TCX2-40863
Programmable Universal controller

TCX2-40863-OP

OPA-X2

Features

- 4 control loops with each 2 PID sequences and 6 binary sequences
- Free heating or cooling functions (economizer – loop, based on enthalpy or temperature)
- 8 Universal inputs for passive temperature, binary, analog DC 0/2…10V or 0/4…20 mA sensors with 10 bit resolution
- 3 modulating outputs for DC 0/2...10V or 0/4…20 mA actuators with 10 bit resolution.
- 6 normally open relays contacts with independent common to switch up to 250V, 7A each, configurable to be up to 3 floating or 6 binary or PWM outputs.
- 8 assignable alarms or interlocks
- Selectable state of outputs on alarm condition
- Transformation of display value according to analog sensor range
- Password protected programmable user and control parameters
- RS485 bus communication with remote terminal
- Transmitter function for inputs and set points.
- 12 Time schedule events: change of setpoint, position of manual outputs or operation modes
- Special functions for economizer, cascading, enabling, heat – cool change, dehumidifying, set point shift and VAV
- Copy – paste parameter sets with a plug-in memory module

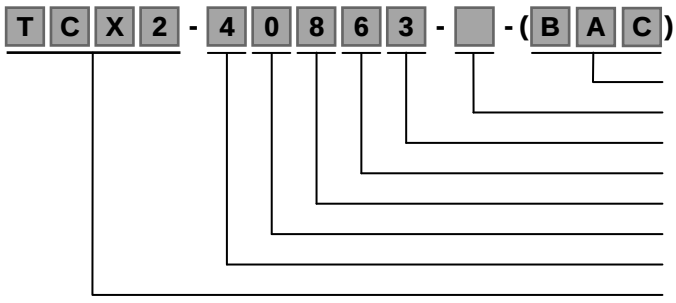
Applications

- Air Only Systems: Constant or Variable Air Volume systems for single or dual duct systems with options of:
  - up to 6 reheat stages
  - radiator control, chilled ceiling
  - supply air, extract air cascade control
  - humidity control
  - pressure control
  - Control for variable speed fans
- Air/Water Systems: Air handling units, fan coil units for 2-pipe or 4-pipe systems with options of:
  - Modulating, floating or on/off actuators
  - Humidity control
  - Frost protection
  - Energy recovery
- Water Only Systems: Boiler with DHW, Radiator, floor heating or chilled ceilings
- Individual room control of almost any heating/cooling system available
- Economizers

General Description

The TCX is an electronic universal controller with four autonomous control loops. Each control loop may use up to 2 PI sequences and 12 binary sequences. The TCX-40863 features 8 universal inputs, 6 binary outputs (relays contacts with separate common) and three analog outputs. The TCX2 comes with a built in RS485 communication interface. The controller is configured with the use of a simple configuration routine.
Parameters may be saved and restored by the use of an external memory module.

Name

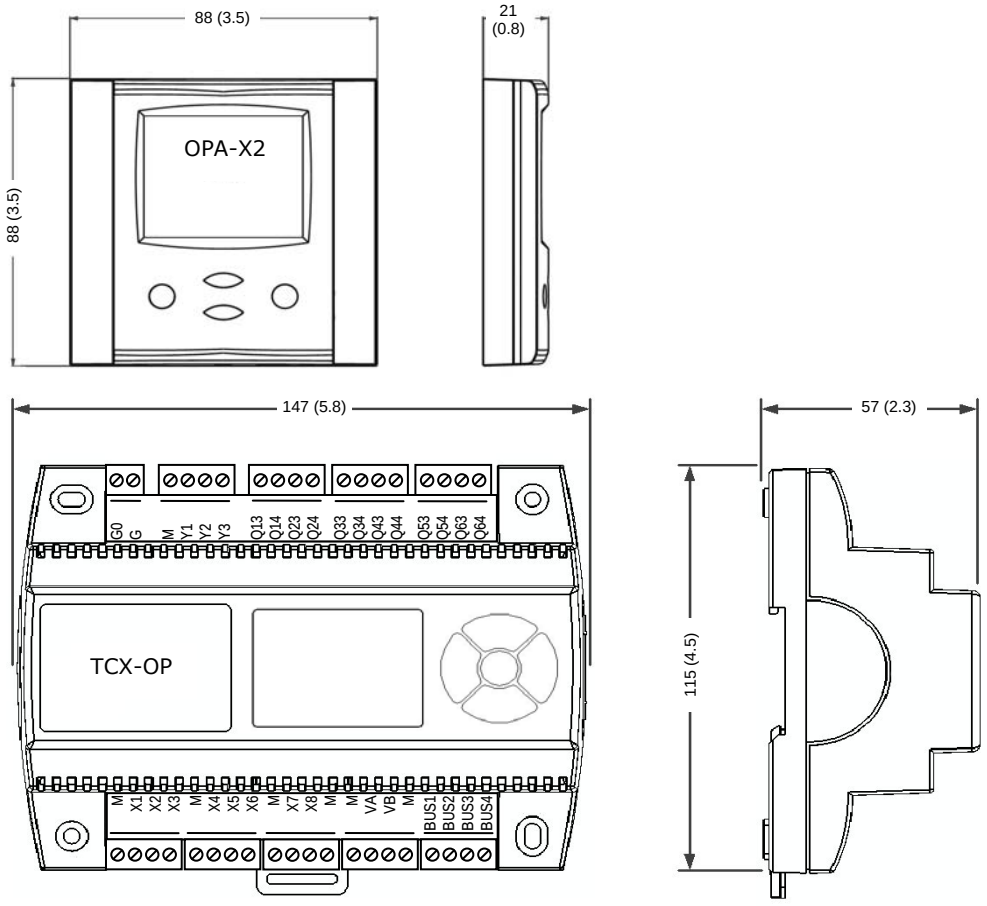


Com:	Communication standard
Function:	Blank = Universal, FC = Fan Coil
# AO:	3 Analog outputs
# DO:	6 Binary outputs
# AI:	8 Universal inputs
# DI:	0 Binary inputs
# LP:	4 control loops
Series:	**TCX2**

Ordering

Item name	Item code	Function	Type	Key-data
TCX2-40863	40-11 0032	Controls units	Universal controller	Cabinet mounted controls unit with either built-in or remote operation terminals. 4 control loops, 8 universal inputs, 2 remote inputs, 6 binary outputs, 3 analog outputs
TCX2-40863-OP	40-11 0036	+ Built-in interface		
OPA-X2-VCP	40-50 0007	Square housing	Operation Terminal	

