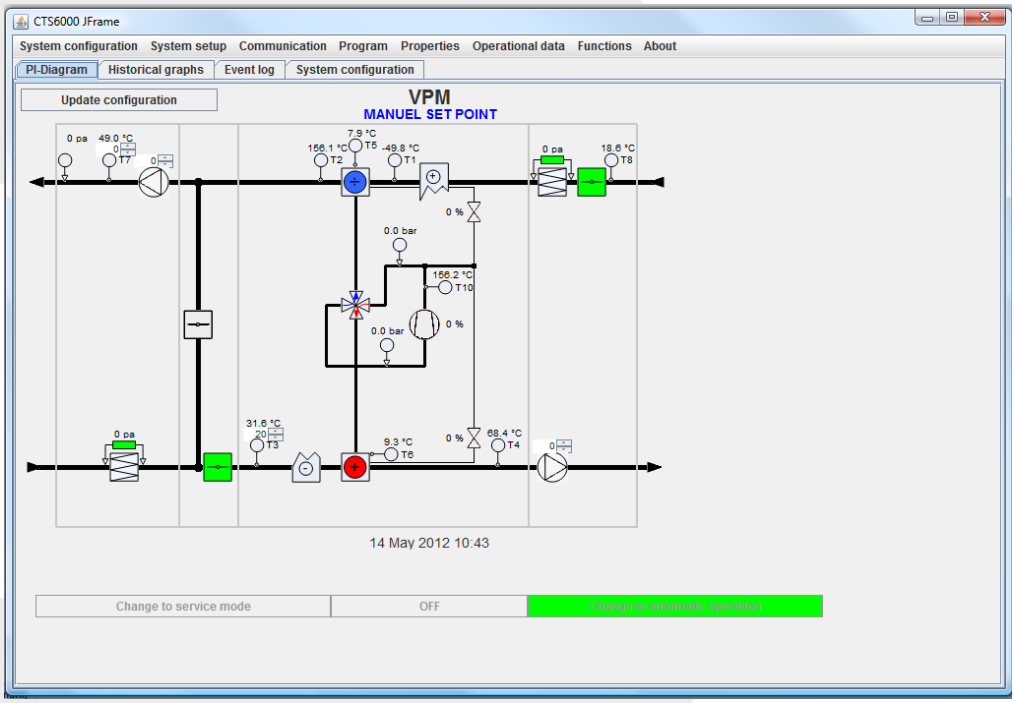
Database
for
CTS6000 MODBUS



Valid for: LONcard SW1.7.4B, Variable List V2.02

Version 1.08-4, 01-05-2016

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Contents

1. Installation

When Nilan-LON is delivered it is already configured. This means that when it is powered up the application program will start automatically. The Flash memory will contain Firmware and application code. Furthermore the communication parameters will be present in the EEPROM memory of the chips. The customer will need to install the network and make the required bindings. Nilan-LON can be installed by pushing the SERVICE pin (SW2) which will cause the neuron-chip to transmit a unique 48 bit ID code to the network.
The SERVICE pin SW1 will reset and restart the LON chip. It has *NO* influence on MODBUS chip.
Nilan-LON has a yellow service LED which indicates various states of the interface. When Nilan-LON is installed, it should only flash for a moment and then remain off.

