



ThermoPad Reference Manual

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1 Revision History

Rev 0.9

- SSH added to the manual

Rev 0.8

- NVDB support in DXS models

Rev 0.7

- CYCL parameter

Rev 0.6

- DXS v0.4.9
- Operational Mode dISP/Hide
- Freeze Protection
- Virtual Auto Mode

Rev 0.5

- M
- Set Point Float MODBUS Register
- Models Table

Rev 0.4

- S,T,H Fixes

Rev 0.3

- DXS Customization



2 Specification

Height	69 mm
Width	159 mm
Depth	46 mm
Operating Voltage	6.5-12V DC
Power Consumption	25 mA
Operating Temperature	-10 +60 °C
Temperature Sensor Accuracy	+/- 1°C
Set Point Range	Variable
Out1 High	Vin - 0.7V
Out1 Low	0V
Out1 Max Power	40mA

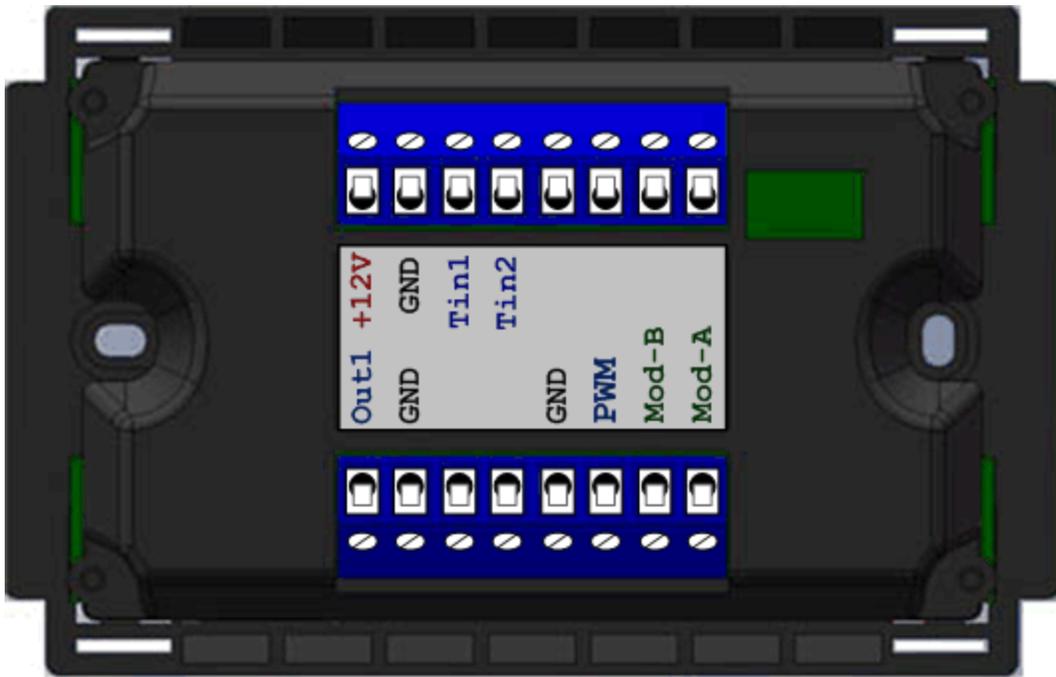


3 Thermopad Models

Model Name	HVAC Brand	Model Letter
Heater		H
ABTS	Sanyo, Toshiba, Panasonic	A
P1P2	Daikin	P
DXS	Daikin	DES,P
Tadiran	Tadiran	t
MELCO	Mitsubishi Electric	E
Split		S
Boiler		b



4 Terminals





5 MODBUS Map

ThermoPad supports Modbus RTU Transmission Mode with following byte format:

Baud Rate 9600
 Start Bits 1
 Data Bits 8
 Parity No
 Stop Bits 1

Physical bytes transmission is done over “Two-Wire” electrical interface in accordance with EIA/TIA-485 standard via Mod-A and Mod-B terminals.