Dimensions [mm] (inch)



Technical specifications

Power Supply	Operating Voltage	24 V AC/DC ± 10 %, 50…60 Hz
	Power Consumption	Max. 10 VA
	Electrical Connection	Terminal Connectors, wire 0.34…2.5 mm² (AWG 24…12)
	Clock backup	48 hours
Signal inputs	Universal Input	UI1…UI8
	Jumper set to	Voltage or Current:
	Input Signal	0...10 V or 0...20 mA
	Resolution	9.76 mV or 0.019 mA (10 bit)
	Accuracy	± 1 %
	Jumper set to RT/DI	Passive temperature input NTC 10k@25°C (77°F)
	Range	-40…140 °C (-40…284 °F)
	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
	For binary inputs: Cable length for ∅ ≥ 1mm²	open contact max. 100 m
Signal outputs	Analog Outputs	AO1, AO2, AO3
	Output Signal	DC 0...10 V or 0...20 mA (300 Ω max.)
	Resolution	9.76 mV resp. 0.019 mA (10 bit)
	Accuracy	± 1 %
	Maximum Load	20 mA, 500 Ω max.
	Relays Outputs	DO1…DO6
	AC Voltage	0…250 VAC, 6 A max. each output
	DC Voltage	0…30 VDC, 6 A max. each output
Environment	Operation Climatic Conditions	To IEC 721-3-3 class 3 K5
	Temperature	0…50 °C (32…122 °F)
	Humidity	<95 % r.H. non-condensing
	Transport & Storage Climatic Conditions	To IEC 721-3-2 and IEC 721-3-1 class 3 K3 and class 1 K3
	Temperature	-25…70 °C (-13…158 °F)
	Humidity	<95 % r.H. non-condensing
	Mechanical Conditions	class 2M2
Standards	CE 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 Special requirement on temperature dependent controls	 EN 60 730 –1 EN 60 730 – 2 – 9
General	Degree of Protection	IP30 to EN 60 529 (if mounted correctly)
	Safety Class	III (IEC 60536)
	Material	Fire proof ABS plastic (UL94 class V-0)
	Dimensions (H x W x D)	57 x 147 x 115 mm (2.3 x 5.8 x 4.5 in)
	Weight (including package)	TCX2-40863: 380g (13.4 oz) TCX2-40863-OP: 450g (15.9 oz)

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!

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.

Modulating Actuators:

Choose actuators with an input signal type of 0-10 V DC or 4-20 mA. Minimum and maximum signal limitations may be set in software.

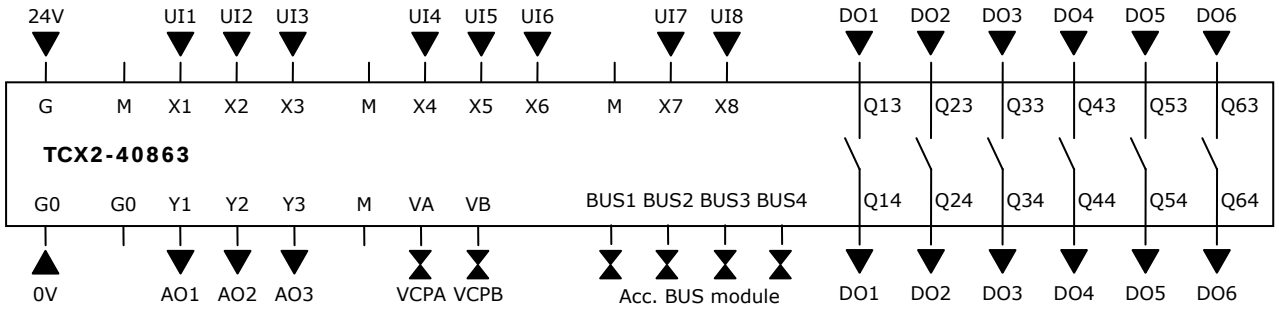
Floating Actuators:

Actuators with constant running time are recommended. Observe power limits on binary devices.

Binary auxiliary devices:

E.g. pumps, fans, on/off valves, humidifiers, etc. Do not directly connect devices that exceed contact ratings as set in technical specifications. Observe startup current on inductive loads.

Connection diagram



Description:

G0	Power supply:	0V; common for power supply, analog outputs
G	Power supply:	24V
M	Signal ground:	Common for universal inputs (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*
VA / VB	VCP-BUS:	Connector for PC-Tool or peer-to-peer operation terminal (RS485)
BUS1	BUS-Module:	Connector for bus module. Connections for MODBUS, BACnet, etc.

**) selectable by jumper*

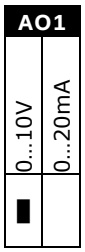
Jumpers

Jumpers are located on the backside of the controller

AO: Selection of analog output type

Left position: voltage output (0…10 V),
factory default

Right position: current output (0…20 mA)

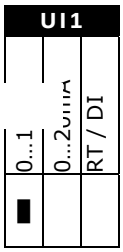


UI: Selection of universal input type

Left position: voltage input (0…10
factory default

Middle position: current input (0…20 mA)

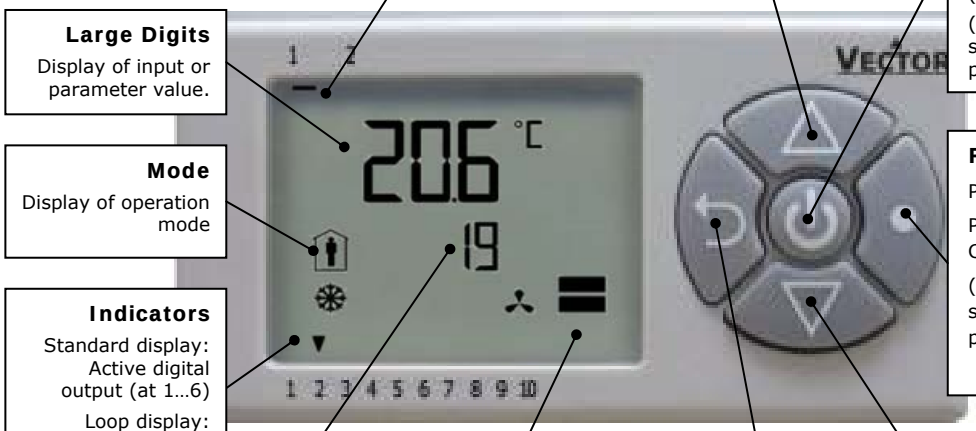
Right position: RT or dry-contact



Installation

- Mount in standard cabinet to DIN 43880
- Surface mount to top-hat rail to EN 60715 or 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.

