TCY-FT Series Intelligent Temperature Controller

Features

- Temperature PI or on/off control for HVAC systems.
- Up to two 3-point outputs for 24VAC actuators.
- 1 internal temperature sensor and up to 2 external sensor inputs
- Multiple remote control functions on external input
- Password protected programmable user and control parameters
- Blue backlight

Applications

- Various temperature control applications
- Water Only Systems: Radiator, floor heating or chilled ceilings
- Individual room control for offices, residential, hotel rooms, meeting rooms, etc.

General Description

The TCY-FT is a stand-alone electronic universal controller with one temperature control loop. It may use up to 2 PI sequences. The TCY-FT features 1 internal NTC temperature sensor, up to two external sensors inputs and up to four binary outputs. The configuration has been reduced to a minimum to allow for a simple and off the shelf usage. For more advanced features the TCI product range may be used. The TCY-FT can be configured using the standard operation terminal. No special tool or software is required.

Name

| T | C | Y | - | F | T | 2 | - (| U |) |

Housing: U = Vertical (2x4") housing, Standard is square housing
Function: 2 = 2 = 2-Pipe, 4 = 4-Pipe
Input: T = Temperature, H = Humidity
Output: F = 3-point, M = Modulating, B = Binary
Series: **TCY**

Ordering

Item Name	Item code	Control Type	Key-data
TCY-FT2-W01	40-10 0067-1	Cooling only	Compact PI controller with: 2 TI, 1 3-point output
TCY-FT2-W02	40-10 0067-2	Heating only	
TCY-FT2	40-10 0067	2-Pipe system	
TCY-FT4	40-10 0071	4-Pipe system	1 TI, 2 3-point outputs

Accessories

S-Tn10-2	40-20 0001	Flying lead sensor with 2 m cable
SD-Tn10-12-2	40-20 0002	Flying lead duct sensor 12cm immersion depth, 2m cable
SD-Tn10-20-2	40-20 0003	Flying lead duct sensor 20cm immersion depth, 2m cable
SDB-Tn10-12-1	40-20 0124	Duct sensor with housing, 12cm immersion depth
SDB-Tn10-20-1	40-20 0133	Duct sensor with housing, 20cm immersion depth
SRA-Tn10	40-20 0005	Room sensor

Selection of actuators and sensors

Temperature Sensors:

Use only our approved NTC sensors to achieve maximum accuracy. Recommended is SDB-Tn10-20 as Duct sensor, SRA-Tn10 as Room sensor and SDB-Tn10-20 with AMI-S10 as immersion sensor.

3-point Actuators:

Actuators with constant running time are recommended. Observe power limits. Do not use actuators with power consumption > 6VA. Adjust running time in SW. Default running time is 90s for fully open / close running time.

Technical specifications

Power Supply	Operating Voltage	24 V AC ± 10 %, 50…60 Hz, Class 2, 48VA max
	Power Consumption	Max. 1.5 VA
	Electrical Connection	Terminal Connectors, wire 0.34…2.5 mm² (AWG 24…12)
Signal inputs	Temperature Input Range Accuracy	 0…50 °C (32…122 °F) 0.5 K
Signal outputs	TRIAC Outputs Switching power	 24 VAC, 250mA max Do not use actuators with power consumption > 6VA
Environment	Operation Climatic Conditions Temperature Humidity	To IEC 721-3-3 class 3 K5 0…50 °C (32…122 °F) <95 % r.H. non-condensing
	Transport & Storage Climatic Conditions Temperature Humidity Mechanical Conditions	To IEC 721-3-2 and IEC 721-3-1 class 3 K3 and class 1 K3 -25…70 °C (-13…158 °F) <95 % r.H. non-condensing class 2MT2
Standards	CE conform according to EMC Directive 2004/108/EU Low Voltage Directive 2006/95/EU	 EN 61 000-6-1/ EN 61 000-6-3
	Product standards Automatic electrical controls for household and similar use Special requirement on temperature dependent controls	 EN 60 730 –1 EN 60 730 – 2 – 9
	Degree of Protection	IP30 to EN 60529
	Safety Class	III (IEC 60536)
	Cover, back part Mounting Plate	Fire proof ABS plastic (UL94 class V-0) Galvanized Steel
General	Dimensions (H x W x D)	Front part: 88 x 88 x 21 mm (3.5" x 3.5" x 0.8") Power case: ø 58 x 32 mm (ø 2.3" x 1.3")
	Weight (including package)	250 g (8.8 oz)