MODBUS Address*		Description	Notes
Hex	Dec		
Holding Registers			
0001	1	Modbus Own Address	Effective after reset
0040	64	RTC Year	
0041	65	RTC Month 1-12	
0042	66	RTC Day of the week 1-7	
0043	67	RTC Hour BCD, bit 6 = 0-12 1-24 format	
0044	68	RTC Minutes BCD	
0050	80	Disable Mode bit 0 - Cool Disabled bit 1 - Heat Disabled bit 2 - Auto Disabled bit 3 - Dry Disabled bit 4 - Haux Disabled bit 5 - Fan Disabled bit 6 - Combined Heat & Haux Disabled	Write effective after reset
0051	81	Disable Fan bit 0 - Low Disable bit 1 - Medium Disable bit 2 - High Disable bit 3 - Auto Disable bit 4 - Top Disable	Write effective after reset
0060	96	Config0 bit0 - Use Internal Thermo Sensor bit1 - Use External Thermo Sensor bit2 - Use Indoor Ambient Temperature bit3 - Show Ambient Temperature on LCD bit4,5 - Failure format 0-Xn, 1-nnnn, 2-Xnn bit6,7 - Reserved bit8 - Timer Visible	Write effective after reset
0061	97	Application Type 0 - Standard 1 - Heater (external heater) 2 - Presentation (for external heater) 3 - Under floor heater box 4 - Under floor heater relay	



00FF	255	Flags0 bit 0 - onoff changed by user bit 1 - mode changed by user bit 2 - fan speed changed by user bit 3 - set point changed by user bit 4 - idle run in progress (for underflow heater box application) If bit 0 .. bit 3 in Flags0 register is set, corresponding status can not be changed by writing Status0 or Set Temperature register. To clear bit 0 .. bit 3 read the Flags0 register.	
0100	256	Status0 bit 0 - On/OFF bit 1,2,3 - Mode: 0-Cool, 1-Heat, 2-Auto, 3-Dry, 4-Haux, 5-Fan bit 4,5,6 - Fan Speed: 0-Low, 1-Med, 2-Hi, 3-Auto	
0101	257	Set Temperature	in Celsius
0102	258	Indoor Unit Ambient Temperature	Temperature read from linked Indoor Unit
0103	259	Failure code	
0104	260	Internal failure bit0 - Modbus timeout (no communication for defined period of time)	
0105	261	Ambient Temperature. bits 15-8 (MSB) - Integer part bits 7-0 (LSB) - Fractional part *0.1	Temperature read from Thermopad in Celsius
0106	262	Set Temperature Float bits 15-8 (MSB) - Integer part bits 7-0 (LSB) - Fractional part *0.1	in Celsius
0200	512	PWM1 Limit (in 50ms units)	Terminal Out1
0201	513	PWM1 Duty (in 50ms units)	
0202	514	PWM2 Limit (in 50ms units)	Terminal PWM
0203	515	PWM2 Duty (in 50ms units)	
0210	528	Digital Output bit0 - Out1 bit1 - Out2	Out1 - Terminal Out1 Out2 - Terminal PWM
Coils			
0001	1	Boot - enter boot mode	
0002	2	Reset	
0003	3	Main RC in AC System	RO, DXS Only
0200	512	Out1	
0201	513	Out2	

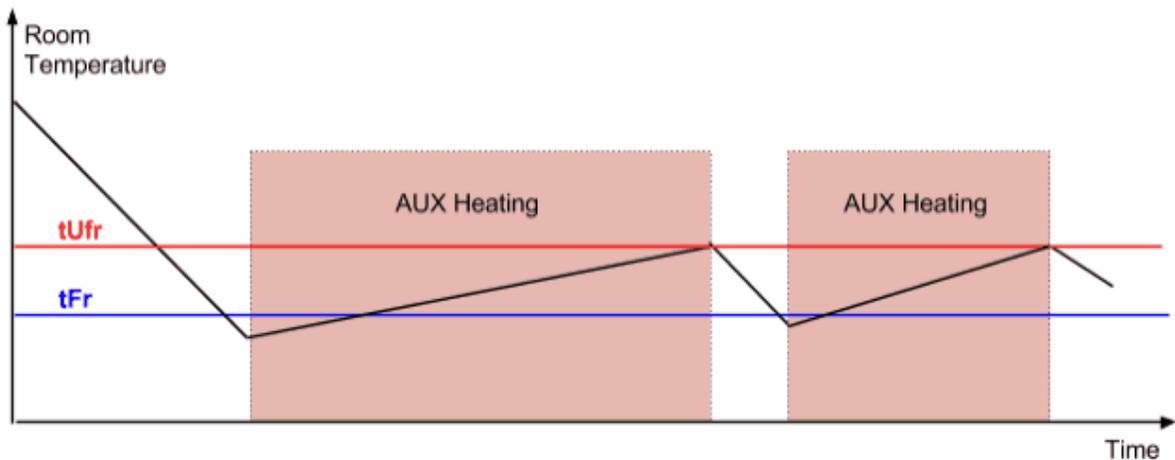
* On the MODBUS wire address starts from 0 and thus is 1 less