User Interface: Display and Operation



Loop indication
Standard display (no button pressed for 30 sec.): Not visible.
Loop display: Bar at 1 = Loop 1, Bar at 2 = Loop 2, etc

Up
Increment SET POINT
(Parameter setting: SCROLL menu options and parameters)

Center (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.

Mode
Display of operation mode

Indicators
Standard display: Active digital output (at 1…6)
Loop display: Active digital stages (at 8,9,10)

Right (OPTION)
Press < 2 sec.: Select Control Loop
Press > 2 sec.: Enter set-up CLOCK, SCHEDULES, H/C
(Parameter setting: ENTER to select menu option, accept parameter change)

Down
Decrement SET POINT
(Parameter setting: SCROLL menu options and parameters)

Small Digits
Display of setpoint, clock or parameter number.

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

Left (ESC)
Select Control Loop
(Parameter setting: ESCAPE menu option, discard parameter setting)

Operation mode symbols		Control symbols	
	Comfort (occupied)		Heating (Reverse) Active
	Economy (unoccupied):		Cooling (Direct) Active
OFF	Energy Hold Off		Schedule Set
Comfort: All control functions operating per set points. *Standby:* Set points shifted according to *Parameters 1L07, 2L07*. *Energy Hold Off*: 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: Communication Error
Err2: Internal data corrupt. Replace product.
Err3: Problem with the internal real-time clock or eeprom. Restart product. If error reappears, replace product.
Err4: Configuration error. Parameter settings are conflicting. Verify control setup.
Err5: Parameter copy mode: Copy error – if external module is addressed, communication error with external product
Err6: Parameter copy mode: Checksum mismatch of eeprom data. Data in external eeprom corrupt.

Extended User operation

The controller contains a quartz clock with battery back-up. Up to 12 time schedule events based on time and day of the week may be programmed. Time schedule events are change of operation mode, state or position of an output or change of setpoint. A blinking clock indicates that the time has not been set or 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)

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

Creating time schedules

Step 1: Select a switching time (Up to 12, Pr01–Pr12)

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	**08:00** Pr01 ▬

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 (2nd bar indicates step 2 complete): Repeat for DAY2 – DAY7	**DAY1** Pr01 ▬ ▼ 1 2 3 4 5 6 7

Step 3: Select action for switching time (Pr01+Days)

After Pro1, DAY1–DAY7 is completed (Pro1 switching time activate or deactivate on desired days), press POWER to come to desired event for Pro1. The following options appear in order: No = switching time not active OP = operation mode (select ON, OFF, COMFORT, STANDBY) LP = set point AO = Position of analog output (Analog output must be in manual mode) FAN = Fan state (fan must be in manual mode) do = Position of binary output (3-point or PWM), Output must be in manual mode. Press UP/DOWN to scroll through the possible events(3nd bar indicates step 3 complete) Press Option to complete selection of event	**LP** Pr01 ▬

Step 4: Select ID (For example: LP01 or FAN2)

For all non operation mode changes, it is required to select the output or control loop in this step. For example for setpoint LP1, LP2, etc. or for an output the number of the output that should be changed. Press UP/DOWN to select, OPTION to complete	**LP01** Pr01 ▬

Step 5: Complete switching event

Choose operation mode, setpoint or position of output Characteristics of action (e.g. 0–100% for A1) appear (5th bar indicates step 5 complete) Press UP/DOWN to select, OPTION to complete	**25%** Pr01 ▬

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	**H-C** SEL 

Display of input and output values

Step 1: Select type or in- or output

Press UP/DOWN Small digits display SEL, Large digits show: UI = universal inputs AO = Analog outputs FAN = Fan outputs do = Binary, 3-point or PWM outputs Press OPTION to display state of In- or Output	**UI** SEL

Step 2: Select number of in- or output

Press UP/DOWN to step through the number of available in- or outputs Large digits show in-output type & number, Small digits show value	**UI 01** 25%

Step 3: Display total run time for binary outputs

While in binary output mode, Press OPTION key to display the total number of hours the binary output has been ON. Large digits show in-output type & number, Small digits show running time in hours. If the running time is larger than 9999 hours, 10000 hours are shown as level on the vertical bar. The example on the right equals 50345h running time. (Maximum runtime is 65535h = 7.5 years)	**UI 1** 345h 

Control loops

TCX2-40863 has 4 independent control loops. 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.

Economy set point shift *(Parameter L07)*

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

Dead zone span (Parameters L08)

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 L01—L04)

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

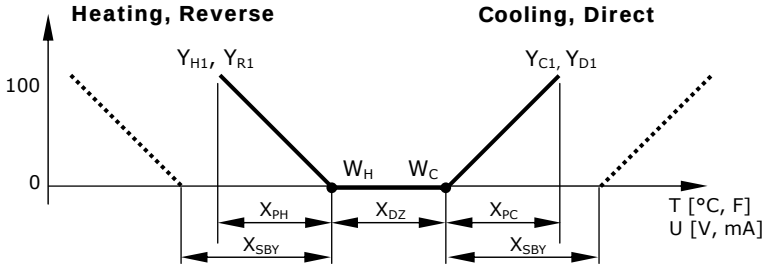
Cascade control (Parameters L06)

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. Cascade control is activated by setting the parameter L06 of the secondary control loop. The control loop with the lower number is the primary loop.

For example: Select the cascade parameter on Loop 2 (2L06) to make Loop 1 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. 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)	

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

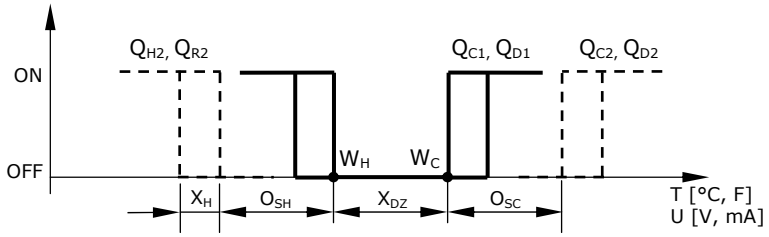
- Time interval (TI) - speed of reaction (seconds).
- Integral gain (KI) - strength of reaction (K factor).