Dimensions [mm] (inch)
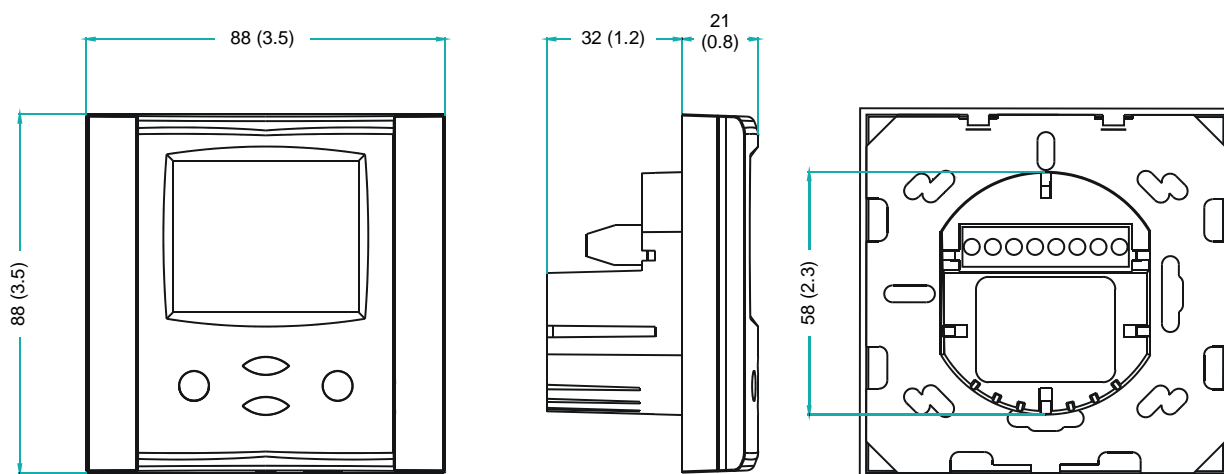
Connection diagram
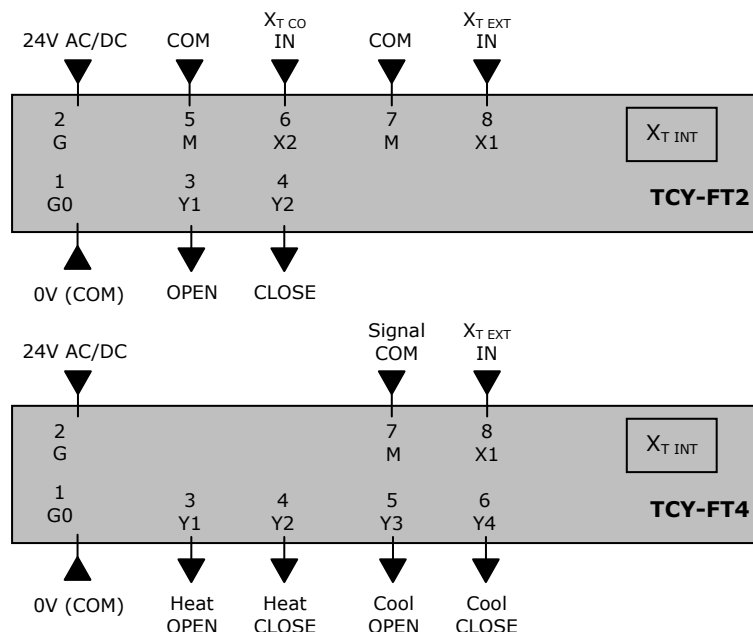
Description:

G0	0V	Power supply:	0VAC, internally connected to signal common
G	24V	Power supply:	24VAC
M	0V	Signal common:	Common 0 potential for analog inputs and analog outputs.
X1	RT	External temperature input:	NTC 10kΩ @ 25°C (77°F)

TCY-FT2:

X2	CO	Change over input:	NTC 10kΩ @ 25°C (77°F)
Y1	DO1	Binary output:	Valve open
Y2	DO2	Binary output:	Valve close

TCY-FT4:

Y1	DO1	Binary output:	Heating valve open
Y2	DO2	Binary output:	Heating valve close
Y3	DO3	Binary output:	Cooling valve open
Y4	DO4	Binary output:	Cooling valve close