6 Special Features

6.1 Freeze Protection

This feature is enabled if **tFr** setting is defined (only for DXS model v0.4.9 or higher). By default it is disabled.

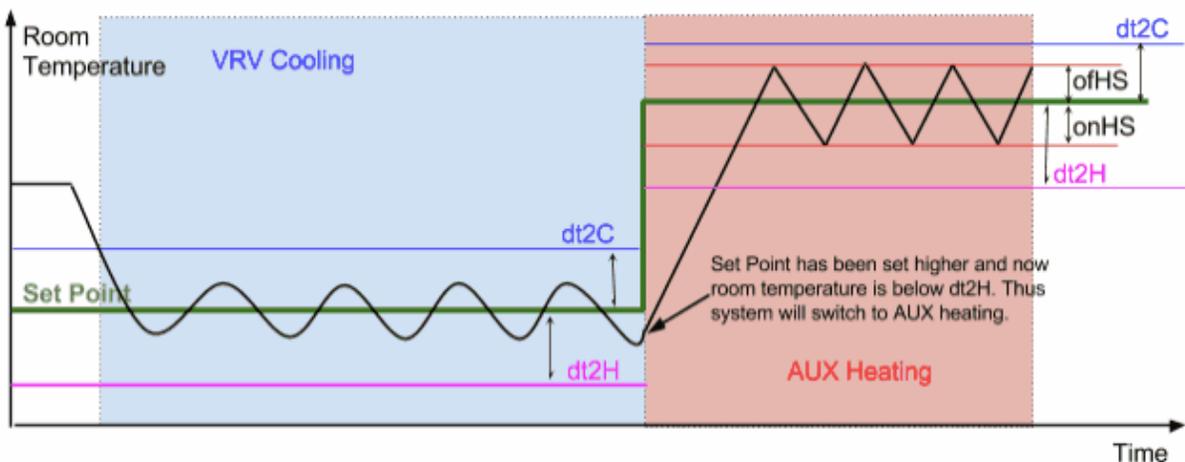


When enabled, In case Room Temperature measured by ThermoPad goes below **tFr** (Freeze Temperature), ThermoPad turns on AUX heating until Room Temperature equals to **tUfr**.

tFr and **tUfr** can be configured via [Configuration Menu](#).

6.2 Virtual Auto Mode

This feature is enabled if **dt2C** setting is defined (only for DXS model v0.4.9 or higher). By default it is disabled.



Customer is allowed to change SetPoint, Fan Speed and turn HVAC On/Off but not allowed to change operation mode. ThermoPad will decide about Cooling or Heating mode based on Set Point, Room Temperature and **dt2C, dt2H** values according to the below rules:



- In Cooling mode ThermoPad will stay in Cooling mode while
 $RoomTemperature > SetPoint - dt2H$
- In Cooling mode ThermoPad will pass to Heating mode if
 $RoomTemperature < SetPoint - dt2H$
- In Heating mode ThermoPad will stay in Heating mode while
 $RoomTemperature < SetPoint + dt2C$
- In Heating mode ThermoPad will pass to Cooling mode if
 $RoomTemperature > SetPoint + dt2C$

In Cooling mode HVAC is responsible for Cooling operation. ThermoPad takes no control over this process. In AUX Heating Mode ThermoPad uses Hysteresis Temperatures - **onHS** and **ofHS** to keep RoomTemperature close to the SetPoint according to the below rules:

- AUX Heating goes ON if
 $RoomTemperature < SetPoint - onHS$
- AUX Heating goes OFF if
 $RoomTemperature > SetPoint + ofHS$