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_{QH}	Offset Heating, Direct
O_{QC}	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

UI		
0…10V	0…20mA	RT or contact
■		

Each universal input has jumpers, placed only vertically, on the back of the controller with the following options:

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

The jumpers define the electrical selection of the universal input type, the parameter must be set as well to allow the controller to interpret the electrical signal correctly.

- Disabled *(U00=0)*
- 0–10v/0–2mA or open contact *(U0=1)*
- 2–10v/4–20mA *(U0=2)*
- NTC *(U0=3)*

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 *(U1)* and signal display maximum value *(U2)*. For example:

4-20mA input signal, 0-200 Pa pressure transmitter	
Signal type: 1U00=2 Min. display *1U01=0*, Max. display *1U02=200* *Unit: 1U04=3*	
4 mA	0 P
12 mA	100 P
20 mA	200 P

- Values may be displayed with no unit or as: 1=%, 2=°C/°F, 3=P *(U04)*

Flexible resolution depending on display range

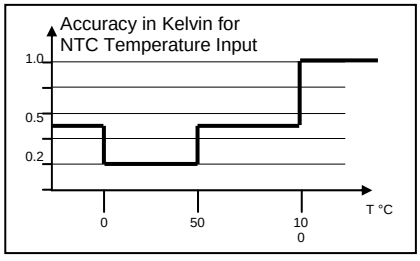
With a measuring range of 0–100 and a display value of 0-100, the resolution is 0.5 below 100, 0.2 below 50, and 0.1 below 25. A signal display value 0–100, therefore, is displayed with a resolution up to 0.1 for the input measurement and 0.5 for the set point. In our example above 0–200 P is displayed with a resolution up to 0.2 for the input and 1.0 for the set point. With the range parameter *(U3)* larger numbers may be displayed: The allowable range of -50–205 may be multiplied 10 or 100. The largest displayable values are -990–9999.

Square root calculation on input values

If required the input signal maybe subjected to the square root function prior to calculating the display values
The 10 bit resolution will not be lost. The square root is calculated from the input signal and the result is again conditioned to 10bit resolution. The square root function is useful when flow needs to be calculated from differential pressure; for example in air ducts for VAV systems.

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 to RT (remote temperature). Set the parameter for the same UI to analog input *(U0=1)*. An open contact reads as a high value (100%), a closed contact as a low value (0%).

Virtual inputs

Virtual inputs are not physically located within the controller. They can be located on another controller in case a bus plug-in is installed or on a remote terminal. Choose Remote Terminal with 09U0=1 or bus plug-in with 09U0=2.
In case the address is not online or incorrect ERR4 will display and the outputs connected to the virtual input will be switched off.

Input signal filtering (Parameter U5)

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 reaction delays as the number of samples taken for the filter increases.

Differential, average, minimum or maximum over a range of inputs (Parameter U7)

A group of up to 10 inputs may be combined to one input using an input function. The number of inputs involved may be selected by parameter U7. All the inputs with matching parameter U7 values will be combined to one input. The exception is the differential input. The differential input only need to be selected once.
Following mathematic functions are available:

1. Average: The mean value of the selection
2. Minimum: The lowest value of the selection
3. Maximum: The largest value of the selection
4. Difference: The difference of UI1 – UI2

The input with the highest index will carry the calculated signal. For example 06U7=4 will change the signal of UI6 to UI6-UI5. The signal of UI5 will be unaffected and may be used for other control functions. Another example: 02U7= 04U7 =05U7=1: Calculates the average input of UI2, UI4 and UI5. The display value of UI5 will change to the calculated signal. The signals of UI2 and UI4 will remain unaffected.

Inputs must be of same type and range. Disabled inputs will not affect the result as they will be omitted from the calculation.

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.

Alarm functions

8 alarm functions are available. The highest priority alarm is alarm 1, the lowest one alarm 8.

Alarm source *(AL0, AL1)*

There are several sources that can trigger an alarm. These are the options:

1. Universal input: The input value is either too low or too high
2. Setpoint deviation: The setpoint can't be met within the allowed time
3. Maintenance alarm from run time counters: A run time counter has exceeded its limit, maintenance need to be performed.
4. Fan1 follow alarm: Supervise state of fan 1 with a flow sensor. If fan runs, flow must be on, if fan stops flow must be off.
5. Fan2 follow alarm: Supervise state of fan 2.

Alarm notification or interlock *(AL2)*

Low or high limits of inputs may as well be used as interlock to supervise conditions when an output should be switched on or off, in parallel to control situations. In this case an alarm display may be disturbing. The display of an alarm can be suppressed by setting the interlock parameter to ON.

Alarm automatic reset or acknowledge only *(AL3)*

Certain alarms should automatically reset once the condition is removed, but still keep the end user informed that the alarm condition occurred: A typical example is a frost alarm. If the temperature drops too low, the heat should come on and it should stop again once the frost protection reset temperature is reached.
If an alarm indicates a failure of system equipment that would endanger the operation of the control loop, the alarm should not automatically reset. For example a fan fails to come on or a pump does not operate. In this case the alarm situation needs to be resolved before restarting the outputs.
By setting AL3 to ON the engineer determines that the alarm must be reset manually before normal operation can continue.

Alarm delay, alarm limit and alarm reset

For the above alarms an activation delay, a limit and a reset (where applicable) may be defined. The reset determines when the alarm condition will return to normal. It is used with input limit alarms for example frost protection. The frost protection alarm is activated once the temperature drops below 5°C (41°F), the alarm reset is set to 5K. The room is now heated until the temperature reaches 5°C (41°F) + 5K = 10°C (50°F). Once this temperature is reached the alarm will switch off, it will remain blinking until acknowledged.

Alarm Settings on Outputs

The position of an output in case of an alarm may be defined for each output and each alarm individually.
The output can be switched on (100%) or off (0%). The alarm takes precedence over operating state and control 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.

Priority for output control
1. Alarm level low
2. Alarm level high
3. Operation mode OFF
4. Control function

Output Configuration

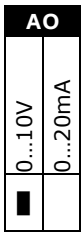
General

An output must be assigned to a function or a control loop using the corresponding parameter set. Assigning an output to a control function will automatically activate the respective function. Unassigned functions are not active.

Dehumidifying for cooling output in a 4-pipe system

The maximum value is taken of both direct acting sequences of loop 1 and loop 2 (cooling and dehumidifying). Cooling will start to operate if the humidity gets too high, even if there is no cooling need, the temperature drops below the heating setpoint and heating starts to operate. Cool air holds less humidity than warm air, by first cooling the air and then heating it, the air is dehumidified.