1.1. Installation and operating instructions

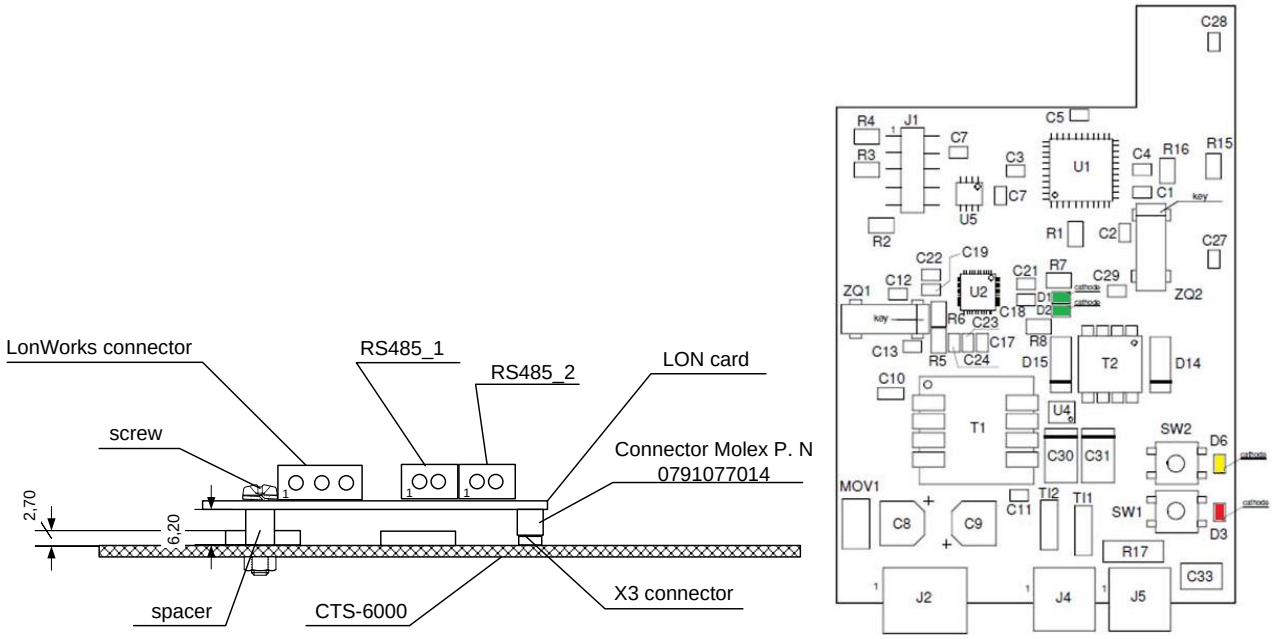


Figure 1: Nilan-LON interface

LonWorks interface connector

Pin number	Description
1	Zero
2	NETA
3	NETB

RS485 interface connector
It is mandatory to have min. 3-wire connection: RS485 –B, S485 – A & COM.
It is recommended to use a shielded connection.

Connector name	Pin number	Decription
RS485_1	1	RS485 –B (DATA -)
RS485_1	2	RS485 – A (DATA +)
RS485_2	1	COM
RS485_2	2	SHIELD

2. Introduction

CTS6000 is a MODBUS Slave and communicates at speeds up to 115200 bps. The MODBUS is activated by placing a tick in the LON communication box under System settings.

2.1. Preface

This manual contains information regarding the monitoring and control of Nilan CTS6000 via MODBUS. Some examples of how MODBUS is used can be found at the end of the manual.

2.2. RS485 setup

Address = 1
Baud rate = 57600
Parity = Odd
Stop bits = 1

2.3. The communication order

There is a 2 second pause between every request.

Device	**CTS6000**		**LON Card**		**Modbus Master**
Interface		**IIC**		**UART**	
	Sync the CTS6000 parameters with the Storage Memory				
	Send Output Parameters	→	Store Parameters		
	Get Input Parameters	←	Send Parameters		E
	Data exchange over Modbus				
				←	Send Request For Input Parameters
			Send Required parameters	→	
				←	Send New Parameters
			Send Acknowledge	→	

2.4. Sending output registers

This command sends all output registers from #40001 to #400125 to the slave with address 01.
Both read and write functions operate with 2-byte Modbus registers.
Variables can:

- occupy registers if it can't be fit in 2 bytes;
- occupy 1 register;
- be stored in lower part of 2-bytes register; in this case additional service data is stored in higher part of the register and it has to be processed to get the value.

01 10 0000 007D Size Register 1 Register 2 ……. …… …. ..CRC

01	:	The Slave Address
10	:	The Function Code (Preset Multiple Registers 16 = 10 hex)
0000	:	The Data Address of the first register.
007D	:	The number of registers to write
Size	:	The number of data bytes to follow
Register 1	:	The value to write to register 40002
Register 2	:	The value to write to register 40003
……		
CRC	:	The CRC (cyclic redundancy check) for error checking.

2.5. Requesting input registers

This command reads all input registers from #30001 to #30125 from the slave with address 01.

01 04 0000 007D CRC

01	:	The Slave Address (01 = 01 hex)
04	:	The Function Code (read Analog Input Registers)
0000	:	The Data Address of the first register requested
007D	:	The total number of registers requested (read all input registers)
CRC	:	The CRC (cyclic redundancy check) for error checking.

2.6. Supported functions

Input and holding registers are supported.

The controller will respond to the below listed Modbus message functions only.
Please note that no other function codes are supported.

Function code	Name
04	Read Input Registers
16	Preset Multiple Registers

2.7. 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.

Example of changes of register (Outlet Fan Speed (274)):
Dec 9542 = hex 2546 (bin= 10010101000110)
Byte 1: hex 46 = dec 70 ➔ speed is 70/2 = 35 %
Byte 2: hex 25 = dec 37 ➔ Fan is ON (38 = OFF)

3. Description of output from CTS6000

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.

Space temperature sensor

000	Size 2 byte
Contains the temperature value of space temperature sensor if such is connected to the unit.	Byte 1 MSB Byte 2

Contains temperature of the space temperature sensor.

