

TCI-C Series Cabinet Mounted Universal Controller



Features

- Universal PID and/or binary control for any analog input/output signal and range.
- Multiple auxiliary functions: heat-cool auto changeover, automatic enable, set point compensation.
- Averaging, min and max functions
- Cascading of control loops (-C22 type).
- Alarm monitoring of low and high limits on all inputs.
- Programmable reaction in case of alarm.
- Feedback function for inputs and set points.
- Functions for dehumidifying, set point shift, cascade control.
- Password protected programmable user and control parameters.

TCI-C22 also includes

- Power Cap protected real-time clock with 24hr power backup.
- 8 programmable time schedule events.
- Blue backlight.

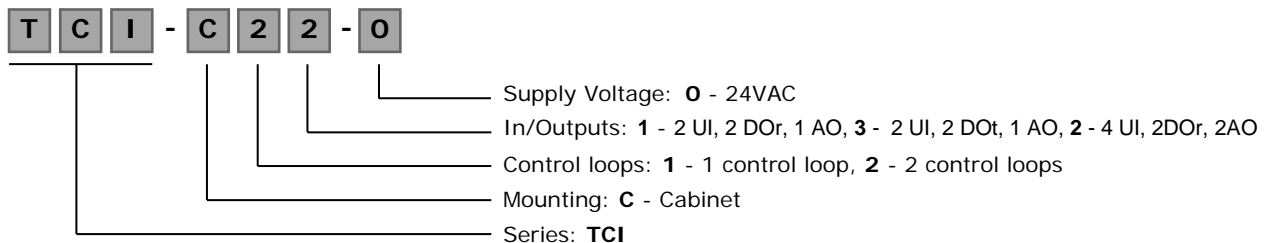
Applications

- Fan coil units
- Heat exchanger
- Zoning
- VAV
- Air handlers
- Fan, Pump control
- Humidifiers
- Dehumidifiers
- Ventilation
- Radiant heating
- Radiant cooling
- Pressurization

General

- TCI-C11: 1 independent control loop, 2 universal inputs (analog/binary/temp), 2 binary outputs, 1 analog output
- TCI-C22: 2 independent control loops, 4 universal inputs, 2 binary outputs, 2 analog outputs.
- Flexible application configuration is made with a parameter-setting routine using the standard operation terminal.

Name



Ordering


Model	Order code	Power	Option	Loop	Input	Binary Output	Analog Output	Housing
TCI-C11-0	40-11 0060	24VAC	Standard	1	2	2 Relays	1	Cabinet, DIN rail mounted
TCI-C13-0	40-11 0064	24VAC	Standard	1	2	2 TRIAC	1	
TCI-C22-0	40-11 0062	24VAC	Schedules	2	4	2 Relays	2	

Temperature sensors: Use Vector Controls NTC sensors to achieve maximum accuracy: SDB-Tn10-20 (duct), SRA-Tn10 (room), SDB-Tn10-20 + AMI-S10 as immersion sensor.

Actuators: Choose modulating actuators with an input signal type of 0-10 V DC or 4-20 mA (Min. and max. signal limitations may be set with parameters. 3-point point actuators with constant running time are recommended.

Binary auxiliary devices (e.g. pumps, fans, on/off valves, humidifiers, etc): Do not directly connect devices that exceed specified limits in technical specifications – observe startup current on inductive loads.

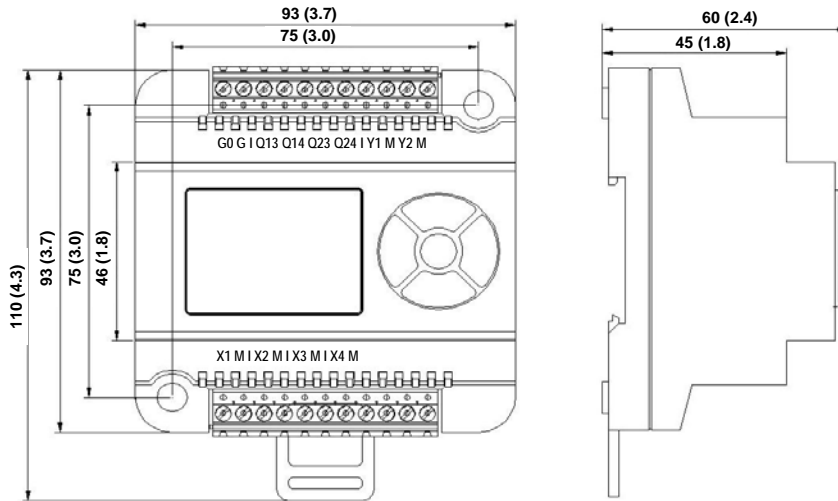
Technical specifications

Power supply	Product type	TCI-Cxx-0
	Operating Voltage $\pm 10\%$, 50/60 Hz	24 VAC
	Power Consumption	Max. 3 VA
	Electrical Connection	Terminal Connectors, wire 0.34...2.5 mm ² (AWG 24...12)
	Clock backup	Min. 48 hours
Signal inputs	Universal Input	Setting for Voltage or Current
	Input Signal	0...10 V or 0...20 mA
	Resolution	9.76 mV or 0.019 mA (10 bit)
	Universal Input	Setting for temperature input or open contact
	Range	NTC (Sxx-Tn10 sensor): -40...140 °C (-40...284 °F)
Signal outputs	Accuracy	-40...0 °C (-40...32 °F): 0.5 K 0...50 °C (32...122 °F): 0.2 K 50...100 °C (122...212 °F): 0.5 K > 100 °C (> 212 °F): 1 K
	Analog Outputs	
	Output Signal	DC 0...10 V or 0...20 mA (500 Ω max.)
	Resolution	9.76 mV resp. 0.019 mA (10 bit)
	Maximum Load	20 mA, 500 Ω max.
Environment	Relays Outputs	TCI-C11, TCI-C22
	AC Voltage	0...250 VAC, 5 (3) A max. each output
	DC Voltage	0...30 VDC, 5 (3) A max. each output
	TRIAC Outputs	TCI-C13
	AC Voltage	0...250 VAC, 3 A max. each output, (higher short term peaks are permitted)
Standards	Operation	To IEC 721-3-3
	Climatic Conditions	class 3 K5
	Temperature	0...50 °C (32...122 °F)
	Humidity	<95 % r.H. non-condensing
	Transport & Storage	To IEC 721-3-2 and IEC 721-3-1
	Climatic Conditions	class 3 K3 and class 1 K3
	Temperature	-25...70 °C (-13...158 °F)
	Humidity	<95 % r.H. non-condensing
	Mechanical Conditions	class 2M2
	 conform according to EMC Standard 89/336/EEC EMEI Standard 73/23/EEC	EN 61 000-6-1/ EN 61 000-6-3
	Product standards	
	Automatic electrical controls for household and similar use	EN 60 730 –1
	Special requirement on temperature dependent controls	EN 60 730 – 2 – 9
	Degree of Protection	IP30 to EN 60 529 if mounted correctly
General	Safety Class:	III (IEC 60536) if SELV is connected to DO II (IEC 60536) if line voltage is connected to DO
	Cover, back part	Fire proof ABS plastic (UL94 class V-0)
	Dimensions (H x W x D)	60 x 93 x 93(110*) mm 2.4 x 3.7 x 3.7(4.3*) inch *DIN rail mounting
	Weight (including package)	TCI-C11: 270g (9.5oz) TCI-C13, TCI-C22: 290g (10.2oz)

Electrical connections

Use normal cables maybe in an EMC-save environment. In an extremely impaired EMC environment use only twisted pair and shielded cables for input /output connections. The operating voltage must comply with the requirements for safety extra-low voltage (SELV) as per EN 60 730. Use safety insulating transformers with double insulation as per EN 60 742; they must be designed for 100 % ON-time. When using several transformers in one system, the connection terminal 1 must be galvanically connected. The TCI is designed for operation of AC 24 V max. 10 A safety extra-low voltage and is short-circuit-proof. Supplying voltages above AC 24 V to low voltage connections may damage or destroy the controller or any other connected devices. Additionally, connections to voltages exceeding 42 V endanger personnel safety. Observe limits mentioned in the technical specifications. Local regulations must be observed!