Analog outputs



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.

Assigning the analog output to a function or control sequence *(A00/A01)*

An analog output may be assigned to:

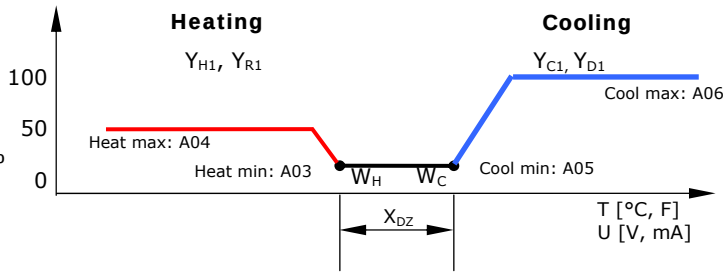
1. a control loop and one or both of its PID sequences,
2. a special function such as dehumidifying or economizer
3. manual operation: The user can position the output directly with a setpoint with 0.5% resolution
4. sensor or setpoint feedback/signal converter function.

Minimum and maximum limits for heating and cooling mode *(Parameter 1A03—1A06)*

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.

Application example: VAV Function (individual output limits for heating and cooling)

At peak cooling airflow set point is the maximum amount of air the VAV box is set to deliver. It may be adjusted through the maximum limit on the analog output (*A06*). 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 maximal cooling airflow. Minimal airflow can be adjusted by the min. limit on the analog output (*A05*). 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 maximal air flow required for heating mode. This is typically 30 to 50% of maximal airflow of cooling mode. The parameter for this is called VAV function: maximum limitation in heating mode (*A04*). Minimum airflow in heating mode is adjusted with *A03*.



Sensor and set point feedback / signal converter

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. The controller can thus be used as a signal converter or analog interface for a BAS control system.

Binary (digital) outputs

The binary outputs may be used as floating outputs, outputs for a fan, outputs for 3-point actuators or as single binary or PWM output.
In case an output is defined for more than one function the following priority applies:

1. Fan
2. 3-point output
3. Binary output

	DO1	DO2	DO3	DO4	DO5	DO6
Fan	FAN1-1	FAN1-2	FAN1-3	FAN2-1	FAN2-2	FAN2-3
3-point output	FO1		FO2		FO3	

Fan Control

It is possible to operate two three speed fans with the TCX2.

Assigning the fan module to a function or control sequence *(FA0/FA1)*

The fan module may be assigned to:

1. a control loop and one or both of its PID sequences,
2. the operation mode: the fan runs when controller is on, in heating or cooling mode
3. manual operation: The user can position the output directly with a setpoint with 0.5% resolution

The active fan speed is defined by the binary function of the control loop, in case the fan module is assigned to it. Automatic fan speeds can be overridden by keypad if manual mode is enabled.

Mould protection *(FA2)*

The fan may be left running in its lowest speed while the controller is in comfort or standby mode. The idea is to keep the air moving and prevent mould build up in case high humidity is present.

Startup and switch off delay *(FA3/FA4)*

For air handling and re-condition units it is desirable to first start the fan before opening humidifiers, heating or cooling coils. The same goes for switching off. In case the heating or cooling coil was just running, the fan should extend its run time after the control valves are closed. Set the delay time for starting up and shutting down to extend fan run time before and after control outputs come on.

3-point outputs (Floating)

Assigning a 3-point output to a function or control sequence *(D01/D02)*

With *Parameter D00* set to ON two single binary outputs are changed into one 3-point output.
A 3-point output may be assigned to:

1. a control loop and one or both of its PID sequences,
2. a special function such as dehumidifying or economizer.
3. manual operation: The user can position the output directly with a setpoint with 0.5% resolution

Operation of 3-point outputs

The running time of the actuator used needs to be specified with *Parameter D03*. 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 D04*, 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.
Note: 3-point outputs with relays outputs should only be used with a large switching difference. Frequent switching may reduce operation life of relays and actuators.

Single binary outputs

Assigning a binary output to a function or control sequence *(D01/D02)*

With *Parameter D00* set to OFF, the binary output may be assigned to:

1. a control loop and one or both of its binary sequences,
2. a special function such as dehumidifying or economizer.
3. manual operation: The user can position the output directly with a setpoint with 0.5% resolution
4. state functions. The binary output is on while the controller is in comfort or standby, heat or cool mode, etc.

State functions

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.
- Output is ON if the controller is ON and in heating mode.
- Output is ON if the controller is ON and in cooling mode.
- Output is ON if demand exists on any other output. Typically for fan-supported heating/cooling.

Switch OFF delay *(D04)*

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

Switch ON delay *(D05)*

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

PWM outputs *(D06)*

Pulse width modulation (PWM) mode is enabled when setting a PWM cycle time of 1 second or above with *Parameter D06*. (The 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 PID settings of the respective control sequence.

It is not recommended to use cycle times below 100 seconds on relays outputs as the lifetime of the relays will be shortened with frequent switching. For PWM applications requiring cycle times below 100 seconds products with TRIACs are recommended.

Run time counter *(D09)*

Run time counters can be used to sum up the accumulated runtime of a device connected to a binary output. The counter runs up to 65536 hours and saves the run time every hour to EEPROM. The run time hours and the status of the binary output will be displayed when stepping through the available display pages with the operation terminal.

Maintenance alarm *(D10)*

The run time counter may be used to trigger a maintenance alarm once a certain run time is exceeded. Select limit to trigger a maintenance alarm. The limit is selectable in steps of 256 hours. Setting the time to 0 disables the maintenance alarm.

FU: Auxiliary Functions

The controller features 5 auxiliary functions that can be configured individually.

- 1FU: Enable controller based on input or/and alarm states
- 2FU: Switch comfort (occupied) and standby (non-occupied) mode
- 3FU: Switch heating – cooling mode
- 4FU: Setpoint setback
- 5FU: Economizer function

All the auxiliary functions are activated once they are assigned to an input. The setpoint setback has to be configured as well in the control loop. Please refer to descriptions of the control functions for details about setpoint setback.

Using an open contact input to activate a function

For an open contact input, the jumper needs to be placed into the RT setting. The software switch may be set to 0-10V setting. An open contact will result in a high value (100%). A closed contact reads as a low value (0%).