Formula : Temperature = recorded value/ 100

Unit status

001	Size 12 byte
Contains the status of the unit.	Byte 1 : Mode. MSB Byte 2 : Heat output primary Byte 3 : Heat output primary MSB Byte 4 : Heat output secondary Byte 5 : Heat output secondary MSB Byte 6 : Cool output Byte 7 : Cool output MSB Byte 8 : Econ output Byte 9 : Econ output MSB Byte 10 : Fan output Byte 11 : Fan output MSB Byte 12 : In alarm

Mode

HVAC_NUL	-1	Invalid value
HVAC_AUTO	0	Controller automatically changes between application modes
HVAC_HEAT	1	Heating only
HVAC_MRNG_WRMUP	2	Application-specific morning warm-up
HVAC_COOL	3	Cooling only
HVAC_NIGHT_PURGE	4	Application-specific night purge
HVAC_OFF	6	Controller not controlling outputs
HVAC_FAN_ONLY	9	Air not conditioned, fan turned on
HVAC_FREE_COOL	10	Cooling with compressor not running

Formula:
Byte 3 Byte 2 * 0.5 = Heat output primary in % (Compressor)
Byte 5 Byte 4 * 0.5 = Heat output secondary in % (Heating Element)
Byte 7 Byte 6 * 0.5 = Cool output in % (Compressor)
Byte 9 Byte 8 * 0.5 = Econ output in % (Not used)
Byte 11 Byte10 * 0.5 = Total fan output in % (Inlet & Outlet FAN)

If byte 12 has a value different from 0 then the unit is in an alarm status = ALARM ID number.

Unit temperature sensors

008-024	Size 2 byte
Contains the temperature values of the units temperature sensors	Byte 1 MSB Byte 2

Contains the temperature of the different sensors mounted in the HVAC unit.

008 > T1 = Outdoor air temperature after heat pipe.
009 > T2 = Inlet air temperature after heat pump.
010 > T3 = Exhaust air temperature
011 > T4 = Outlet air temperature
012 > T5 = Temperature evaporator / condenser.
013 > T6 = Temperature evaporator / condenser.
014 > T7 = Inlet air temperature.
015 > T8 = Out door air temperature.
016 > T9 = Temperature of aux. heater.
017 > T10 = Compressor 1 hot gas temperature.
018 > T11 = Compressor 2 hot gas temperature.
019 > T12 = Compressor 3 hot gas temperature.
020 > T13 = Unused / Shared compressor hot gas temperature cooling unit
021 > T14 = Unused / Temperature AUX. heater return water
022 > T15 = Unused / Evaporator pre cooling unit
023 > T16 = Unused / Condenser pre cooling unit
024 > T17 = Unused / User panel temperature

Formula : Temperature = recorded value / 100
Meaning if 2100 is recorded at 015, then the temperature at T8 is 2100/100 = 21.00°C

Status indication

This value contain various On/Off signals used by the system. The parameters allow the system to be monitored. ALARM is active low.

025	Size 8 byte
Registers indicating ON/OFF signals	Bit0 = Compressor 1 (1 = On ; 0 = Off) Bit1 = Compressor 2 (1 = On ; 0 = Off) Bit2 = Compressor 3 (1 = On ; 0 = Off) Bit3 = Bypass valve heat (1 = Open ; 0 = Closed) Bit4 = 4-way valve (0 = Heat mode ; 1 = Cooling mode) Bit5 = Electric heater step 1 (1 = On ; 0 = Off) Bit6 = Electric heater step 2 (1 = On ; 0 = Off) Bit7 = Electric heater step 3 (1 = On ; 0 = Off) Bit8 = Pump status for water heating element (1 = On ; 0 = Off) Bit9 = Active cooling (1 = the unit is running active cool ; 0 = the unit is running in heat mode) Bit10 = Common Alarm (1 = there is no alarms ; 0 = there is an alarm on the unit) Bit11 = Exhaust fan step 1 (1 = On ; 0 = Off) Bit12 = Exhaust fan step 2 (1 = On ; 0 = Off) Bit13 = Inlet fan step 1 (1 = On ; 0 = Off) Bit14 = Inlet fan step 2 (1 = On ; 0 = Off) Bit15 = Bypass valve Cooling (1 = Open ; 0 = Closed) Bit16 = Digital Out 1 (1 = On ; 0 = Off) Bit17 = Digital Out 2 (1 = On ; 0 = Off) Bit18 = Digital Out 3 (1 = On ; 0 = Off) Bit19 = Digital Out 4 (1 = On ; 0 = Off) Bit20 = Digital Out 5 (1 = On ; 0 = Off) Bit21 = Digital Out 6 (1 = On ; 0 = Off) Bit22 = Digital Out 7 (1 = On ; 0 = Off) Bit23 = Digital Out 8 (1 = On ; 0 = Off) Bit24 = AUX 1(1 = On ; 0 = Off) Bit25 = AUX 2 (1 = On ; 0 = Off) Bit26 = AUX 3 / Dampers (1 = On ; 0 = Off) Bit27 = AUX 4 (1 = On ; 0 = Off) Bit28 to Bit63 = future use