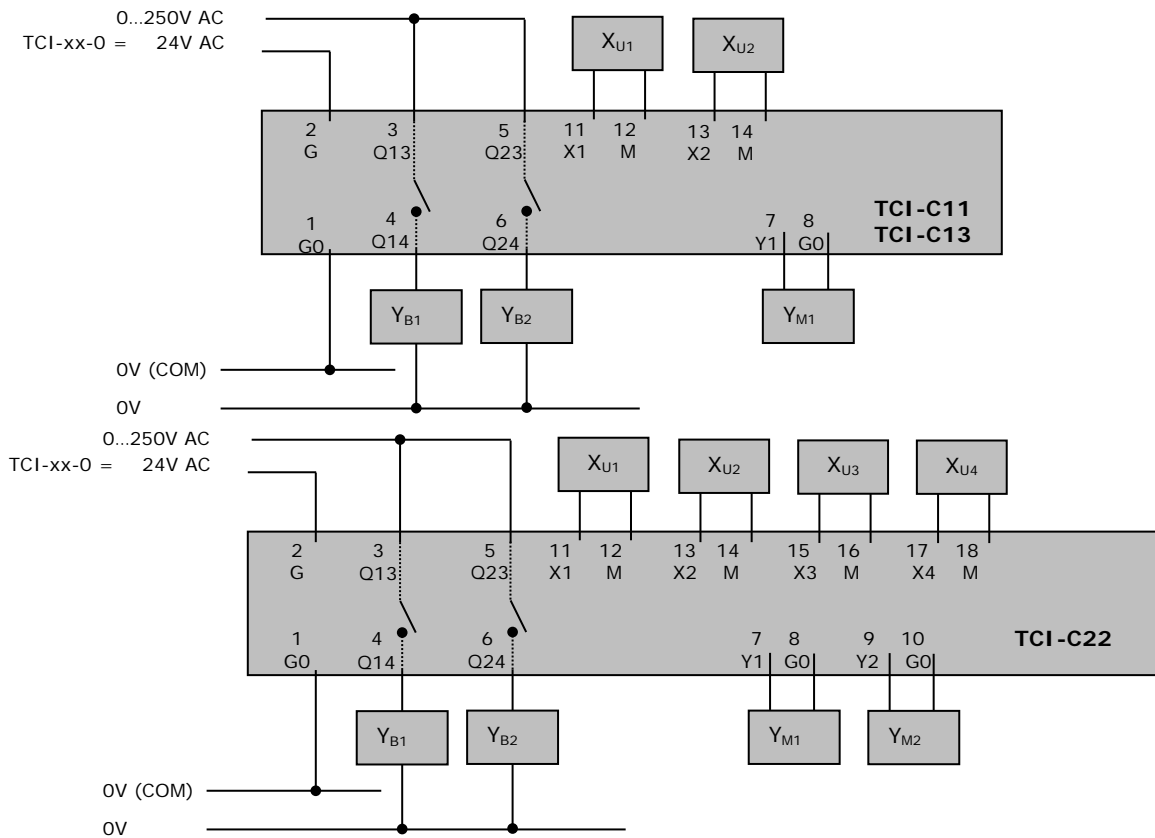
Dimensions [mm] (inch)



Installation

- Mount in standard cabinet to DIN 43880
- Surface mount to top-hat rail to EN 60715
- Surface mount with 2 #4 screws.
- A protective housing must be used if mounted outside an electrical cabinet.
- Ensure adequate air circulation to dissipate heat generated during operation.
- Observe local regulations.
- Do not mount in a wet or condensation prone environment.

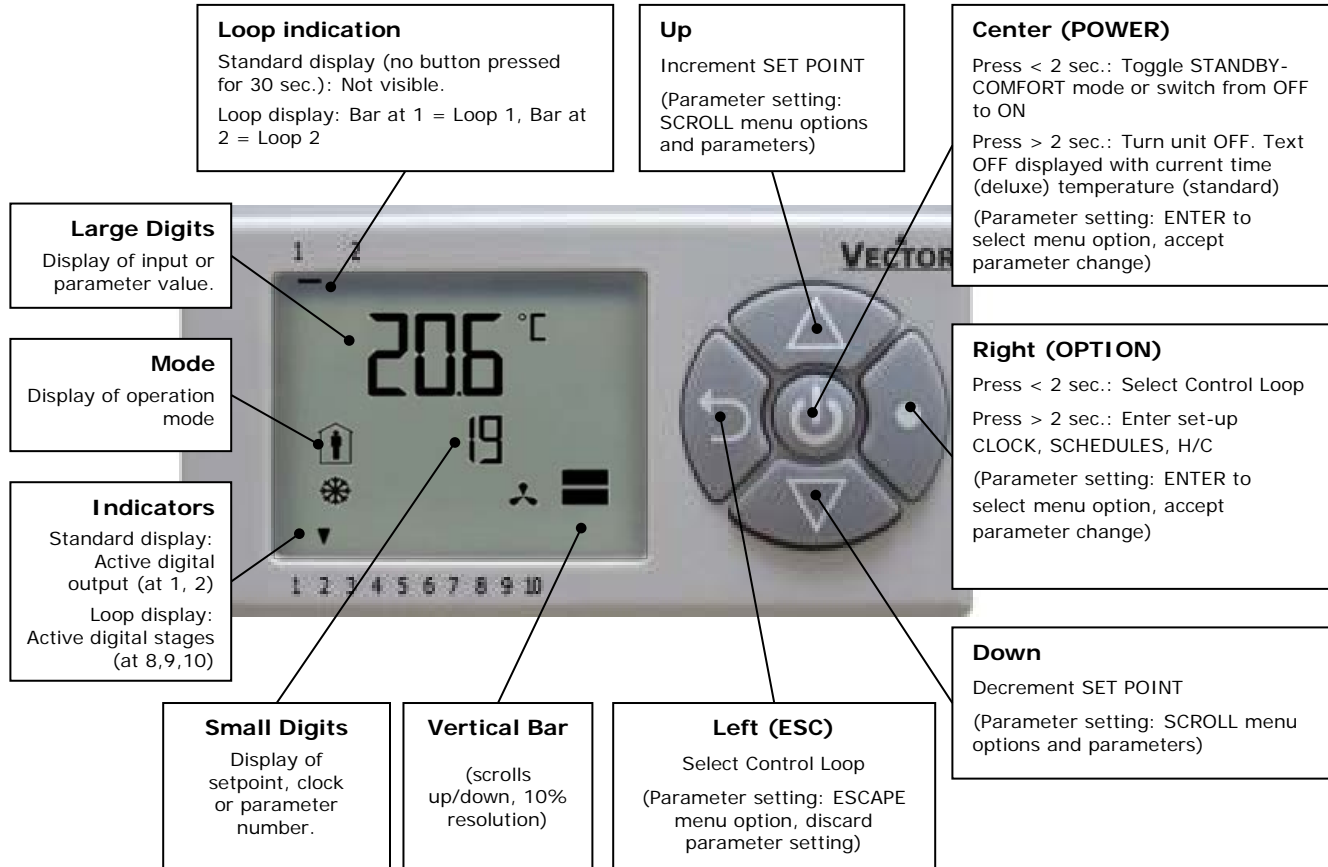
Connection diagram



Description (*selectable by jumper):

G0	Power supply:	0V, -24VDC; common for power supply, analog outputs
G	Power supply:	24VAC, +24VDC
M	Signal ground:	Common for universal inputs. Internally connected to G0
Q..	Binary outputs:	Potential free relays output for 0...250 VAC or 0...30 VDC
X..	Universal input:	NTC 10kΩ @ 25°C (77°F), 0...10 V or 0...20 mA*
Y..	Analog output:	0...10 V or 0...20 mA*

User Interface: Display and Operation



Operation mode symbols		Control symbols	
	Standby (unoccupied):		Heating (Reverse) Active
	Comfort (occupied)		Cooling (Direct) Active
OFF	Energy Hold Off		Schedule Set
<i>Comfort:</i> All control functions operating per set points. <i>Standby:</i> Set points shifted according to <i>Parameters 1L07, 2L07</i> . <i>Energy Hold Off:</i> Outputs are off, inputs monitored for alarm condition			Override Cascade Control
			Fan Active

Standard display (Parameters UP08, UP09, UP10)

- Active when UP/DOWN or OPTION have not been pressed for 30 seconds. Contents may be chosen with parameters.