6.3 Second Stage Heating

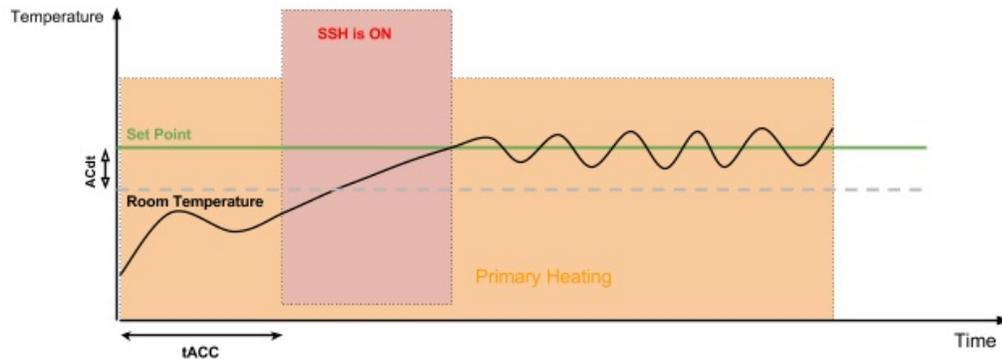
This feature is enabled if SSH(Second Stage Heating) setting is set to "AC" or "HAu" (only for DXS model v0.5.0 or higher). By default it is disabled.

SSH Setting Value	Primary Source	Secondary Source
"dIs"	SSH Disabled	
"AC"	HAUX	HVAC
"HAu"	HVAC	HAUX

SSH has 3 modes, which can be used separately or simultaneously:

- **Acceleration mode**

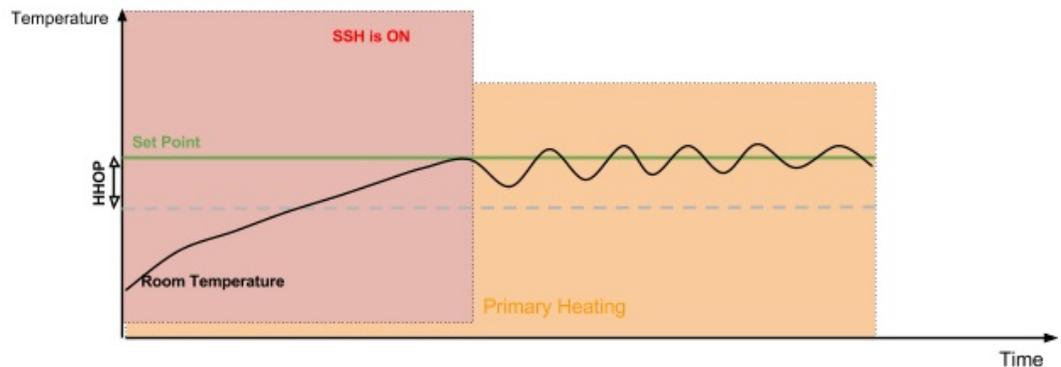
Second Stage is ON if after tACC time of primary heating SetPoint - RoomTemp > ACdt



SSH will be activated if Room Temperature stays ACdt [degree] below Set Point during tACC[minutes] time. In this case SSH will accelerate (or make it possible) to reach desired Set Point. SSH will be deactivated once Set Point has been reached. The feature is disabled if ACdt=0.

- **Kick off mode**

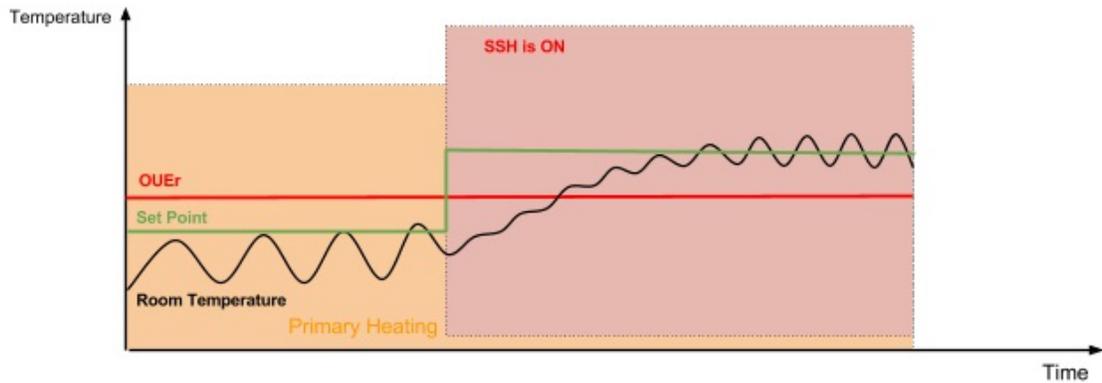
Active when: $\text{SetPoint} - \text{RoomTemp} > \text{HHOP}$