Mechanical Design and installation

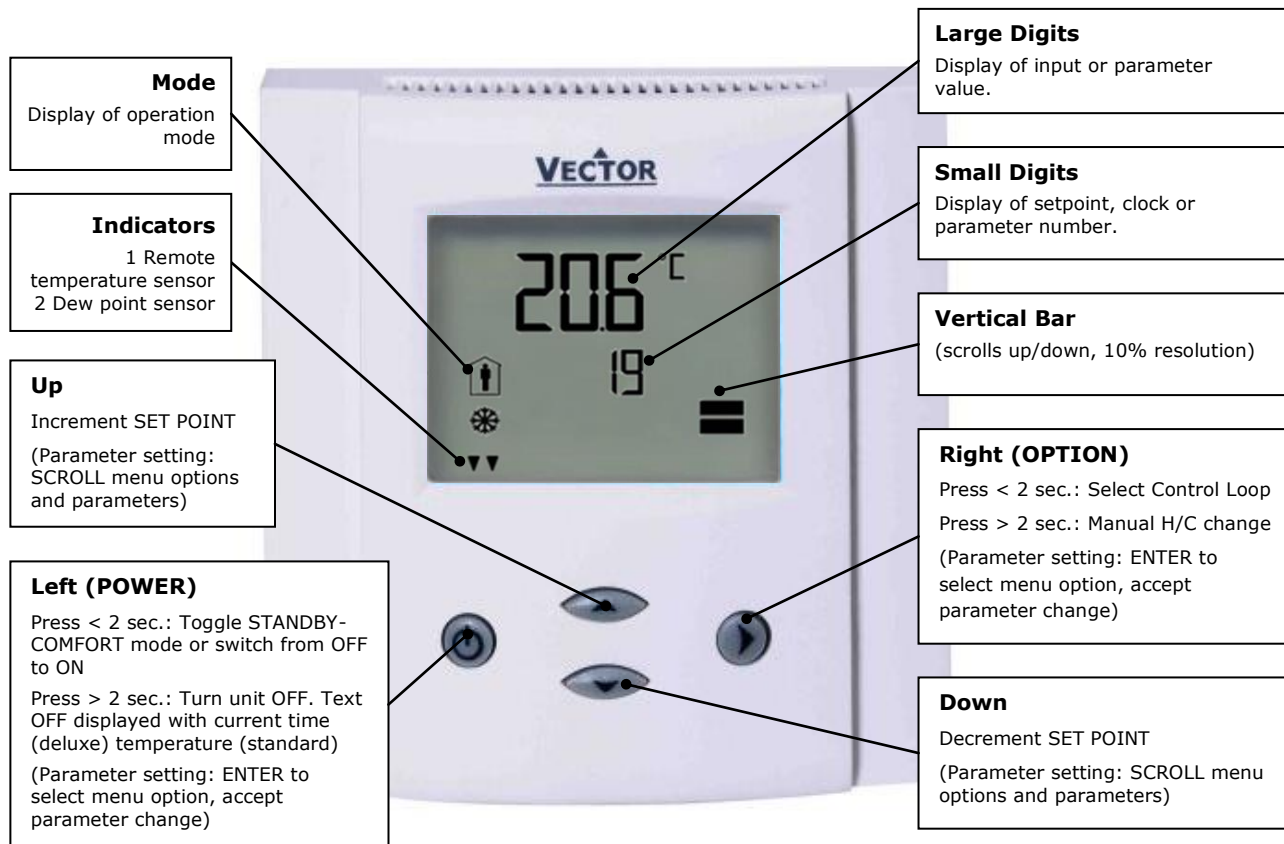The unit consists of two parts: (a) The power case with attached mounting plate and (b) the front part.

Mounting location

- On an easy accessible interior wall, approx. 1.5 m (4.5') above the floor in an area of average temperature.
- Avoid exposure to direct sunlight or other heat sources, e.g. the area above radiators and heat emitting electrical equipment.
- Avoid locations behind doors, outside walls and below or above air discharge grills and diffusers.
- Location of mounting is less critical if external temperature sensors are used

Installation

1. Connect the wires to be connected to the terminals of the power case according to wiring diagram
2. Install the mounting plate to the flush mounting box. Make sure that the nipple with the front holding screw is facing to the ground. Make sure the mounting screw heads do not stand out more than 5 mm (0.2") off the surface of the mounting plate.
3. Ensure that the jumpers are set correctly.
4. Slide the two latches located on the top of the front part into the hooks at the upper side of the mounting plate.
5. Carefully lower the front part until the interconnector reaches the mounting-plate. Continue pressing in a gentle way until the front part is fully connected. While inserting the connectors, a slight resistance can be felt. This is normal. Do not use excessive force!
6. With a Philips-type screw driver of size #2, carefully tighten the front holding screw to secure the front part to the mounting plate. This screw is located on the front lower side of the unit. There is no need to tighten the screw too much