Loop display

- Active when changing set points. Large digits show input value. Small digits show set point. Vertical bars show analog output value. Arrows on 8, 9, 10 show binary (digital) output stages

Power Failure

- All parameters and set points are memorized and do not need to be re-entered.
- Upon return of power: Set *Parameter UP05* to keep the unit off, switch on, or operation mode before power failure.
- Clock and time schedule settings retained for 48 hours (after powered for at least 10 hours).

Override of secondary set point in cascade control

- If cascade control is active (with VAV for example) you can override the primary loop and manually select the set point of the secondary loop (the loop is now changed to CAV). Typically for tuning the VAV system.
- While the secondary loop is displayed change the set point with UP/DOWN. Override Cascade symbol appears.
- Press OPTION to move back to the temperature loop and cancel cascade override.

Error messages

Err1: An assigned input is not enabled or missing. All control loops, functions and outputs tied to this input will be disabled. Verify input connections, jumper settings and parameter settings for the input involved.

Err3: A function refers to a disabled input. Disable the function or enable the input.

Err4: Failure of an internal component required for operation. Product must be replaced.

Clock operation

TCI-C22 contains a quartz clock with battery back-up (not available in TCI-C11 or TCI-C13). Up to 8 mode changes based on time and day of the week may be programmed. Also position an output or select a set point directly with a time schedule. A blinking clock indicates that the time has not been set or if the unit was without power for longer than 48 hours. The time needs to be set to allow time schedules to operate.

Clock setup


Press OPTION > 2 sec. SEL and current time displayed Press OPTION < 2 sec. to change time, Minutes blink: UP/DOWN to changes, OPTION to save, Hours blink: UP/DOWN to changes, OPTION to save, Press OPTION to save time, DAY1 blinks: UP/DOWN to change, OPTION to save	SEL 00:00 DAY1 (Mon)
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Enable/disable time schedules



Press OPTION > 2 sec. SEL and current time displayed Press UP: SEL and PRO displayed, clock symbol blinks Press OPTION: Time schedule status displayed OFF or ON: Press OPTION OFF/ ON blinks, UP/DOWN to change, OPTION to save	SEL PRO 	Pro OFF/ON
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Creating time schedules


Step 1: Select a switching time (Up to 8, Pr01–Pr08)

Press UP while PRO-ON displayed: Large digits display Pr01, small digits display 00:00 Press OPTION: 00:00 blinks Press UP/DOWN to select Pr01 switching time from 00:00–23:45 Press OPTION to save switching time (bar appears indicating step 1 complete): DAY 1 blinks	Pr01 08:00 
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Step 2: Apply selected switching time (Pr01) to DAY1 (Mon) – DAY 7 (Sun)

While Pr01 is displayed and DAY1 is blinking: Press UP: Activate Pr01 switching time for DAY1 (triangle appears on 1), Press DOWN: Deactivate Pr01 switching time for DAY1 (triangle disappears) Press OPTION to save Pr01 DAY1 (2 nd bar indicates step 2 complete): Repeat for DAY2 – DAY7	Pr01 DAY1  1 2 3 4 5 6 7 
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Step 3: Select action for switching time (Pr01+Days)

After Pr01, DAY1–DAY7 is completed (Pr01 switching time activate or deactivate on desired days), press OPTION again to come to desired action for Pr01. The following options appear in order: No = switching time not active OP = operation mode (select ON, OFF, COMFORT, STANDBY) L1 = set point of loop 1 (select set point) L2 = set point of loop 2 (select set point) d1 = ON/OFF status of do1 (output must be in manual mode) d2 = ON/OFF status of do2 (output must be in manual mode) A1 = set point (0-100%) of ao1 (output must be in manual mode) A2 = set point (0-100%) of ao2 (output must be in manual mode) After repeatedly pressing OPTION through DAY7: First available action No appears, blinking: Press UP/DOWN to scroll through the 8 possible actions (3 rd bar indicates step 3 complete)	Pr01 no 
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Step 4: Complete switching event (e.g. Pr01 = 08:00, DAY 1, Comfort mode)

Available actions blink as you scroll through them, Press OPTION to select one: Characteristics of action (e.g. 0–100% for A1) appear (4 th bar indicates step 4 complete) Press UP/DOWN to select, OPTION to complete	Pr01 08:00 
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Manual heat–cool changeover

Press UP/DOWN Small digits display H-C: Press OPTION Currently active H or C symbol displayed: Press OPTION again to toggle H or C	SEL H-C  
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Control loops (Parameters 1L00—1L08, 2L00—2L08; 1A00, 2A00, 1D01, 2D01)

TCI-C11 and TCI-C13 have 1 control loop (labeled 1L). TCI-C22 has 2 independent control loops (1L and 2L). Each control loop may utilize 6 binary (on/off) and 2 PID control sequences. Control loops and sequences are activated when output parameters are defined.

Standby set point shift (Parameters 1L07, 2L07)

This function shifts the set point for STANDBY (unoccupied) mode. The heating set point is reduced and the cooling set point increased by a value set in parameters

Dead zone span (Parameters 1L08, 2L08)

Dead zone span lies between the heating and the cooling set point. It is selectable with parameters. A negative dead zone is not possible.

Minimum and maximum set point (Parameters 1L01—1L04, 2L01—2L04)

The adjustable range of heating and cooling set points may be chosen individually

Cascade control (Parameters 1L06, 2L06)

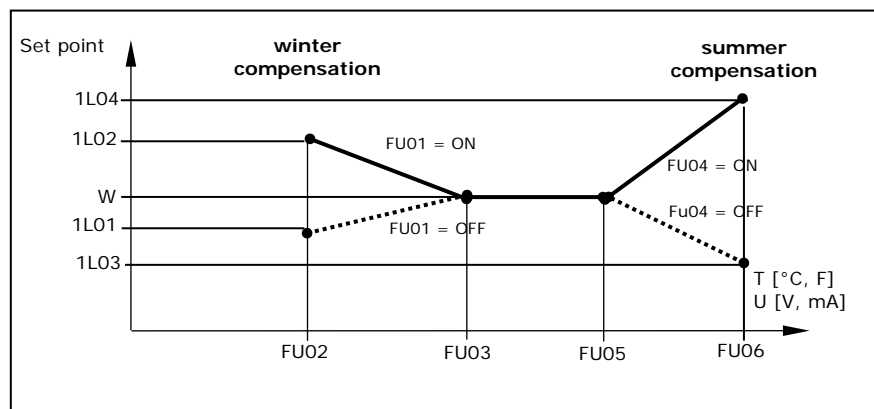
TCI-C22 features 2 independent control loops with available cascade function. In cascade control the output of the primary loop determines the set point of the secondary loop. The output of the set-point-providing primary loop is spanned between the min. and max. set point limits of the secondary loop. Select the cascade parameter on Loop 2 (2L06) to make Loop 1 primary. Select the cascade parameter on Loop 1 (1L06) to make Loop 2 primary. In the secondary loop you choose to cascade with 1) the reverse sequence, 2) the direct sequence, or 3) both the reverse and the direct sequence of the primary loop. (Heating is a *reverse* sequence because output from the controller rises as temperature lowers. Cooling is a *direct* sequence because output from the controller rises as temperature rises.) The following example of cascade control represents a typical pressure independent VAV application where the temperature control loop (primary) determines the set point of the air flow control loop (secondary).