1 / high is ON

Pressures

High pressure compressor

029/030	Size 4 byte
Contains the pressure level at the high pressureside of the compressor	Byte 1 MSB (029) Byte 2 (029) Byte 3 MSB (030)Byte 4 (030)

Formula: Pressure (bar) = (recorded value) / 100

Low pressure compressor

031/032	Size 4 byte
Contains the pressure level at the low pressure side of the compressor	Byte 1 MSB (031) Byte 2 (031) Byte 3 MSB (032) Byte 4 (032)

Formula: Pressure (bar) = (recorded value) / 100

Pressure drop over inlet filter

033	Size 2 byte
Contains the pressure drop over the inlet filter.	Byte 1 MSB Byte 2

Formula: Pressure (Pa) = (recorded value)

Pressure drop over outlet air filter

034	Size 2 byte
Contains the pressure drop over the outlet filter.	Byte 1 MSB Byte 2

Formula: Pressure (Pa) = (recorded value)

Pressure inlet duct

035	Size 2 byte
Contains the actual pressure level in the inlet duct.	Byte 1 MSB Byte 2

Formula: Pressure (Pa) = (recorded value

Pressure outlet duct

036	Size 2 byte
Contains the actual pressure level in the outlet duct.	Byte 1 MSB Byte 2

Formula: Pressure (Pa) = (recorded value)

Alarm

037	Size 31 byte
Contains the latest alarm on the unit until alarm flag has been set.	Byte 1 : Alarm type MSB Byte 2 : Priority level Byte 3 : Alarm time MSB Byte 4 : Alarm time Byte 5 : Alarm time MSB Byte 6 : Alarm time Byte 7 : Milliseconds MSB Byte 8 : Milliseconds Byte 9 : Sequence number MSB Byte 10 : Alarm text Byte 11 : Alarm text MSB Byte 12 : Alarm text Byte 13 : Alarm text MSB Byte 14 : Alarm text Byte 15 : Alarm text MSB Byte 16 : Alarm text Byte 17 : Alarm text MSB Byte 18 : Alarm text Byte 19 : Alarm text MSB Byte 20 : Alarm text Byte 21 : Alarm text MSB Byte 22 : Alarm text Byte 23 : Alarm text MSB Byte 24 : Alarm text Byte 25 : Alarm text MSB Byte 26 : Alarm text Byte 27 : Alarm text MSB Byte 28 : Alarm text Byte 29 : Alarm text MSB Byte 30 : Alarm text Byte 31 : Alarm text MSB

Formula : Alarm type : Type number
Priority level : 0 – 1 – 2 – 3
Alarm time : Time in seconds since 2000-01-01T00:00:00Z = recorded value
Milliseconds : Milliseconds = recorded value.
Alarm text : Alarm text = recorded value as null terminated string.

Level 0 = for information
Level 1 = the Alarm leads to a warning and status of the system. The system continues to operate under the actual conditions.
Level 2 = an Alarm to control the compressor = stop compressor; but the regulation is still active. Acknowledge of alarm needed to allow compressor to run.
Level 3 = critical alarm that stop the entire system.

Only ALARMS level 2 and 3 are accessible in MODBUS.

Alarm texts are send in ASCII code.

Date and time

This value contains the system's date and time settings.

053	Size 7 byte
Contains the systems time and date settings	Byte 1 : Year MSB Byte 2 : Year Byte 3 : Month MSB Byte 4 : Day Byte 5 : Hour MSB Byte 6 : Minute Byte 7 : Second MSB

Formula : Year = (recorded value)
Month = (recorded value)
Day of the month = (recorded value)
Hour = (recorded value)
Minute = (recorded value)
Second = (recorded value)

Capacities

These values are used to show the capacities for capacity regulated parts.

Outlet fan capacity

057	Size 2 byte
This value contains the actual capacity of the outlet fan	Byte 1: Value MSB Byte 2: State

Formula : Capacity in % = (recorded value) / 2

Inlet fan capacity

058	Size 2 byte
This value contains the actual capacity of the inlet fan	Byte 1: Value MSB Byte 2: State

Formula : Capacity in % = (recorded value) / 2

Water valve capacity

059	Size 2 byte
This value contains the actual capacity of the water valve	Byte 1: Value MSB Byte 2: State

Formula : Capacity in % = (recorded value) / 2

Capacity of capacity regulated compressor

060	Size 2 byte
This value contains the actual capacity of the outlet fan	Byte 1: Value MSB Byte 2: State

Formula : Capacity in % = (recorded value) / 2

4. Description of Input parameters for CTS6000

Space temperature

256	Size 2 byte
Contains the temperature value of space temperature sensor if such is connected to the unit.	Byte 1 MSB Byte 2

Contains temperature of the space temperature sensor.