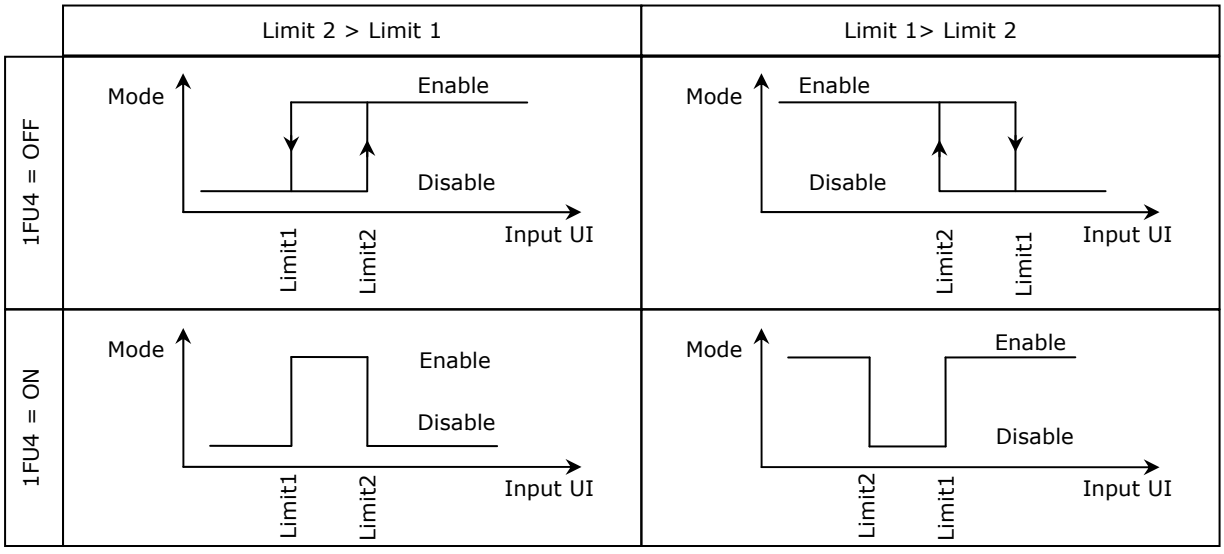
1Fu: Enable controller based on an input or/and alarm state:

The controller may be enabled or disabled based on an input and the state of alarms. There are several scenarios to enable the controller based on upper and lower limits of the input. Please see the table below for details.
Based on parameter 1Fu3 manual override may be permitted. This is useful to manually start the controller and allow it to get the measured input to an allowed state. If the allowed state cannot be achieved within the allowed time delay, the controller will again switch off.
These are the priorities for the enable functionality:

1. Disable when alarm: 1Fu 7
2. Time schedules
3. Enable – disable based on input
4. Manually enable disable

The alarm flags do disable the controller may be selected individually by parameter. Switch off delays still apply when an alarm becomes active. Delay times may be assigned for both activation and de-activation. This allows for a controller to startup before validation of operation values takes place. This function may be used as AND function for several conditions that need to be met for the controls outputs to remain active. It may as well be used as window contact to prevent loss of energy.

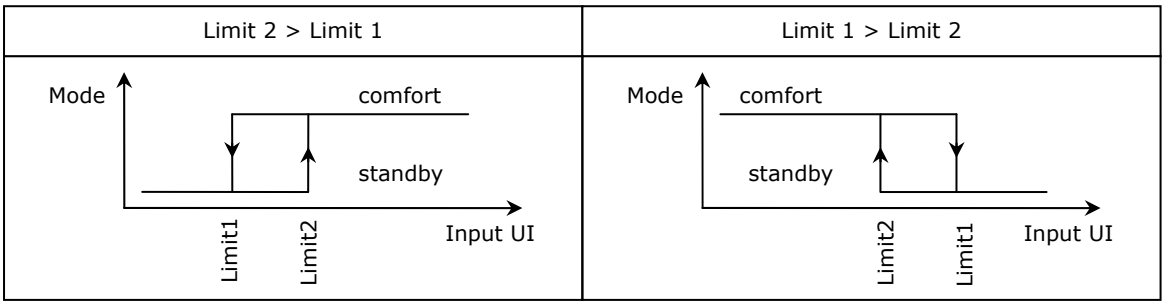
1Fu0: Select input and activate function
1Fu1: Manual override enabled
OFF = Manual override is not allowed
ON = Manual override is allowed
1Fu2: Time delay before enabling controller once conditions are met.
1Fu3: Time delay before disabling controller once allowed conditions are not met anymore.
Set limit 1 and limit 2 to enable or disable the controller. Following are the possibilities:



2Fu: Toggle of comfort and standby modes based on an external input

Standby and Comfort modes may be controlled through an external contact or input. This function may be used together with key card switches for hotels or motion detectors for offices.

Set limit 1 and limit 2 to switch between comfort and occupied mode. Following are the possibilities:

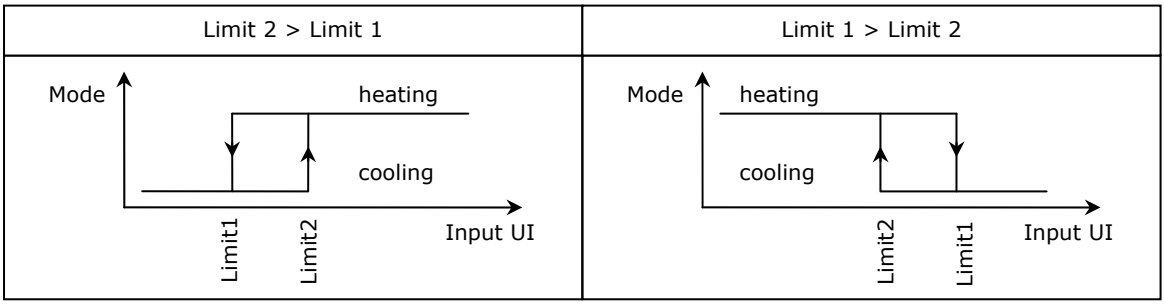


Standby activation Delay: The change from comfort to standby mode is delayed. The delay does not apply for a change from standby to comfort.

3Fu: Automatic controller heat – cool mode change

The heat – cool state of the controller may be controlled from a central location by binary contact or switched according to temperature levels of outside air or supply media. The state may as well depend on heating or cooling demand of a control loop.

Set limit 1 and limit 2 to switch between heating and cooling mode. Following are the possibilities:



Switch-over delay: The change between heating and cooling mode is delayed to avoid rapid switching. The delay may be defined in software. The factory setting is set to 5 minutes.