Secondary Loop Airflow (Loop 2 - 2L)	Primary Loop Temperature (Loop 1 - 1L)
Parameter 2L06=2 Cascade with reverse sequence of primary loop only	Output 1L spanned between min. and max. set point limits of 2L when 1L is reverse sequence.
Min. set point heating is 20% (2L01) Max. set point heating is 100% (2L02)	Output of 1L is spanned between 20% and 100%.
When 1L output is 50%, 2L set point is 55%	
When 1L output is direct (cooling) sequence, set point 2L is fixed to min. cooling set point limit (2L03)	

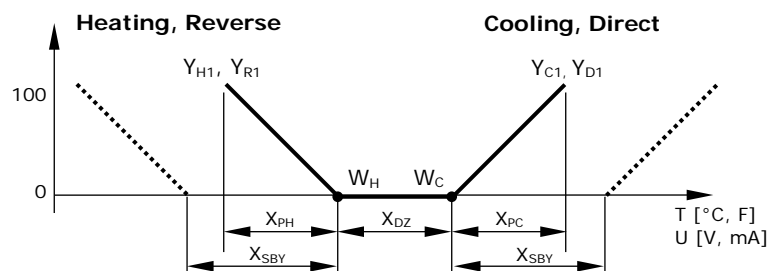
Set point compensation – Set point reset (Parameters 1L05, 2L05 to enable; FU00—FU07 to configure input)

Shift the set point either towards the set point minimum (negative shift) or the set point maximum (positive shift) depending on an external input signal. This is done to compensate the set point due to a change in the environment. It is most commonly applied to outside temperature. Summer-winter compensation is activated through parameters 1L05 or 2L05. Parameter FU00 selects the compensation input signal, either external temperature or analog input. Winter compensation is active when outside temperature drops below the upper limit of winter compensation (FU03). Depending on parameter FU01, the set point is shifted towards the heating set point min. or max. Maximum compensation is reached when the temperature reaches the lower limit (FU02). The actual set point will in this case be equal to the min. heating set point limit for a negative shift or the max. set point limit for a positive shift. Summer compensation is active when the outside temperature exceeds the lower limit for summer compensation (FU05). Depending on parameter FU04, the set point is now shifted towards the cooling set point min. or max. It reaches its max. when the temperature equals the upper limit (FU06).

Summer–winter compensation active on loop 1



PID control *(Parameters 1L09-1L15, 2L09-2L15)*



Legend:

T, U	Input Signal
X_{PH}	P-band Heating, Direct
X_{PC}	P-band Cooling, Reverse
X_{DZ}	Dead zone
X_{SBY}	Standby set point shift
W_H	Set point Heating, Reverse
W_C	Set point Cooling, Direct
Y_{H1}, Y_{R1}	P sequence Heating, Reverse
Y_{C1}, Y_{D1}	P sequence Cooling, Direct

The Vector Controls PID control algorithm balances accuracy with stability to achieve a stable control loop. The PID components are adjustable through parameters to suit the application. A narrow P-band increases sensitivity. A wider P-band increases stability. A long interval (TI) slows reaction time and adds stability. A short interval increases accuracy but can increase swinging tendency the risk of an unstable control loop. A low integral gain factor (KI) delays the response and provides stability. A high integral gain factor increases response but can add instability. To prevent instability the P-band should be extended whenever the integral is active. Once the integral is activated, the speed of the control reaction must fit to the speed of the application; else the control result may be unsatisfactory.

Proportional (P-band)

- The deviation of the input to the set point which will result in 100% output.

Integral

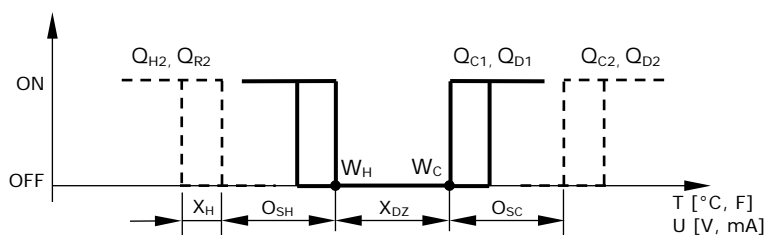
- Time interval (TI) - speed of reaction (seconds).
- Integral gain (KI) - strength of reaction (K factor).

Recommended values	Heating (air)	Heating (radiant)	Humidifying	Cooling	Dehumidifying	Pressure (VAV)
P-band	2 – 3°C (4-6°F)			1 – 1.5°C (2-3°F)		
TI (seconds)	2	5	15	1	70	1
KI	0.2	0.1	0.1	0.2	0.3	0.8

Binary/digital control *(Parameters 1L16-1L24, 2L16-2L24)*

Available action of stages	
One stage at a time	Stage 1 is off when stage 2 is on. (e.g fan speeds).
Cumulative	Stage 1 stays on when stage 2 is on. (e.g. electric heat)
Binary coded (3 steps, 2 outputs)	Step 1 - Only stage 1 is on.
	Step 2 - Only stage 2 is on.
	Step 3 - Stage 1 and stage 2 are both on. (Example, electric heat: step 1=100W, step 2=200W, Step 3=300W)

Action	Stage 1	Stage 2	Stage 3
One at the time	Q_1	Q_2	
Cumulative	Q_1	Q_1+Q_2	
Binary coded	Q_1	Q_2	Q_1+Q_2



T, U	Input Signal
O_{OH}	Offset Heating, Direct
O_{OC}	Offset Cooling, Reverse
X_{DZ}	Dead zone
X_{SBY}	Standby set point shift
W_H	Set point Heating, Reverse
W_C	Set point Cooling, Direct
Q_C, Q_D	Binary Output Stage Cooling, Direct
Q_H, Q_R	Binary Output Stage Heating, Reverse

Switching hysteresis: Is the difference between switching on and switching off. A small hysteresis will increase the number of switching cycles, and thus the wear on associated equipment.

Switching delay: Cumulative stages will not switch simultaneously. With a sudden demand or at power on, stage 2 will not start earlier than 5 seconds after stage 1 has been initiated.

Universal Inputs (Parameters 1U00–1U12, 2U00–2U12, 3U00–3U12, 4U00–4U12)

TCI-C11 and TCI-C13 have 2 universal inputs (1U and 2U). TCI-C22 has 4 (1U, 2U, 3U, 4U). Each universal input has jumpers, placed only vertically, on the back of the controller. Default is 0-10 VDC with the following options:

- Analog input 0-10VDC
- Analog input 0–20mA
- RT: Temperature input (NTC) or binary open/close contact input

Analog input

Analog inputs may be further customized with parameters:

- 0–10v/0–2mA (1U00=1)
- 2–10v/4–20mA (1U00=2)

The display value of the input signal should be specified according to the output range of the transmitter using parameters for signal display minimum value (1U01) and signal display maximum value (1U02). For example:

4-20mA input signal, 0-200 Pa pressure transmitter	
Min. display 1U01=0, Max. display 1U02=200	
4 mA	0 P
12 mA	100 P
20 mA	200 P

- Values may be displayed with no unit or as: °C/°F % P (1U04)

With a measuring range of 0–100 and a display value of 0-100, the resolution is 0.5 below 100, 0.2 below 50, and 0.1 below 25. A signal display value 0–100, therefore, is displayed with a resolution up to 0.1 for the input measurement and 0.5 for the set point. In our example above 0–200 P is displayed with a resolution up to 0.2 for the input and 1.0 for the set point. With the range parameter (1U03) larger numbers may be displayed: The allowable range of -50–205 may be multiplied 10 or 100. The largest displayable values are -990–9999.

NTC Temperature Input

Place the jumper to RT for a passive NTC sensor input. Specified accuracy can only be guaranteed using Vector Controls Sxx-Tn10 sensors. Range values described above also apply to temperature inputs. Limiting the range increases resolution.

Binary Input (open/close contact)

Set the jumper for the desired UI on the back of TCI to RT (remote temperature). Set the parameter for the same UI to analog input (1U00). An open contact reads as a high value (100%), a closed contact as a low value (0%).

Alarm Settings on Inputs

Each input features low and high limit alarms. Each alarm is defined with a *limit*, a *hysteresis* and an *enable* parameter. The limit specifies the input signal level required to trigger the alarm. Hysteresis is the difference between input signal and limit required to return the alarm state to normal. The hysteresis parameter is shared between low and high limit alarms of the same input. Once an alarm is triggered it will be displayed as text (see table below). The alarm text can be set to blink continuously (even after the conditions that triggered the alarm are no longer active) until acknowledged by pressing the OPTION button, or only when the conditions that triggered it are active (Parameter UP15).