If RoomTemperature is significantly - HHOP[degree] below Set Point, Second stage will be activated to enable faster reaching of the Set Point. Second stage will be turned off once Set Point is reached. This feature is disabled if HHOP=0.

- **Overheating**

Active when: $\text{SetPoint} > \text{OUER}$



If Set Point is set above OUEr, then SSH will be activated. The feature is disabled if OUEr=0.

6.3.1 SSH Configuration

1. Enter [Configuration Menu](#).
2. Enable Heating Relay Application (APPL= rEL).
3. Press MENU button to reach SSH setting. Select desired secondary heating stage: AC or HAUX.
4. Configure desired SSH mode(s):
 - Set tAAC time and ACdt temperature for Acceleration mode.
 - Set HHOP temperature for Kick Off mode.
 - Set OUEr temperature for Overheating mode.

Note: In SSH mode, blinking HAUX or HEAT icon, means that it's a second heating stage and it's currently inactive. When second stage is active both HAUX and HEAT icons will be displayed (no blinking).

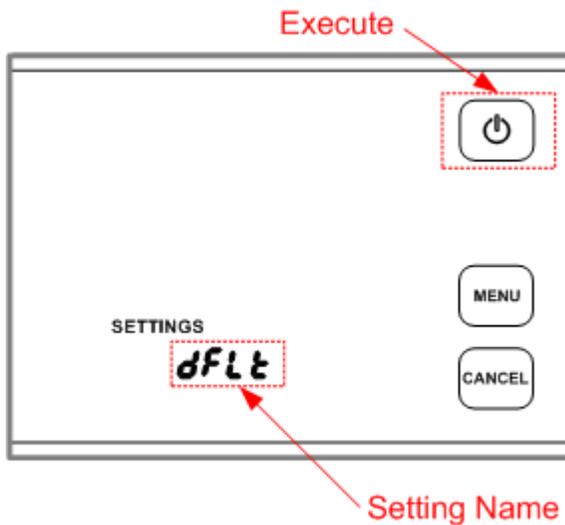


7 Configuration Menu

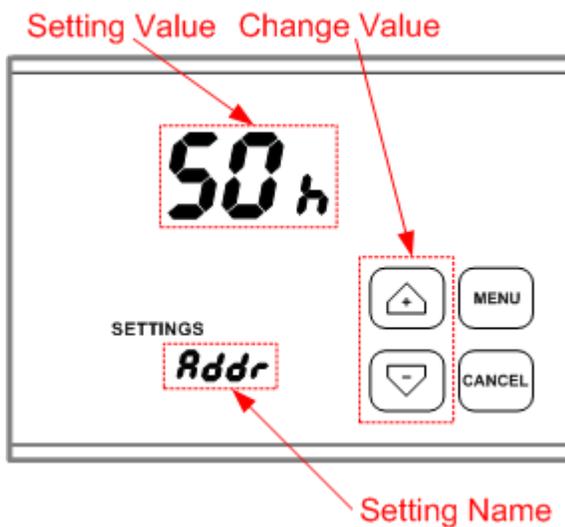
To enter Configuration Menu turn off the Air Conditioner and tap the upper left corner of the ThermoPad screen 4 or more times subsequently until Configuration Menu shows up.