Display and Operation

Mode
Display of operation mode

Indicators
1 Remote temperature sensor
2 Dew point sensor

Up
Increment SET POINT

(Parameter setting: SCROLL menu options and parameters)

Left (POWER)
Press < 2 sec.: Toggle STANDBY-COMFORT mode or switch from OFF to ON

Press > 2 sec.: Turn unit OFF. Text OFF displayed with current time (deluxe) temperature (standard)

(Parameter setting: ENTER to select menu option, accept parameter change)

Large Digits
Display of input or parameter value.

Small Digits
Display of setpoint, clock or parameter number.

Vertical Bar
(scrolls up/down, 10% resolution)

Right (OPTION)
Press < 2 sec.: Select Control Loop

Press > 2 sec.: Manual H/C change

(Parameter setting: ENTER to select menu option, accept parameter change)

Down
Decrement SET POINT

(Parameter setting: SCROLL menu options and parameters)

	Operation mode	
👤	Comfort (occupied)	All control functions operating per set points.
🏠👤	Economy (unoccupied):	Set points shifted according to *Parameters CP04.* Economy mode and setpoint shift may be disabled with UP07
OFF	Energy Hold Off	Outputs are off, inputs monitored for alarm condition
☀	Heating	Output activates if temperature lower than setpoint
❄	Cooling	Output activates if temperature higher than setpoint

Power Failure

All the parameters and set points are memorized and do not need to be reentered. Depending on **UP05** the unit will remain switched off, switch on automatically or return to the operation mode it was in before the power failure. *Deluxe version only*: Timer operation and daytime setting will be retained for 24h. The controller has to be connected to a power supply for at least 10 hours for the backup function to operate accordingly.

Error messages

The TCY-FT may display the following error condition:

Err1: The connection to the temperature sensor may be interrupted or the temperature sensor is damaged. The output is switched off. Verify parameter settings and wiring.

Configuration parameters for firmware version 1.3

The TCY-FT is preset to work for most applications. For special requirements it can be fine tuned to work ideally with a simple parameter setup routine. The parameters can be changed on the unit without the need of additional equipment.

Identifying the firmware version

The parameters and functionality of controller depend on its firmware version and revision. It is therefore important to use a matching product version and parameter set. The Firmware version and revision version can be found when pressing simultaneously the ▲ and ▼ keys during several seconds. On the upper 7 segment display, the firmware version can be found, on the lower 7 segment display the current revision index (or "sub-version").

Access to parameters

The TCY-FT is an *intelligent* controller and can be adapted to fit perfectly into your application. The control operation is defined by parameters. The parameters are set during operation by using the standard operation terminal.
The parameters are password protected. There are two levels of parameters: User operation parameters for access control settings and Expert parameters for control functions and unit setup. The passwords for user levels and expert levels are different. Only control experts should be given the control parameter password.
The parameters can be changed as follows:

1. Press UP and DOWN button simultaneously for three seconds. The display will indicate the firmware version in the upper large digits and the revision in the lower small digits. Pressing any key will show: CODE.

2. Select a password using UP or DOWN buttons. Select 009 in order to get access to the user parameters, 241 for controls parameters.
   Press OPTION after selecting the correct password.

3. Once logged in, the parameter is displayed immediately

4. Select the parameters with the UP/DOWN keys. Change a parameter by pressing the OPTION key. The MIN and MAX symbols show up and indicate that the parameter may be modified now. Use UP and DOWN key to adjust the value.

5. After you are done, press OPTION or POWER in order to return to the parameter selection level.

6. Press the POWER key again so as to leave the menu. The unit will return to normal operation if no key is pressed for more than 5 minutes.

User Parameters (Password 009)