	Universal Input 1 (1U)	Universal Input 2 (2U)	Universal Input 3 (3U)	Universal Input 4 (4U)
Low limit alarm	ALA1	ALA3	ALA5	ALA7
High limit alarm	ALA2	ALA4	ALA6	ALA8

Input signal filtering (Parameters 1U04–4U04)

Filtering prevents unwanted fluctuation of sensor signals. The controller measures signal inputs every second and creates a final input signal based on a number of measured values and a digital low pass filter. The number of samples taken for the filtered control signal can be selected with this parameter. Take into account that control speed decrease as the number of samples taken for the filter increases.

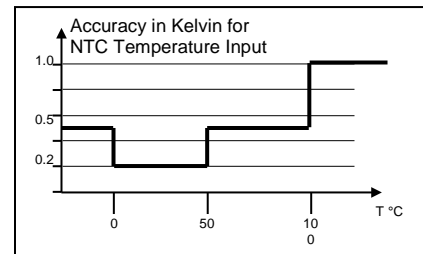
Average, minimum and maximum over a range of inputs (Parameters 1U12–4U12)

This function calculates average, minimum, or maximum values over the selected inputs. When activated on universal input 3 (3U) and input 1 (1U) the inputs averaged will be 1U and 3U; The result of the averaging will may only be used for control or display on the largest input of the group. In this example input 3 will carry the averaged value. Input 1 will show its measured value. The measured value of input 3 is not visible. Inputs must be of same type and range. Disabled inputs will not affect the result as they will be omitted from the calculation.

- Average calculates the average value of all the inputs involved.
- Minimum determines the input with the minimum value.
- Maximum determines the input with the maximum value.

It is possible to use different functions on different inputs. For example min of 1U and 3U and max of 2U and 4U. It is not possible to use different functions on one input.

UI		
0...10V	0...20mA	RT or contact
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Auxiliary functions of the universal input

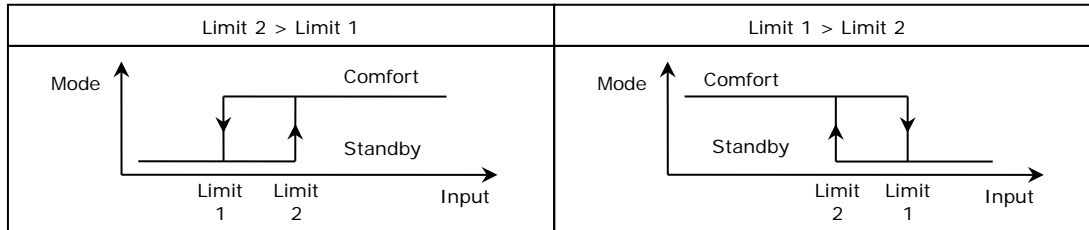
Each function below may be activated with the universal input functioning as analog input (0/2–10V, 0/4–20mA), binary open/close contact, or resistive temperature input (NTC). For binary open/close contact inputs a high value creates an open contact (i.e. 100%), and a low value creates a closed contact a (i.e. 0%).

Summer/winter compensation (Control loop parameters 1L05/2L05, 1L01-1L04; input parameters FU00–FU07)

Select the control loop and set point you want to affect, and minimum and maximum set points for heating and cooling with control loop parameters (see page 4). Input parameters shift the set point toward the minimum set point (negative shift) or towards the maximum set point (positive shift).

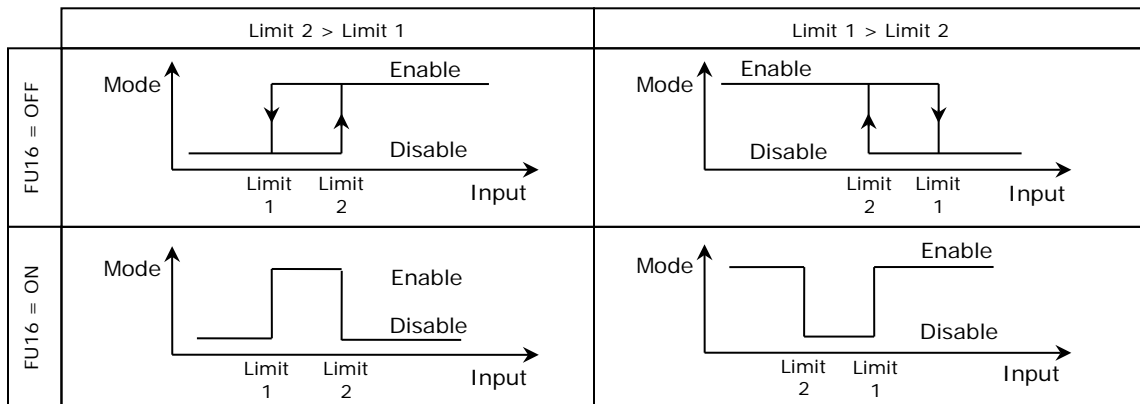
Auto comfort–standby mode switch (Parameters FU08–FU11)

This function is used with key card switches, occupancy sensors, etc. Set input limit 1 and 2 with possibilities below. Example: When Limit 2 > 1, switch comfort-to-standby at the lower value, standby-to-comfort at the higher value. Standby set point shift value is determined by control loop parameters 1L07 and 2L07.



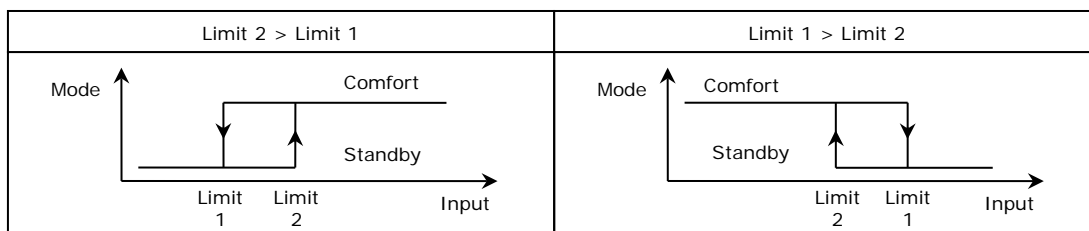
Enable–disable (Parameters FU12–FU19)

Enable or disable the controller based on desired input values, such as high or low temperature, occupancy sensor, window contact, etc. Can be used as AND function where several conditions must be met before disable or enable. Time schedules do not override, but manual override is permitted. Delay times may be assigned for both enable and disable (allows for the controller to start before validation of operation values takes place). Set input limit 1 and 2 with options below. Example: With FU16=OFF, and Limit 2 > Limit 1, switch enable-to-disable at Limit 1, disable-to-enable at Limit 2.



Auto heat–cool mode switch (Parameters FU20-FU23)

Switch between heating and cooling based on a universal input value. The input may be from a supply media (air or water) or outdoor air temperature sensor. For supply media temperature we recommend switching to cooling at 28°C/83°F and to heating at 16°C/61°F. For outdoor temperature we recommend switching to cooling at 28°C/83°F, and to heating at 16°C/61°F outdoor temperature. The change between heating and cooling is delayed to avoid rapid switching (factory default 5 min.) may be changed with parameter FU21. Heat-cool status of one control loop may also be determined by the heat-cool state of the other loop with parameter FU20 (The control loop used to determine the heat /cool state of must be set to demand-based heating and cooling (parameter 1L23 or 2L23 = OFF). Set limit 1 and limit 2 to switch between heating and cooling mode with the options below. (Example: when Limit 2 is greater than Limit 1, switch heat to cool at the Limit 1, cool to heat at Limit 2.) For binary open/close contact: open is a high value (100%), closed is a low value (0%).



Alarm Settings on Outputs

A control loop, special function, digital control or analog control sequence is not active until it has been assigned an output.

Alarm function (Parameters 1A08/1A09, 2A08/2A09, 1D06/1D07, 2D06, 2D07)

In the universals input we define low limit and high limit alarms. There are a total of 8 alarms for TCI-C22: For universal input number 1 (1U) we have ALA1 low limit and ALA2 high limit alarms, on universal input 2 (2U) we have ALA3 low limit and ALA4 high limit alarms, etc. With the output parameters we define the output we want to assign an alarm to and how the output should respond to that alarm. The output can be switched on (100%) or off (0%). The alarm takes precedence over operating state and calculated output signal. Two parameters define the behavior of the output based on an alarm: One parameter defines which alarm deactivates the output (0%), the other parameter defines which alarm activates the output to 100%. Each alarm can be individually selected. Multiple alarms can be signed to one output. Should one alarm be simultaneously selected to activate and deactivate the output, the one to de-activate has precedence.