Formula : Value = Temperature * 100

Setpoint

257	Size 2 byte
Contains the temperature **setpoint**, i.e. the required temperature.	Byte 1 MSB Byte 2

Formula : 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

258	Size 2 byte
Contains the temperature offset value of the controlling temperature sensor.	Byte 1 MSB Byte 2

Contains the offset value of the controlling temperature sensor.

Formula : Value = Temperature offset * 100

Min. inlet temperature summer

259	Size 2 byte
Contains value for Min. inlet summer	Byte 1 MSB Byte 2

Formula : Value = Temperature * 100
Min. inlet summer specifies the minimum permissible value.

Min. inlet temperature winter

260	Size 2 byte
Contains value for Min. inlet winter	Byte 1 MSB Byte 2

Formula : Value = Temperature * 100
Min. inlet winter specifies the minimum permissible value.

Max. inlet temperature

261	Size 2 byte
Contains value for Max. inlet temperature	Byte 1 MSB Byte 2

Formula: Temperature = Temperature * 100
Max. inlet specifies the maximum permissible value.

Pressure set point outlet duct.

262	Size 2 byte
Contains the pressure set point for the outlet duct if a pressure transmitter is connected to the unit.	Byte 1 MSB Byte 2

Contains the pressure set point at the outlet duct.

Formula: Value = Pressure set point

Pressure set point inlet duct.

263	Size 2 byte
Contains the pressure set point for the inlet duct if a pressure transmitter is connected to the unit.	Byte 1 MSB Byte 2

Contains the pressure set point at the inlet duct.

Formula: Value = Pressure set point

Controlling sensor.

265	Size 2 byte
Contains the value who decides which sensor is the controlling sensor.	Byte 1: Value MSB Byte 2: State

Formula: Value = 0,0 = T7 sensor active
Value = 1,200 (0xC8,0x01) = 456 = T3 sensor active
If a room compensated temperature control is wanted one has to select T3 as the controlling sensor, if constant inlet temperature is wanted T7 must be the controlling sensor.
When “Controlling sensor” is changed, “Setpoint” (257) must be set too.

Setting the date and time.

266	Size 7 byte
Contains the date and time of the HVAC unit.	Byte 1 : Year MSB Byte 2 : Year Byte 3 : Month MSB Byte 4 : Day Byte 5 : Hour MSB Byte 6 : Minute Byte 7 : Second MSB

Formula: In order to set the time on the unit, all seven bytes must be set at the same time.

Application mode (Start / stop).

270	Size 1 byte
Contains the application mode of the HVAC unit.	Byte 1: Value MSB Byte 2: unused

Contains the application mode of the HVAC unit.

ApplicMode	Data	Description
HVAC_NUL	-1	Invalid value
HVAC_AUTO	0	Controller automatically changes between application modes
HVAC_HEAT	1	Heating only
HVAC_MRNG_WRMUP	2	Application-specific morning warm-up
HVAC_COOL	3	Cooling only
HVAC_NIGHT_PURGE	4	Application-specific night purge
HVAC_OFF	6	Controller not controlling outputs
HVAC_FAN_ONLY	9	Air not conditioned, fan turned on
HVAC_FREE_COOL	10	Cooling with compressor not running

Other values are not acceptable

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.

Alarm reset.

272	Size 2 byte
Resets the alarm flag and marks an alarm as action taken.	Byte 1: Value MSB Byte 2: State

Formula : State : 0 inactive, 1 = active
Setting : 0 = OFF, 200 = ON
Scene number : Not used set to 0

If a fire alarm has been activated, it must be reset before the system can be restarted. This is done by writing to 40272 byte 2. If this is "high"(200) all alarms will be reset.

Auxiliary heat.

273	Size 2 byte
Allows the AUX. heater to be active.	Byte 1: Value MSB Byte 2: State

Formula : Value = 1,200,0 = ON :0,0,0 = OFF (see Alarm reset)
This variable indicates whether auxilliary heat has been enabled or disabled. If auxilliary heat is enabled, it is allowed in the heating mode.

Outlet fan speed.