Heat-cool changeover with external switch	Control heat and cool setting of your controller from a central location by a central switch over. Note: all ground levels of involved controllers must be the same. Select binary input settings outlined above.
Auto Changeover with supply media temperature sensor	The external input may be used to automatically determine heating or cooling mode by measuring the temperature of the supply media. Connect a qualified passive sensor or active temperature transmitter to the assigned input. Heating mode is activated once the supply temperature is above the limit 2. Cooling is activated when the supply temperature is below the limit 1. The limits may be defined in software. Recommended is 16°C (61°F) for cooling and 28°C (83°F) for heating
Auto Changeover with outside temperature sensor	The external input may be used to automatically determine heating or cooling mode by measuring the outdoor temperature. Connect a qualified passive sensor or active temperature transmitter to the assigned input. Heating mode is activated once the outdoor temperature is below limit 2. Cooling is activated when the outdoor temperature is above the limit 1. The limits may be defined in software. Recommended is 16°C (61°F) for heating and 28°C (83°F) for cooling.
Heat-cool changeover based on demand of one control loop	Heat and cool state of the controller may as well be determined by the state of one of its control loops. Make sure the control loop chosen to determine the heat / cool state of the controller is set to demand based heating and cooling mode. (1L23 or 2L23 = OFF)

4Fu: Summer – Winter Setpoint compensation

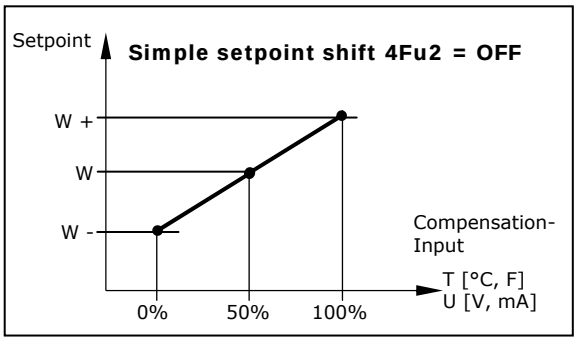
The measured value may be shifted up or down by the compensation parameter if required. Summer-Winter compensation is activated through parameter **L07** of each control loop.

4Fu0: Choose compensation input: This input delivers the measuring signal required to drive the setpoint shift. Normally an outdoor sensor is used.

4Fu1: Select if simple or detailed compensation is required

Simple compensation:

The setpoint is shifted based on the compensation input value. Three parameters are required.



4Fu2: Defines if the input signal has a direct or reverse effect on the setpoint. The setpoint grows with the input value in case direct is selected; it acts in the opposite way if reverse is chosen.

4Fu3: Defines the input span required to shift the setpoint by one step. For example a value of 5% for a control loop setpoint that has 0.5°C steps, will change the setpoint by 0.5° for every 5% the compensation input changes.

4Fu4: Defines the value of the compensation input where the control setpoint is not compensated.

For example: The compensation input is voltage from 0-10V. With 5V there shall be no compensation. For every 1V shift up or down, the setpoint shall change 1°C up or down simultaneously. The setpoint is in 0.5°C steps.
Following settins are required:
4Fu2 = OFF, set the shift to a direct relation
4Fu3 = 5%, for 0.5V (5%) we need to change 1 step = 0.5°. So that for 1° change we will use 1V.
4Fu4 = 50%. No change for 5V input

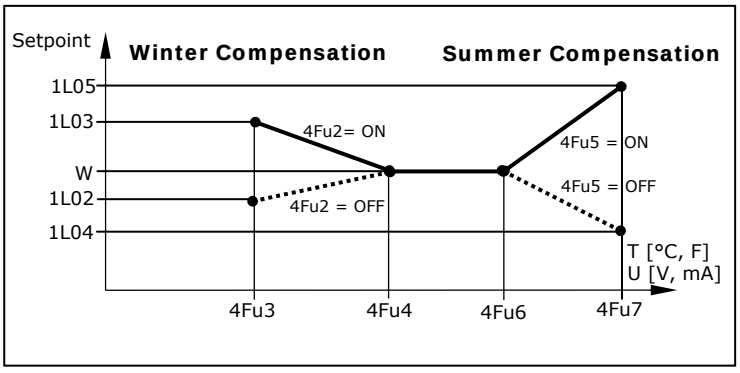
Detailed compensation:

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.

The winter compensation is active when the outside temperature drops below the upper limit of winter compensation **4Fu4**. Depending on parameter **4Fu2**, the setpoint is now shifted towards the heating setpoint minimum or maximum. The maximal compensation is reached when the temperature reaches the lower limit **4Fu3**. The actual set point will in this case be equal to the minimum heating set point limit for a negative shift or the maximum set point limit for a positive shift.

The summer compensation is active when the outside temperature exceeds the lower limit for summer compensation **4Fu6**. Depending on parameter **4Fu5**, the setpoint is now shifted towards the cooling setpoint minimum or maximum. It reaches its maximum when the temperature equals the upper limit **4Fu7**.

Example: Summer – Winter compensation active in control loop 1. **1L07** = 3



5Fu: Economizer (Free cooling)

The aim of the economizer function is to reduce energy consumption by utilizing situations where cooling requirements may be satisfied or supported by outdoor air. To operate, the economizer needs to receive a cooling demand signal. This signal may be generated from an onboard control loop or it can come from an external device.
In case demand origins from internal control loop, use the cascade feature of control loop 2: 2L06 = 3 or 4.
For a demand signal through an external controller, use the enable function FU1 of this controller.

The economizer function then determines if free cooling shall be provided for the first cooling stage. In case free cooling is to be provided, the outdoor and return air dampers are modulated to achieve a predefined cooling setpoint of the supply air. If mechanical cooling is to be used, cooling stage 2 is activated, the outdoor damper is closed to its minimum setting and return air damper is opened correspondingly.

Control loop 2 is fixed as control loop to maintain supply air temperature. Assign the supply air input and mechanical cooling stages or valves to control loop 2, binary stage 2 upwards. Do not assign mechanical cooling to stage 1 as this is reserved for free cooling. The outputs for outdoor and return air damper are assigned under special functions setup of the outputs. For example 1A00 = 5 and 1A01 = 1 for AO1 as outdoor damper and 2A00 = 5, 2A01 = 1 for AO2 as return air damper. The running direction for the return air damper needs to be reversed. It should be normally open whereas the outdoor damper is normally closed.