Analog outputs

TCI-C11 and TCI-C13 have 1 analog output (AO1). TCI-C22 has two analog outputs (AO1 and AO2). Each analog output has jumpers, placed only vertically, on the back of the controller. Default is setting 0-10 VDC with option for 0-20mA. Parameters can be set to further customize analog input ranges—0-10v/0-2mA, 2-10v/4-20mA. Additional custom ranges can also be created by setting minimum and maximum signal limits.

AO	
0...10V	0...20mA
<input type="checkbox"/>	<input type="checkbox"/>

Auxiliary functions of the analog output

Manual (Parameter 1A00=4)

With the manual positioning feature you can position the output directly with a set point. The number of positioning steps can be selected: 2, 10, 100.

Dehumidifying for 4-pipe systems (Parameter 1A00=3)

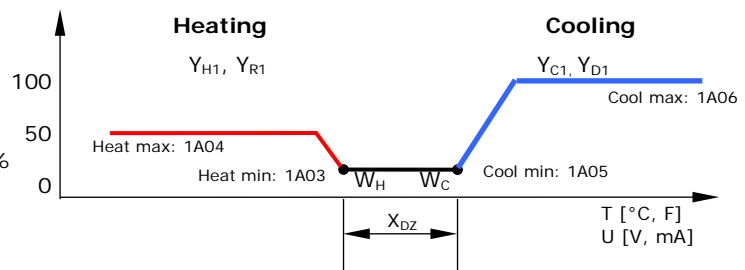
The maximum value is taken of both direct acting PI sequences (cooling and dehumidifying). Cooling will start to operate if the humidity gets too high, even if there is no cooling need, thus the heating will be forced to come into play, which in turn dehumidifies the air.

Minimum and maximum limits for heating and cooling mode (Parameter 1A02—1A05)

Individual minimum and maximum limits for heating and cooling mode may be assigned. Limitations in cooling mode are only used if the analog output is assigned to a control loop and that control loop has its cooling sequence active. For any other mode, the limitations for heating mode apply.

VAV Function (individual output limits for heating and cooling)

At peak cooling airflow set point is the max. amount of air the VAV box is set to deliver. It may be adjusted through the max. limit on the analog output (1A06 or 2A06). As cooling requirements decrease, airflow dwindles until it reaches its min. set point. This set point will be based on the airflow needed at design cooling and is typically 10% to 15% of max. cooling airflow. Min. airflow can be adjusted by the min. limit on the analog output (1A05 or 2A05). When it reaches this min., the system is in its dead band and is neither heating nor cooling. As the system moves into heating mode, airflow increases until it reaches the max. air flow required for heating mode. This is typically 30 to 50% of max. airflow of cooling mode. The parameter for this is called VAV function: maximum limitation in heating mode (1A04 or 2A04). Minimum airflow in heating mode is adjusted with 1A03 or 2A03.



Sensor and set point feedback

Values of universal inputs as well as set points of control loops may be transmitted on the analog outputs. Minimum and maximum value of the feedback value may be set for each output.

Binary (digital) outputs

With *Parameter 1D00* set to OFF (default setting) DO1 and DO2 are used as binary (digital) outputs. They may be used for digital heating and cooling output stages, as pulse width modulation (PWM) outputs, or for auxiliary functions.

Dehumidifying in 4-pipe systems (*Parameter 1D01=3*)

The maximum value is taken of both direct acting sequences of LP1 and LP2 (Cooling and dehumidifying). Cooling will come on when humidity is above set point even without cooling demand. Heating will then come on to dehumidify the air.

State functions (*Parameter 1D01=5, 1D02*)

State functions activate the output based on certain conditions with or without a demand for heating or cooling, in either comfort or standby mode. In energy hold off mode (EHO) the output will be off.

- Output is ON if the controller is ON. (*Parameter 1D02=0*)
- Output is ON if the controller is ON and in heating mode. (*Parameter 1D02=2*)
- Output is ON if the controller is ON and in cooling mode. (*Parameter 1D02=3*)
- Output is ON if demand exists on any other output. Typically for fan-supported heating/cooling. (*Parameter 1D02=1*)

Switch OFF delay (*Parameter 1D03*)

The time output remains ON after there is no more demand.

Switch ON delay (*Parameter 1D04*)

The time demand needs to be active before the output switches on. With state functions, all control outputs are disabled during switch ON delay.

Fan indication

Fan symbol appears on the display when DO1 is active.

PWM outputs (*Parameter 1D05, when 1D00=OFF*)

Pulse width modulation (PWM) mode is enabled when setting a PWM cycle time of 1 second or above with *Parameter 1D05*. (PWM cycle time can be set up to 1650 seconds. A cycle time of 0 disables PWM and sets the output to binary mode). In PWM mode the binary output will be switched on-off once per cycle. The on and off times are calculated according to the PI settings of the respective control sequence (*Parameters 1L09–1L15, 2L09–2L15*).

TCI-C11 and TCI-C22 use relays for the digital outputs. It is not recommended to use cycle times below 100 seconds as the lifetime of the relays will be shortened with frequent switching. For PWM applications requiring cycle times below 100 seconds we recommend using TCI-C13 with TRIAC outputs.

3-point outputs (*Parameter 1D00=ON*)

With *Parameter 1D00* set to ON DO1 and DO2 are changed into one 3-point output with control characteristic according to the PID settings of the respective control sequence (*Parameters 1L09–1L15, 2L09–2L15*). The running time of the actuator used needs to be specified with *Parameter 1D03*. Running time is defined as the time required for the actuator to run from fully open to fully closed or vice versa. Actuators with a fixed running time are recommended. Once fully open or fully closed the running time for the actuator is extended for a full run-time cycle. This will allow the actuator position to be synchronized in case it has been moved during off time or an actuator with variable running time was used. Use switching difference, *Parameter 1D04*, to reduce the switching frequency of the actuator. The actuator will only move if the difference to the current actuator position is larger than this parameter.

Setting parameters to configure the controller

TCI is an intelligent controller with the flexibility to fit a wide range of applications. The control operation is defined by parameters set using the standard operation terminal. There are two levels: User/display parameters and control parameters, each with a different password. Only control experts should be given access to the control settings.

Recommended setup procedure

1. Set jumpers on the back of the controller for inputs and outputs
2. Connect power supply and inputs
3. Program input parameters
4. Program control parameters
5. Program output parameters
6. Test function of unit
7. Switch off power
8. Connect outputs
9. Test control loop
10. Set user settings

Control modules

Parameters are grouped according to modules.

Module	Description	Notes
UP	User and display parameters	Control user access and select display elements
UI	Input configuration: 1U, 2U, 3U, 4U	TCI-C22 has 4 inputs, TCI-C11 and TCI-C13 have 2 inputs
LP	Control loops Lp1, Lp2	TCI-C22 has 2 loops, TCI-C11 and TCI-C13 have 1 loop
AO	Analog output configuration, AO1, AO2	TCI-C22 has 2 analog outputs, TCI-C11 and TCI-C13 have 1
DO	Binary output configuration, do1, do2	All TCI have 2 binary (digital) outputs
FU	Special functions	Common to all TCI

Changing parameters

1. Press UP/DOWN buttons simultaneously for three seconds. The display will show firmware version and revision number. Press the right hand OPTION or POWER button to start login.
2. CODE is shown in small display.
3. Code to access user parameters is 009, control parameter is 241. The access numbers are fixed and cannot be changed.
4. Select this using UP/DOWN buttons.
5. Press OPTION or POWER after selecting the correct code.
6. Once logged in with 009, the user/display parameters are displayed immediately. Once logged in with 241 control modules are displayed (Lp1, Lp2, 1u, 2u, etc.) – select with UP/DOWN and open with OPTION or POWER. As soon as the module is open its parameters are displayed.
7. Select the parameters with the UP/DOWN buttons. Change a parameter by pressing the OPTION button. Arrows 8 to 10 are displayed to indicate that the parameter may be modified. Use UP/DOWN buttons to adjust the value.
8. After you are done, press OPTION or POWER to save the new value and return to the selection level. Pressing left hand ESC button will discard the value and return without saving. For control parameters press ESC again to leave parameter selection and return to control module selection.
9. Press the ESC to leave the menu. The unit will return to normal operation if no button is pressed for more than 5 minutes.