274	Size 2 byte
Contains the fan speed set point for the outlet fan if the fans is VLT controlled or fixed speed fans.	Byte 1: Value MSB Byte 2: State

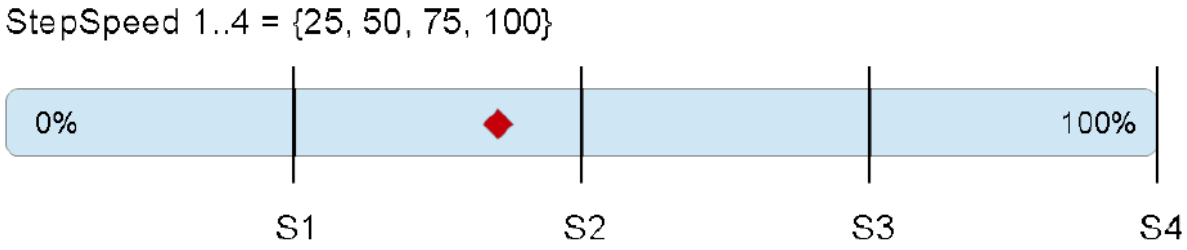
Contains set point for the outlet fan.

Formula : Value / 2 = Fan speed

Speed	Fan type		
	1 Speed	2 Speeds	VLT controlled
Off	1	1	1
1	200	150/167(1)	S1(2)
2	-	200	S2(2)
3	-	-	S3(2)
4	-	-	S4(2)

1. Fan speed depends on settings: fan speed can be 50% or 66% of power.
2. FAN speed may be adjusted individually, but always 1 < S1 < S2 < S3 < S4.

VLT fan speed Modus control



Modbus data = value x 2;

```
E.g. Modbus data = 70
Value = 70 / 2 = 35₈
Speed = [S2] = 50₈
```

The Modbus command is equal to the desired fan speed multiplied by 2.

In the SW when divided by two, it's compared to step speeds entered using *Fan configuration* Dialogue box.

Inlet fan speed.

275	Size 2 byte
Contains the fan speed set point for the inlet fan if the fans is VLT controlled or fixed speed fans.	Byte 1: Value MSB Byte 2: State

Contains set point for the inlet fan.

Formula : Value / 2 = Fan speed

Speed	Fan type		
	1 Speed	2 Speeds	VLT controlled
Off	1	1	1
1	200	150/167[1]	S1[2]
2	-	200	S2[2]
3	-	-	S3[2]
4	-	-	S4[2]

1. Fan speed depends on settings: fan speed can be 50% or 66% of power.
2. FAN speed may be adjusted individually, but always 1 < S1 < S2 < S3 < S4.

5. Examples

5.1. Preface

Figure 2 illustrates the basic example described in the following. When LON / Modbus communication is active, it is not possible to stop the unit via the Java.

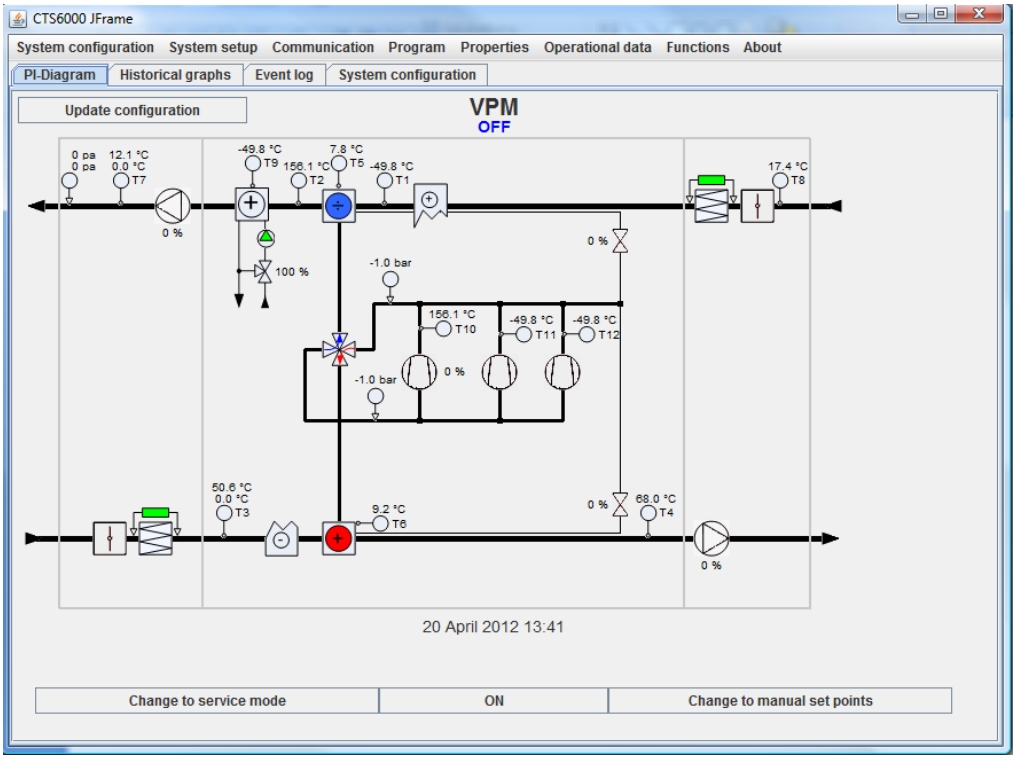


Figure 2: PI diagram normal operation

5.2. Switching to LON/ Modbus communication

To switch to LON / Modbus communication, open Unit configuration and place a tick in the box beside LON control, and you will see the card version. In this case ver. 1.7.4