Parameter	Description	Range	Default
UP 00	Enable access to operation modes	ON, OFF	ON
UP 01	Enable access to set points	ON, OFF	ON
UP 02	Not used	ON, OFF	OFF
UP 03	Enable manual change of Heating/Cooling Mode. No influence on TCY-FT2-W1 (cooling only) or TCY-FT2-W2 (heating only)	ON, OFF	ON
UP 04	Not used	ON, OFF	OFF
UP 05	State after power failure: 0 = off, 1 = on, 2 = state before power failure	0, 1, 2	2
UP 06	Enable Economy (unoccupied) Mode. Shift the setpoint to a lower temperature in winter or higher temperature in summer in order to save energy. May be activated through the POWER button, or with the external input (typically for key card switches in hotel rooms or motion detectors for meeting rooms.)	ON, OFF	ON
UP 07	ON = Fahrenheit, OFF = Celsius	ON, OFF	OFF (Celsius)
UP 08	Calibrate internal temperature sensor −10° to +10° in 0.1° steps. (Sensor is factory calibrated, use this feature for field adjustment only as required.)	-10…10	0.0
UP 09	Enable Frost Protection. Activates the output independent of operation mode when the control temperature drops below 5°C or 41°F. The controller returns to normal operation when the temperature increases above 10°C or 50°F.	ON, OFF	TCY-FT2-W1: OFF TCY-FT2-W2: ON TCY-FT2: ON TCY-FT4: ON

Control Functions (Password 241)

Warning! Only experts should change these settings! See user parameters for login procedure.

Control configuration

Parameter	Description	Range	Default
CP 00	Minimum setpoint limit in heating mode	0-60°C (32-160°F)	16°C (61°F)
CP 01	Maximum setpoint limit in heating mode	0-60°C (32-160°F)	30°C (86°F)
CP 02	Minimum setpoint limit in cooling mode	0-60°C (32-160°F)	18°C (65°F)
CP 03	Maximum setpoint limit in cooling mode	0-60°C (32-160°F)	30°C (86°F)
CP 04	Economy (unoccupied) Mode temperature shift: The comfort (occupied) setpoint is shifted by the value set with parameter. If heating is active the comfort setpoint will be decreased, if cooling is active, the setpoint will be increased. (Enable with UP06.)	0-100°C (200°F)	5.0°C (10°F)
CP 05	Dead Zone Span (TCY-FT4 only): The Dead Zone Span lies between the heating and the cooling setpoint. The output is off while the temperature is within the dead zone span. A negative dead zone is not possible.	0-100°C (200°F)	1.0°C (2°F)
CP 06	Heat/Cool Changeover Delay (TCY-FT4 only): A demand to switch between heating and cooling must persist for the length of time set with this parameter before the controller switches. Prevents activation of a sequence during a short-term change in temperature in order to protect equipment (with control overshoot for example)	0-255 min	5 min
CP 07	P-band heating X_{PH}	0-100°C (200°F)	2.0°C (4.0°F)
CP 08	P-band cooling X_{PC}	0-100°C (200°F)	2.0°C (4.0°F)
CP 09	K_{IH}, Integral gain heating, in 0.1 steps, (TI is fixed to 4s) 0 disables ID part low value = slow reaction high value = fast reaction	0…25.5	0.0
CP 10	K_{IC}, Integral gain cooling, in 0.1 steps, 0 disables I part	0…25.5	0.0
CP 11	Configuration of operation mode 0 = TCY-FT2-W1 = Cooling mode Y_{C1} 1 = TCY-FT2-W2 = Heating mode: Y_{H1} 2 = TCY-FT2 = Heating and Cooling (2 pipe system), Y_{H1} + Y_{C1} 3 = TCY-FT4 = Heating and Cooling (4 pipe system), Y_{H1} + Y_{C1}	TCY-FT2: 0 - 2 TCY-FT4: 0 – 3	TCY-FT2-W1: 0 TCY-FT2-W2: 1 TCY-FT2: 2 TCY-FT4: 3

→ **Proportional control (P-band)**

The proportional control function calculates the output based on the difference between setpoint and measured value. The proportional band (P-band) defines the difference between setpoint and measured value which will result in a 100% output. For example, with a heating or reverse 0-10v control sequence, and a 2.0°C (4.0°F) P-band value, at 10v the controller will be 2.0°C (4.0°F) below setpoint. This is the working range of the proportional control sequence.

Setting the proportional band to 0 disables proportional control.

In case actuator run time was set to 0

→ **Integral and Differential control**

Proportional control is a very stable control mode. The flaw of proportional control alone, however, is that the setpoint is normally not reached. As the measured value gets closer to the setpoint, the output reduces until it reaches a point, a fraction above or below the setpoint, where the output equals the load. To reach the setpoint and achieve a higher level in comfort the Integral/Differential function should be activated.

Integral Gain (KI) dynamically increases the output by the selected KI value until the setpoint is reached. The challenge, however, is to prevent hunting, where the output increases too fast, the temperature overshoots the setpoint, the output goes to 0, the temperature undershoots the setpoint, and the cycle repeats itself. Hunting may result if the integral gain is too high. Each system is different. It is recommended to start with a KI value of 0.5 for water based systems and 1.0 for air based systems. Reduce this value if the measured value overshoots the setpoint by more than 1°C (2°F). Increase the value if the output takes too long to reach the setpoint. Air based systems react faster than water based systems.