User and display 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	Enable manual control in cascade or fan control mode	ON, OFF	ON
UP 03	Enable change of heating/cooling mode for 2 pipe systems	ON, OFF	ON
UP 04	Enable access to time programs:	ON, OFF	ON
UP 05	State after power failure: 0 = off, 1 = on, 2 = state before power failure	0, 1, 2	2
UP 06	Enable standby functionality	ON, OFF	ON
UP 07	Celsius or Fahrenheit, ON for Fahrenheit, OFF for Celsius	ON, OFF	OFF (Celsius)
UP 08	Standard display while no key is pressed	ON, OFF	ON
UP 09	Select contents of large digits:	0...5	1
	<div> 00 = OFF 01 = Input 02 = Set point </div> <div> 03 = Analog Output 04 = Binary Output 05 = Clock </div>		
UP 10	Select ID of contents of large digits:	0...4	1
	<div> <i>Input:</i> 0 – Off 1 – 1U 2 – 2U 3 – 3U 4 – 4U </div> <div> <i>set point:</i> 0 – Off 1 – Lp1 2 – Lp2 </div> <div> <i>Analog out:</i> 0 – Off 1 – AO1 2 – AO2 </div> <div> <i>Binary out:</i> 0 – Off 1 – DO1 2 – DO2 </div>		
UP 11	Select contents of small digits (same options as UP09)	0...5	Standard = 2 Deluxe = 5
UP 12	Select ID of contents of small digits (same options as UP10)	0...4	1
UP 13	Select analog output for vertical bar display	0...5	3
	<div> 00 = OFF 01 = AO1 02 = AO2 </div> <div> 03 = FO1 04 = Output lp1 05 = Output lp2 </div>		
UP 14	ON = Display heating & cooling state of controller in standard mode OFF = Do not indicate heating and cooling state in standard mode	ON, OFF	OFF
UP 15	ON = Alarms blink after being active and need to be confirmed OFF = Alarms are only shown when they are active	ON, OFF	ON
UP 16 TCI-C22 only	Clock display type: OFF = 24-hour clock, ON = 12-hour clock (AM, PM)	ON, OFF	OFF (24h)
UP 17 TCI-C22 only	Reset timer for override mode: 0 = Reset of override mode is not active. Time schedules can be overridden manually. 1...255 = Delay in minutes to switch off device if comfort or standby mode is activated while the unit is scheduled to be in OFF mode	0...255	60 (Min)

Control parameters (password 241)

Universal input configuration (1u, 2u, 3u, 4u)

Parameter	Description	Range	Default
1u 00	Input signal type: 0 = input not active 1 = Analog input: 0...10V or 0...20mA 2 = Analog input: 2...10V or 4...20mA 3 = Passive temperature NTC – Tn10	0 - 3	1
1u 01	Signal display minimum value	-50...205	0
1u 02	Signal display maximum value	-50...205	100
1u 03	Range of universal inputs (For analog inputs only) 0 = x1 1 = x10 2 = x100	0 – 2	0
1u 04	Unit of universal input (For analog inputs only): 0 = no unit 1 = % 2 = °C / °F 3 = Pa	0 – 3	0
1u 05	Samples taken for averaging control signal	0...100	10
1u 06	Calibration	Range dep	0
1u 07	Alarm 1: Enable low limit alarm OFF = Disabled ON = Enabled	OFF, ON	OFF
1u 08	Alarm 1 low limit	-40...215 °C	5°C (40°F)
1u 09	Alarm 2: Enable high limit alarm OFF = Disabled ON = Enabled	OFF, ON	OFF
1u 10	Alarm 2 high limit	-40...215 °C	50°C (122°F)
1u 11	Alarm 1 and 2 Hysteresis for alarm setback	0...100 °	5°C (10°F)
1u 12	Average, minimum, maximum function: Calculates average, minimum or maximum values over each input with matching u12 parameter. Only the highest input will carry the calculated value. For example if 1u, 2u, 4u have their u12 parameter set to 1, the average value calculated from 1u,2u and 4u is only visible through 4u. 1u and 2u will still show their measured inputs. All involved inputs must the same type and range. 0 = Not active 1 = Average function 2 = Minimum function 3 = Maximum function	0 - 3	0

Control loop configuration (1L to 2L)

Parameter	Description	Range	Default
1L 00	Select controls input: 0 = Control loop disabled 1 = Universal input 1 2 = Universal input 2 3 = Universal input 3 4 = Universal Input 4	0...4	1
1L 01	Minimum set point limit for heating	Acc input	10°C (50°F)
1L 02	Maximum set point limit for heating	Acc input	28°C (82°F)
1L 03	Minimum set point limit for cooling	Acc input	18°C (64°F)
1L 04	Maximum set point limit for cooling	Acc input	34°C (92°F)
1L 05	Enable setpoint compensation with auxiliary function 0 = setpoint compensation is disabled 1 = Winter Compensation only 2 = Summer compensation only 3 = Winter and summer compensation	0...3	0
1L 06	Select setpoint input: 0 = Normal setpoint of control loop 1 = Combined setpoint with other control loop 2 = cascade with reverse sequence of primary loop only 3 = cascade with direct sequence of primary loop only 4 = cascade with both reverse and direct of sequence of prim. loop	0...4	0
1L 07	Standby set point shift	Acc input	5.0°C (10°F)
1L 08	Dead zone between heating & cooling set point X_{DZ}	Acc input	1.0° (2°F)

PI Control Sequence

Parameter	Description	Range	Default
1L 09	Offset for heating PI sequence	Acc input	0
1L 10	Offset for cooling PI sequence	Acc input	0
1L 11	P – band heating X_{PH}	Acc input	2.0°C (4.0°F)
1L 12	P – band cooling X_{PC}	Acc input	2.0° (4.0°F)
1L 13	K_{IH} , Integral gain heating, in 0.1 steps low value = slow reaction high value = fast reaction	0...25.5	0.0
1L 14	K_{IC} , Integral gain cooling, in 0.1 steps	0...25.5	0.0
1L 15	T_i , measuring interval integral low value = fast reaction high value = slow reaction	0...255	1 sec

Digital Control Sequence

Parameter	Description	Range	Default
1L 16	Action of stages 0 = Cumulative: 1. Q_{H1} , 2. $Q_{H1}+Q_{H2}$ 1 = Single: 1. Q_{H1} , 2. Q_{H2} 2 = Digital: 1. Q_{H1} , 2. Q_{H2} , 3. $Q_{H1} + Q_{H2}$	0...2	0
1L 17	Offset for reverse (heating) binary sequences	Acc input	0.0° (0.0°F)
1L 18	Offset for direct (cooling) binary sequences	Acc input	0.0° (0.0°F)
1L 19	Switching span heating	Acc input	1.0° (2.0°F)
1L 20	Switching span cooling	Acc input	1.0° (2.0°F)
1L 21	Switching hysteresis X_H	Acc input	0.5° (1.0°F)
1L 22	Switching delay min running and min stopping time for binary sequences	0...255s	10s
1L 23	Reverse / direct sequence follows heat – cool state of controller OFF = control sequences activate based on demand and do not follow heat – cool state of controller ON = control sequence follow heat cool state. Reverse sequence will only be active in heating mode, direct sequences in cooling mode of controller.	ON, OFF	OFF
1L 24	Delay for heat – cool changeover in case above parameter is OFF	0...255 min	5 min

Analog output configuration (1A, 2A)