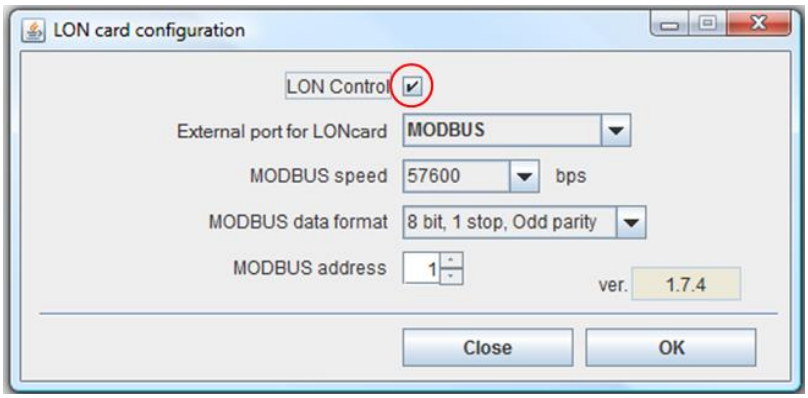


Figure 3 Activating MODBUS

5.3. MODBUS / LON operation (normal= after STARTUP delays)

This type of regulation is used for normal operation. The system operates according to the values entered in the PI-diagram. To change the system set up, proceed as follows.

1. Set the required temperature in 257
2. Set the required fan speed in 274 and 275 or
    a. Set the required inlet pressure for VAV control in 263
    b. Set the required exhaust pressure for VAV control in 262
3. Set Start control in 270

Once the above-mentioned settings have been made, all that is required to start and stop the system is to write to start/stop control in 270.

An example of how the parameters should be set is shown below:

257 = 2100((21.0°C)
Either 274 and 275 = 200 (100% for exhaust and inlet)
Or 263 = 300 (300 Pa for inlet)
and 262 = 300 (300 Pa for exhaust)
270 = 0 (Start automatic operation)

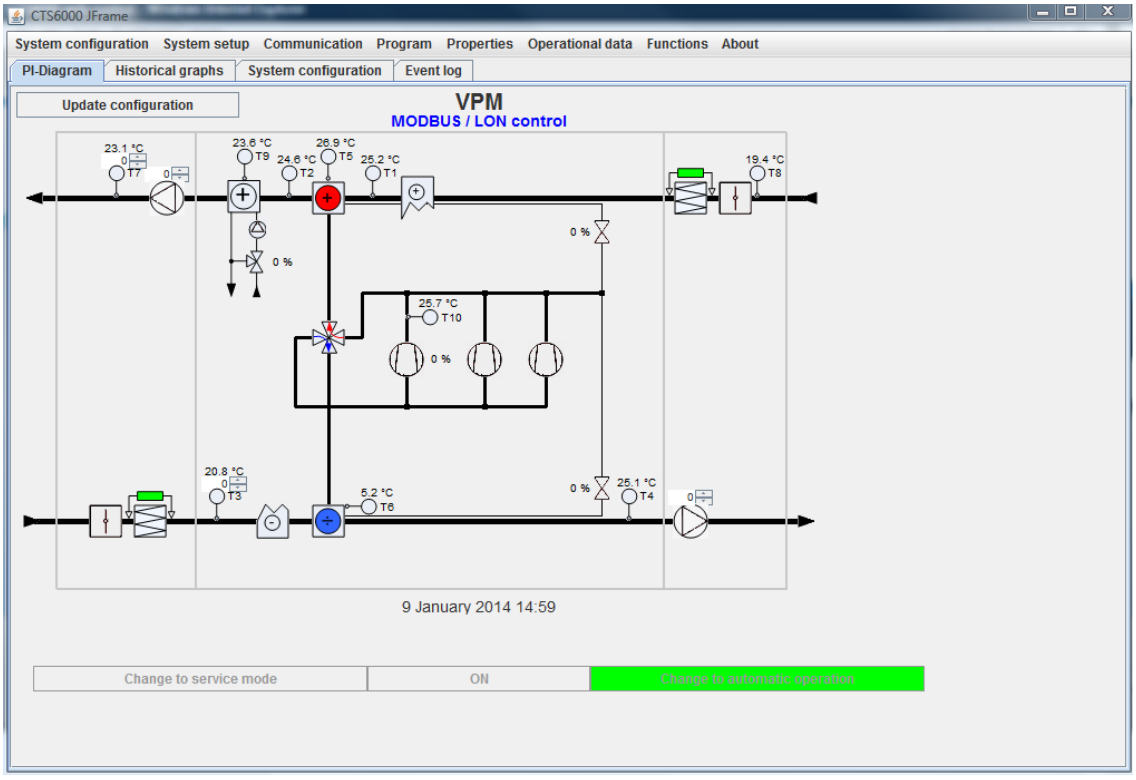


Figure 4 MODBUS / LON operation

5.4. Resetting alarms

If a fire alarm has been activated, it must be reset before the system can be restarted. This is done by writing to 272 byte 2. If this is "high"(200) all alarms will be reset. (See Alarm reset)