The Configuration Menu screen may look like one of the screenshots shown below:

- For settings without value



- For settings with value



MENU and **CANCEL** buttons have following functionality:

- **MENU** - Next Setting
- **CANCEL** - Exit Configuration Menu



7.1 Settings Without Value

Setting Name	Execution	Notes
rSt	Reset ThermoPad	
dFLt	Load Defaults (factory settings)	
tESt	Run Internal Self Test	
ISEt	Go to Indoor Settings (Field Settings) mode	D, S, DXS, M Only

7.2 Settings With Value

Setting Name	Values	Notes
Addr	0x01 .. 0xFE - Modbus Address	
CPri	Cooling Priority (or so called Floating Master) feature (Enable/Disable)	DXS Only
APPL	Application: <ul style="list-style-type: none"> • Std - Standard • HEt - Aux Heater • PrE - Presentation • UbO - Underflow Heating Box • rEL - Underflow Heating Relay 	
dAtE	Show Date and Time (Enable/Disable)	
tSrc	Room Temperature Source <ul style="list-style-type: none"> • I - Internal ThermoPad Sensor • E - External Sensor • u - Indoor Unit Sensor 	<ol style="list-style-type: none"> 1. May be combination of I E u 2. If temperature is shown while configuring this parameter it will be visible by end user
tAdJ	Internal ThermoPad Sensor adjustment in 0.1°C Adjustment range is +-3.0°C	DXS only
°C°F	Celsius or Fahrenheit mode	D,DXS, H(v0.4.9) only
FAIL	Failure Format	H only
CERR	Collision Error Counter	Read Only
SERR	Check Sum Error Counter	
TERR	Timeout Counter	
OUt1	OUT1 Polarity <ul style="list-style-type: none"> • LO - Active Low • HI - Active High 	
onHS	Turn ON Hysteresis for Auxiliary Heating Modes	
oFHS	Turn OFF Hysteresis for Auxiliary Heating Modes	
tOFS	SetPoint Temperature Offset for Auxiliary Heating Modes	
CYCL	PWM Duty Cycle x50ms	H, S,T, DXS v.0.5.4
FLO	Flow Switch Enable	S,T,H Only
FLOi	Flow Switch Input NO/NC <ul style="list-style-type: none"> • nOP - Normally Open • nCL - Normally Closed 	S,T,H Only
IdLH	Idle Run period in hours	
IdLt	Idle Run time in minutes	0 - Disabled