Parameter	Description	Range	Default
1A 00	AO1: Selection of control loop or special function 0 = OFF 1 = Loop 1 2 = Loop 2 3 = Dehumidify in 4 pipe systems (Max LP1 cooling and LP2 direct acting) 4 = Manual override (0 – 100%) 5 = Feedback of universal input	0 – 5	1
1A 01	1AO1: Configuration of output signal depending on 1A00 If 1A00 = 1,2 (control loop 1 or 2) select sequence: 0 = Heating, Reverse Y_{H1} , Y_{R1} 1 = Cooling, Direct Y_{C1} , Y_{D1} 2 = Heating and Cooling (2 pipe system), $Y_{H1} + Y_{C1}$, $Y_{R1} + Y_{D1}$ 3 = Feedback of setpoint IF 1A00 = 5 Select input for feedback function: 0 = Function disabled 1 = Universal input 1 2 = Universal input 2 3 = Universal input 3 4 = Universal Input 4	0 – 4	0
1A 02	Type of output signal: OFF = 0-10V, 0-20mA, ON = 2-10V, 4-20mA	ON, OFF	OFF (0-10V, 0-20mA)
1A 03	Minimum limitation of output signal default and in loop heating mode	0 – 100 %	0
1A 04	Maximum limitation of output signal default and in loop heating mode	0 – 100 %	100%
1A 05	Minimum limitation of output signal in loop cooling mode	0 – 100%	0%
1A 06	Maximum limitation of output signal in loop cooling mode	0 – 100 %	100%
1A 07	Choose alarm to set output to 100%. With conflicting alarms, the output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1A 08	Choose alarm to set output to 0%. With conflicting alarms, the output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1A 09	Feedback function: minimum input value	Acc input	0°C
1A 10	Feedback function maximum input value	Acc input	100°C

Binary or 3-point output configuration (1d, 2d)

Parameter	Description	Range	Default
1d 00	Enable 3-point Output (DO1, DO2 3-point) OFF = DO1, DO2 are two binary outputs ON = DO1, DO2 are one 3-point output DO1 = open, DO2 = close	ON, OFF	OFF

For 3-point outputs: In case 1d 00 = ON

1d 01	Configuration Digital Output 0 = OFF 1 = Loop 1 2 = Loop 2 3 = Dehumidifying, Max of loop 1 cooling and loop 2 direct acting 4 = Manual override 5 = State functions	0...5	0
1d 02	3-point outputs (1d00 = ON) select sequence if 1d01 = Loop 1 or Loop 2: 0 = Heating, Reverse Y_{H1} , Y_{R1} 1 = Cooling, Direct Y_{C1} , Y_{D1} 2 = Heating and Cooling (2 pipe system), $Y_{H1} + Y_{C1}$, $Y_{R1} + Y_{D1}$ If 1d01 = 5 (State functions) 0 = Operation State (On if operation state is ON) 1 = Output while demand on any output 2 = Output while controller in heating mode and operation state ON 3 = Output while controller in cooling mode and operation state ON	0...5	0
1d 03	Running Time (Time to run from Open to Close)	0 – 255s	90s
1d 04	Switching difference for 3-point signal	0 – 100s	5s
1d 05	Not used	0 – 1275 s	0s
1d 06	Choose alarm to set output to 100%. With conflicting alarms, output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 07	Choose alarm to set output to 0%. With conflicting alarms, output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 08	Not used	ON, OFF	OFF

For binary outputs: In case 1d 00 = OFF

1d 01	Configuration Digital Output (only if 3-point disabled) 0 = OFF 1 = Loop 1 2 = Loop 2 3 = Dehumidifying, Max of loop 1 heating and loop 2 direct 4 = Manual override 5 = State functions	0...5	0
1d 02	Binary outputs (1d00 = OFF): Select sequence if 1d01 = Loop 1 or Loop 2: 0 = 1. Stage heating, reverse Q_{H1} , Q_{R1} 1 = 1. Stage cooling, direct Q_{C1} , Q_{D1} 2 = 1. Stage heating and cooling, reverse and direct, $Q_{H1} + Q_{C1}$ 3 = 2. Stage heating, reverse Q_{H2} , Q_{R2} 4 = 2. Stage cooling, direct, Q_{C2} , Q_{D2} 5 = 2. Stage heating and cooling, reverse and direct, $Q_{H2} + Q_{C2}$ If 1d01 = 5 (State functions) 0 = Operation State (On if operation state is ON) 1 = Output while demand on any output 2 = Output while controller in heating mode and operation state ON 3 = Output while controller in cooling mode and operation state ON	0...5	0
1d 03	Switch off delay. The time the binary output keeps running, if there is no more demand.	0 – 255s	90s
1d 04	Switch on delay. The time demand needs to be active, before the output switches on. (during state mode (1d01 = 5), all control outputs will be disabled during switch on delay)	0 – 255s	5s
1d 05	Set PWM cycle time in seconds, 0 deactivates PWM A value > than 0 will operate a standard PWM output.	0 – 1650s	0s
1d 06	Choose alarm to set output to 100%. With conflicting alarms, output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 07	Choose alarm to set output to 0%. With conflicting alarms, output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 08	Display Fan Symbol while active	ON, OFF	OFF

Special Functions Setup (Fu)

Summer–winter compensation / set point setback

Parameter	Description	Range	Default
Fu 00	Select compensation setback input (0=function disabled): 1=Input 1, 2=Input 2, 3=Input 3, 4=Input 4	0...4	0
Fu 01	Winter compensation (shift with low compensation signal): OFF = set point is shifted toward lower set point limit ON = set point is shifted toward upper set point limit	ON, OFF	OFF
Fu 02	Winter compensation lower limit: input signal at maximum set point shift	Range acc input	5°C (41°F)
Fu 03	Winter compensation upper limit: input signal at start of set point shift.	Range acc input	20°C (68°F)
Fu 04	Summer compensation (shift with high compensation signal): OFF = set point is shifted toward lower set point limit ON = set point is shifted toward upper set point limit	ON, OFF	ON
Fu 05	Summer compensation lower limit: input signal at start of set point shift	Range acc input	35°C (95°F)
Fu 06	Summer compensation upper limit: input signal at maximum set point shift.	Range acc input	40°C (104°F)
Fu 07	Hot/Cool Symbol while compensation active, OFF=Hide, ON=Show	ON, OFF	OFF

Remote control of comfort (occupied)–standby (unoccupied) changeover

Fu 08	Select comfort–standby changeover input (0=function disabled): 1=Input 1, 2=Input 2, 3= Input 3, 4=Input 4	0...4	0
Fu 09	Activation delay (seconds) = the time the input needs to be inactive before standby mode is activated,	0 – 1275 s	300s
Fu 10	Input limit 1	Range acc input	10
Fu 11	Input limit 2	Range acc input	90

Remote control of enable–disable

Fu 12	Select enable–disable input (0=function disabled): 1=Input 1, 2=Input 2, 3=Input 3, 4=Input 4	0...4	0
Fu 13	Manual override permitted If set to ON, unit may be started in Manual without waiting for delay time	ON, OFF	OFF
Fu 14	Activation delay (Seconds) = the time the input needs to be within active limits before unit is enabled	0 – 1275 s	0
Fu 15	In-activation delay (Seconds) = the time the input needs to be inactive before the unit is disabled	0 – 1275 s	300
Fu 16	Range of limits: OFF = When limit 2 (e.g. 60) is larger than limit 1 (e.g. 40) the controller will be enabled when the input value is greater than limit 2 (e.g. 60) and disabled when the input value is below limit 1 (e.g. 40). When limit 2 (e.g. 40) is lower than limit 1 (e.g. 60) the controller will be enabled when the input value is lower than limit 1 (e.g. 40) and disabled when the input value is above limit 2 (e.g.10). ON = When limit 2 (e.g. 60) is above limit 1 (e.g. 40) the controller will be enabled when the input value is between limit 1(e.g. 40) and limit 2 (e.g. 60) When limit2 (e.g. 40) is below limit1 (e.g. 60) the controller will be enabled when the input value is below limit 2 (e.g. 40) or above limit 1 (e.g. 60).	ON, OFF	OFF
Fu 17	Input limit 1	Range acc input	10
Fu 18	Input limit 2	Range acc input	90
Fu 19	Disable in case of alarms	Selection	▽▽▽▽▽▽▽▽

Remote control of heat–cool (reverse–direct) changeover

Fu 20	Select heat–cool changeover input (0=function disabled): 1=Input 1, 2=Input 2, 3=Input 3, 4=Input 4 5=Based on heat–cool status of control loop 1 6 =Based on heat– cool status of control loop 2	0...6	0
Fu 21	Activation delay (seconds) = the time the input needs to be over the cooling limit before cooling mode is activated	0 – 1275 s	300
Fu 22	Input limit 1	Range acc input	20
Fu 23	Input limit 2	Range acc input	40