5.5. MODBUS Variables

Type	Type index	name	Size	Total offset	Modbus registers
SNVT_temp_p	105	nvoSpaceTemp	2	0	0
SNVT_hvac_status	112	nvoUnitStatus	12	2	1
SNVT_temp_p	105	nvoEffectSetPt	2	14	7
SNVT_temp_p	105	nvoTemp1	2	16	8
SNVT_temp_p	105	nvoTemp2	2	18	9
SNVT_temp_p	105	nvoTemp3	2	20	10
SNVT_temp_p	105	nvoTemp4	2	22	11
SNVT_temp_p	105	nvoTemp5	2	24	12
SNVT_temp_p	105	nvoTemp6	2	26	13
SNVT_temp_p	105	nvoTemp7	2	28	14
SNVT_temp_p	105	nvoTemp8	2	30	15
SNVT_temp_p	105	nvoTemp9	2	32	16
SNVT_temp_p	105	nvoTemp10	2	34	17
SNVT_temp_p	105	nvoTemp11	2	36	18
SNVT_temp_p	105	nvoTemp12	2	38	19
SNVT_temp_p	105	nvoTemp13	2	40	20
SNVT_temp_p	105	nvoTemp14	2	42	21
SNVT_temp_p	105	nvoTemp15	2	44	22
SNVT_temp_p	105	nvoTemp16	2	46	23
SNVT_temp_p	105	nvoTemp17	2	48	24
SNVT_state_64	165	nvoStatus	8	50	25
SNVT_press_f	59	nvoPressHP	4	58	29
SNVT_press_f	59	nvoPressLP	4	62	31
SNVT_press_p	113	nvoFilterInlet	2	66	33
SNVT_press_p	113	nvoFilterOutlet	2	68	34
SNVT_press_p	113	nvoInletPress	2	70	35
SNVT_press_p	113	nvoOutletPress	2	72	36
SNVT_alarm_2	164	nvoAlarm	31	74	37
SNVT_time_stamp	84	nvoCalTime	7	106	53
SNVT_switch	95	nvoOutletFanCap	2	114	57
SNVT_switch_2	189	nvoOutletFanCap2	2(3)	114	57
SNVT_switch	95	nvoInletFanCap	2	116	58
SNVT_switch_2	189	nvoInletFanCap2	2(3)	116	58
SNVT_switch	95	nvoWaterValve	2	118	59
SNVT_switch_2	189	nvoWaterValve2	2(3)	118	59
SNVT_switch	95	nvoVTZSpeed	2	120	60
SNVT_switch_2	189	nvoVTZSpeed2	2(3)	120	60
SNVT_temp_p	105	nviSpaceTemp	2	512	256
SNVT_temp_p	105	nviSetpoint	2	514	257
SNVT_temp_p	105	nviSetPtOffset	2	516	258
SNVT_temp_p	105	nviMinInletSum	2	518	259
SNVT_temp_p	105	nviMinInletWin	2	520	260
SNVT_temp_p	105	nviMaxInlet	2	522	261
SNVT_press_p	113	nviVAVOutlet	2	524	262
SNVT_press_p	113	nviVAVInlet	2	526	263
SNVT_switch		Not used.	2	528	264
SNVT_switch	95	nviCntSensor	2	530	265
SNVT_time_stamp	84	nviCalTime	7	532	266
SNVT_hvac_mode	108	nviApplicMode	1	540	270
SNVT_occupancy		Not used.	1	542	271
SNVT_switch	95	nviAlarmFlag	2	544	272
SNVT_switch_2	189	nviAlarmFlag2	2(3)	544	272
SNVT_switch	95	nviAuxHeat	2	546	273
SNVT_switch_2	189	nviAuxHeat2	2(3)	546	273
SNVT_switch	95	nviOutletFanSpd	2	548	274
SNVT_switch_2	189	nviOutletFanSpd2	2(3)	548	274
SNVT_switch	95	nviInletFanSpd	2	550	275
SNVT_switch_2	189	nviInletFanSpd2	2(3)	550	275

Figure 5 Variables list 2.02