Setting the integral gain to 0 disables integral and differential control.

Output configuration

Parameter	Description	Range	Default
CP 12	Manual Override Mode: Allows manual control of the floating outputs for using the controller as positioner or during commissioning.	ON, OFF	OFF
CP 13	Running time FO1 (TCY-FT4 = heating output) The total time it takes for the actuator to run from fully open to fully closed or from fully closed to fully open. Setting this value to 0, converts the output to on/off control. Open output will activate if there is demand; close output will stay active if there is no demand. The p-band functions as hysteresis.	0-255s	90s
CP 14	Minimum running time FO1 (TCY-FT4 = heating output) The minimum time the output runs once it starts. This setting prevents frequent switches with very short running times.	0-255s	3s
CP 15	Running time FO2 (TCY-FT4 = cooling output) The total time it takes for the actuator to run from fully open to fully closed or from fully closed to fully open Setting this value to 0, converts the output to on/off control. Open output will activate if there is demand, the p-band functions as hysteresis.	0-255s	90s
CP 16	Minimum running time FO2 (TCY-FT4 = cooling output) The minimum time the output runs once it starts. This setting prevents frequent switches with very short running times.	0-255s	3s
CP 17	Maximum Output in Economy (unoccupied) Mode Reduces the load on the system when is the space is unoccupied.	0 – 100 %	50%

Input configuration

Parameter	Description	Range	Default
CP 18	Configuration of remote input (X1) 0 = Control Input 1 = Comfort/Economy Mode switch 2 = Comfort/OFF Mode switch 3 = Keycard switch function 4 = Output enable	0…4	0
CP 19	Activation delay (minutes): The time the binary input needs to be open before Economy or OFF mode is activated.	0…255 min	5
CP 20	Fixed setpoint for key card function in heating mode	0–60°C (32..160°F)	17°C (63°F)
CP 21	Fixed setpoint for key card function in cooling mode	0–60°C (32..160°F)	27°C (81°F)
CP 22	For TCY-FT2 only: Enable Auto changeover	ON, OFF	OFF
CP 23	For TCY-FT2 only: Auto changeover limit heating	0–60°C (32..160°F)	30°C (86°F)
CP 24	For TCY-FT2 only: Auto changeover limit cooling	0–60°C (32..160°F)	15°C (59°F)

➜ **Configuring the function of the external input X1**
The external input X1 may be configured for several functions:

CP18 = 0	External control input	The control input is provided by the external input. The internal input will not be used.
CP18 = 1	Switching Economy and Comfort modes	Economy (unoccupied) and Comfort (occupied) modes are controlled through an external contact by connecting X1 through a dry contact to signal common. This function may be used together with key card switches for hotels or motion detectors for offices.
CP18 = 2	Switching Energy Hold OFF and Comfort modes	Opening the external temperature input will force the unit into the OFF operation mode. The operation mode cannot be overridden by using the terminal. Connecting the binary input to GND returns control of the operation mode to the terminal. This function may be used as window contact to prevent loss of energy.
CP18 = 3	Key card function	As with CP18 = 1, the key card function switches economy (unoccupied) and comfort (occupied) modes. Instead of using the setpoint shift, the setpoints in unoccupied mode are defined by parameter CP20 and CP21.
CP18 = 4	Output enable	This may be used for a dew point sensor input. Output will switch off if contact opens.

➜ **Configuring auto changeover input X2 (TCY-FT2 only):**
The auto changeover function automatically changes heating and cooling mode based on supply media temperature or outdoor temperature. The difference between the two is in the values of the changeover limits CP23 and CP24. See table below for recommended settings.

Heating and cooling may be as well changed by an open contact switched to signal ground. Note: all signal ground levels of involved controllers must be the same in case more than one controller is switched.

➜ **Recommended settings for CP23 and CP24:**

Change over mode	Relation CP23 to CP24	Example CP23	Example: CP24
Supply media	CP23 > CP24	25°C (77F)	18°C (64F)
Outside temperature	CP23 < CP24	15°C (59F)	25°C (77F)
Dry contact: Heating if contact closed	CP23 > CP24	25°C (77F)	15°C (59F)
Dry contact: Cooling if contact closed	CP23 < CP24	15°C (59F)	25°C (77F)