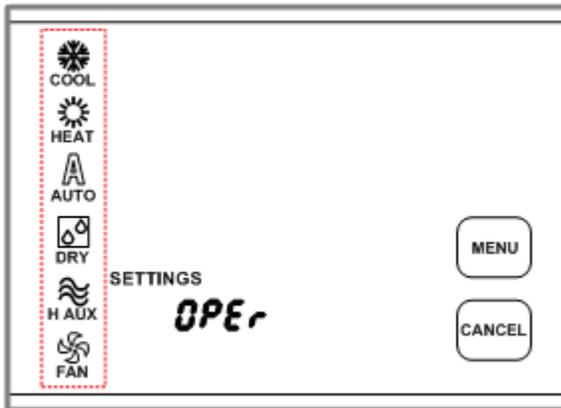


PrSL	PrI - Primary (Main) SLA - Slave (Sub)	D,DXS, M only
AbAd	Address on A/B bus 0x40..0x43	S,T only
SEPA	Separate control for Indoors in group (Enable/Disable)	D only
OPEr	Operation Modes. See Operation Modes Configuration	
HHAU	Combined Heat and Auxiliary Heat Mode (Enable/Disable)	H, S,T, DXS Only
FAnS	Fan Speeds. See Fan Speeds Configuration	H,S,T only
LOUu	Louver <ul style="list-style-type: none"> • no - No Louver • 5Ls - 5 Positions and Swing • 3Ls - 3 Positions and Swing • 0Ls - Swing on/off 	
C-LO	Cooling Mode Lower (Min) SetPoint	DXS Only
C-HI	Cooling Mode High (Max) SetPoint	DXS Only
H-LO	Heating (Aux Heating) Modes Lower (Min) SetPoint	DXS Only
H-HI	Cooling Mode Lower (Min) SetPoint	DXS Only
C-Sb	Cooling Mode SetBack (Enable/Disable) and Value if Enabled	DXS Only Enable/Disable with On/Off button
H-Sb	Heating Mode SetBack (Enable/Disable) and Value if Enabled	DXS Only Enable/Disable with On/Off button
ALrt	When room temperature is above ALrt temperature Out1 relay is toggled	DXS v0.5.6
tFr	Freeze protection low temperature	DXS v0.4.9
tUfr	Freeze protection high temperature	DXS v0.4.9
dt2C	Virtual Auto Mode Cool Temperature	DXS v0.4.9
dt2H	Virtual Auto Mode Heat Temperature	DXS v0.4.9
SSH	Second Stage Heating	DXS v0.5.0
tACC	Time in minutes before Second Stage is turned ON in Acceleration mode	DXS v0.5.0
ACdt	Acceleration mode delta Temperature	DXS v0.5.0
HHOP	Kick Off mode delta Temperature	DXS v0.5.0
OUEr	Overheating mode Temperature	DXS v0.5.0
HOSP	Hospitality (Enable/Disable)	DXS Only
door	IN1 Door Sensor NO/NC <ul style="list-style-type: none"> • nCL - Normally Closed • nOP - Normally Open 	DXS Only Hi/Lo - Shows current sensor state
dCLS	Door Closed delay in seconds. This is delay between Door Closed Event detection and beginning of the Motion Sensor monitoring.	DXS Only Hi/Lo - Shows current sensor state
PrE	IN2 Motion (Present) Sensor NO/NC <ul style="list-style-type: none"> • nCL - Normally Closed • nOP - Normally Open 	DXS Only Hi/Lo - Shows current sensor state
tPrE	Present detection timeout in minutes. If no motion detected in tPrE minutes after Door Closed Event, A/C will be forced to turn off	DXS Only
NUdb	ENABLE / DISABLE mode, fan, set point and On/Off restoring in case of power down.	DXS v0.5.6



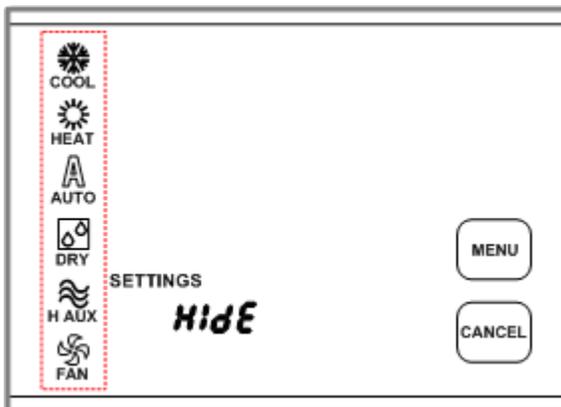
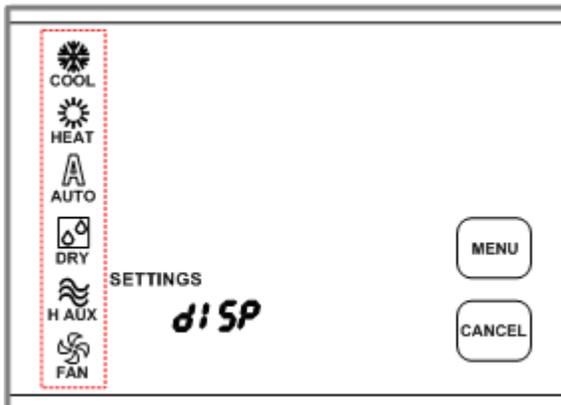
7.3 Operation Modes Configuration

Tap on specific mode icon to Enable/Disable corresponding operation mode. If Icon is visible corresponding operational mode is enabled and vice versa.



- Operation mode visibility control

For DXS model version 0.4.9 and higher Operation mode can be visible (**dISP** showed) or invisible (**HIdE** showed). To change visibility tap the **dISP** or **HIdE**.

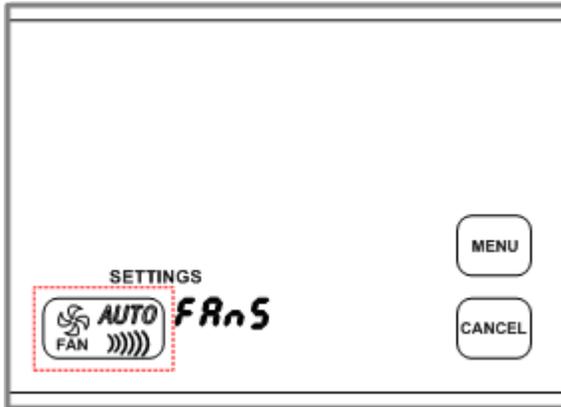


If operational modes are hidden user could not change mode from ThermoPad.



7.4 Fan Speeds Configuration

To Configure enabled Fan Speeds tap FAN icon to get desired configuration



Most popular configurations:



- Low, High



- Low, Medium, High



- Low, Medium, High, Auto

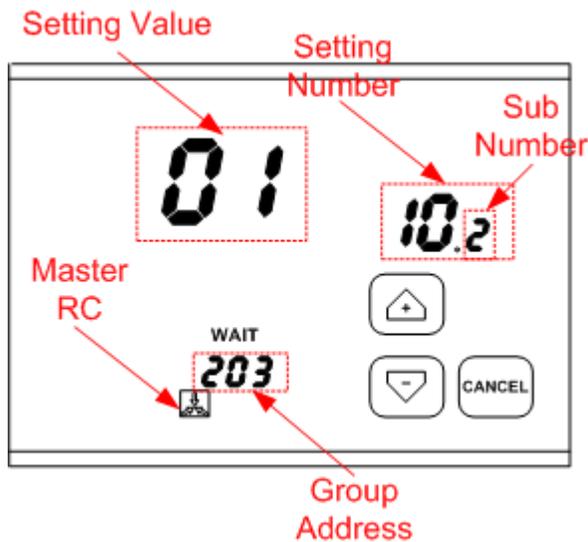


- No FAN Control. FAN Icons will not be shown at all

7.5 Field Settings

- ThermoPad D, DXS

Below is a Field Settings Mode screenshot for ThermoPad D or DXS.



Field Setting Number

To change Field Setting Number tap it. In example above tap **10** and it will change to **11**. Next taps will give **12, 13, ... 1F, 00, 10...** and so on. Sub Number is changed by Up and Down buttons in range 0..9. Every time Field Setting Number (or Sub Number) is changed it's value is being read and showed. While value is read the "**wait**" sign appears. If current Field Setting is not implemented in A/C unit it will be showed as "---".

Some well-known Field Settings

Field Setting Number	Function	Notes
00.0	Group Address	
00.3	AirNet Address	

Changing Field Setting Value

Tap the Field Setting Value and it will start blinking. While value is blinking Up and Down buttons will increment or decrement value. Tap the blinking value again to store new value.

Master RC Sign

If Master RC sign is shown (and not blinking), the A/C Unit is a master unit in system. To change Master RC

1. Tap the Master RC sign on the Master ThermoPad
2. Master RC sign will start blinking. It means that currently there is no master in system
3. On the ThermoPad that is intended to become a new master tap the blinking Master RC sign and wait until it stops blinking.

Group Address

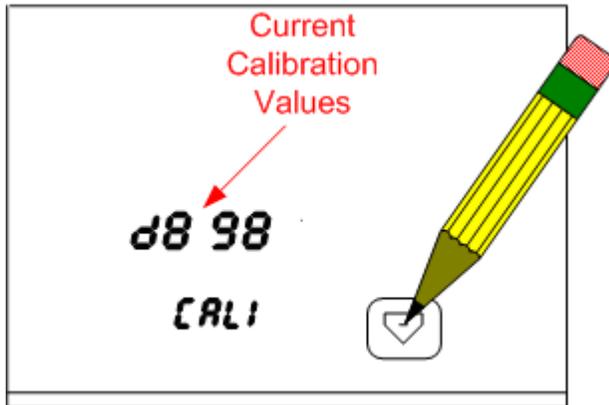
If defined, Group Address will be showed at the bottom of the screen. Group Address can be changed via Field Setting **00.0**.

To exit Field Settings Mode tap **CANCEL**.



8 Touch Screen Calibration

To perform Touch Screen Calibration first enter Configuration Menu and tap the upper left corner of the ThermoPad screen 4 or more times subsequently until Calibration screen shows up.



With a sharp and soft pointing adjustment tap and hold (constantly press) "minus" sign as shown at the picture above. In a few seconds calibration will be executed and ThermoPad will go back to Configuration Menu.



9 Failure Codes

- Internal failure



Failure code bit							
7	6	5	4	3	2	1	0
						Flow Switch	ModBus No communication