The supply air setpoint may be adjusted in the control loop setting.
The economizer is able to make a more or less qualified decision according to the inputs available. There are several options for inputs:

1. Outdoor enthalpy, return air enthalpy
2. Outdoor enthalpy only
3. Outdoor temperature, return air temperature
4. Outdoor temperature only

Obviously with option 1, the best decision may be made. Options 3 and 4, only work in areas with low humidity as the humidity factor cannot be taken into account.
Options 2 and 4 need a fixed setpoint of enthalpy or temperature to operate. The return air condition is not taken into account. With this option, free cooling only works on its own and not in combination with mechanical cooling.

Parameter Settings:

5Fu0: Enable economizer: Loop 2 is assigned as control loop, assign mechanical cooling to sequences of loop 2.
5Fu1: Outdoor sensor input (Temperature (dry bulb) or Enthalpy)
5Fu2: Return air sensor input (Enthalpy). Do not use temperature only for differential systems. Leave at 0 for fixed setpoint and dry bulb temperature systems
5Fu3: Setpoint of outdoor air temperature or enthalpy required to activate free cooling.
5Fu4: Delay time in minutes to activate mechanical cooling in case set point of loop 2 cannot be reached through free cooling.
1A00: = 5: Special function setup
1A01: = 1: Economizer mode: Outdoor damper (Normally closed), reverse direction for return air damper (Normally open)
1D01: = 5: Special function setup
1D02: = 1: Economizer mode: Outdoor damper (Normally closed), reverse direction for return air damper (Normally open)

Economizer Example:

The economizer in this example uses two mechanical cooling stages; demand is on board generated by loop 1; loop 2 controls the supply air temperature. Universal input 1 is the return air temperature sensor, UI 2 is supply air temperature sensor, UI3 is outdoor enthalpy, UI4 is return air enthalpy.
Outdoor damper is on AO1, Cooling stages are on DO1 and DO2.
Recommended parameter settings: Only the settings that are different from the default are listed.
1L00 = 1, select return air temp sensor as input for primary loop
2L00 = 2, select supply air temp sensor as input for secondary loop
2L03 = 16°C (61°F) select low limit for cooling air
2L04 = 20°C (68°F) select high limit for cooling air
2L06 = 3, cascade with cooling sequence
2L21 = 2°C (4°F) increase hysteresis to reduce switching cycles
2L23 = 30 seconds increase minimum stopping times for compressors
2L26 = 1.5C (3°F), set minimum allowed difference to enable the activation of mechanical cooling
5Fu0 = ON, enable economizer
5Fu1 = 3, select outdoor sensor UI3 (in dry areas a temperature sensor could be used as well)
5Fu2 = 4, select return enthalpy sensor UI4 (optional)
5Fu3 = 15° (59°F) for temperature sensor or 24 BTU for enthalpy sensors
5Fu4 = 10 Min
1A00 = 5, 1A01 = 1 select AO1 for outdoor air damper, connect return air damper as well to AO1 but reverse direction. Outdoor damper is closed when 0V and return air damper open. (Observe minimum fresh air amounts according local regulation. These can be adjusted with the min settings 1AO3 or mechanically on the actuator (if possible).
1d01 = 2, 1do2 = 1, 1do3 = 2; mechanical stage 1
2do1 = 2, 2do2 = 1, 2do3 = 3; mechanical stage 2

Setting of user parameters

The TCX2 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. Dial 009 in order to get access to the user 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	Enable manual control in cascade or fan control mode	ON, OFF	ON
UP 03	Enable manual change of controller heating / cooling mode	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	User Display: Select display while no key is pressed	ON, OFF	ON
UP 09	Select signal type of large LCD display in standard mode: 00 = OFF 01 = Input 02 = Setpoint 03 = Analog output 04 = Fan 05 = Binary output 06 = Clock	0…6	3
UP 10	Select ID of signal shown large LCD display in standard mode.	0…16	1
UP 11	Select signal type of small LCD display in standard mode	0…6	1
UP 12	Select ID for small LCD display in standard mode	0…16	1
UP 13	Select signal type of value for vertical LCD display	0…5	0
UP 14	Select ID of setpoint, input or output shown on vertical LCD display in standard mode	0…16	0
UP 15	OFF = Do not show heating & cooling state ON = Display heating & cooling state	ON, OFF	ON
UP 16	ON = Alarms blink after being active and need to be confirmed OFF = Alarms are only shown when they are active	ON, OFF	ON
UP 17	Clock display type: OFF = Show 24hour clock ON = Show 12hour clock (AM, PM)	ON, OFF	OFF (24h)
UP 18	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 return to scheduled mode Comfort mode is activated while the unit is scheduled to be in OFF or Standby mode	0…255	60 (Min)
UP 19	Constant backlight for display. OFF = Backlight will light up only when keys are touched ON = Backlight lights up constantly	ON, OFF	OFF

Configuration of the controller

Proceed in the following steps in order to adapt the controller to its application:

1. Set jumpers 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

Configuration parameters for firmware version 1.0

The TCX2 can be adapted to a wide variety of applications. The adaptation is done through parameters. 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").

Control Parameters (password 241)

Warning! Only experts should change these settings! The parameters are grouped according to following control modules.

Module	Description
LP	Control loops
	1L = control loop 1 to 4L = control loop 4
UI	Universal input
	01u = universal input 1 to 08u = universal input 8
	09u = virtual input 1 to 10u = virtual input 2 (only –VPP type)
AL	Alarm configuration
	1AL = alarm 1 to 8AL = alarm 8
Fu	Functions
	1Fu = Remote enable
	2Fu = Remote Comfort – Standby switchover
	3Fu = Heat – Cool change
	4Fu = Summer – Winter Compensation
	5Fu = Economizer
Ao	Analog output
	1Ao = Analog output 1 to 3Ao = Analog output 3
FAN	Fan output functions
	1FA = Fan output 1 to 2FA = Fan output 2
Fo	Floating output
	1Fo = Floating output 1 to 3Fo = Floating output 3
Do	Binary output
	1Do = Binary output 1 to 6Do = Binary output 6
Co	Communication setup (refer to separate communication brochure)
COPY	copy mode to copy full parameter sets between run, default and an external eeprom with up to 4 saving locations

Setting of engineering parameters

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. Dial 0241 in order to get access to the engineering parameters. Press OPTION after selecting the correct password.
3. Once logged in the parameter group can be selected with the UP and DOWN key. Enter the group with the OPTION key.
4. Select the item number with UP and DOWN keys. Enter the item number with the OPTION key
5. Once the item is selected, the parameter is displayed immediately
6. 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.
7. After you are done, press OPTION or POWER in order to return to the parameter selection level.
8. Press the POWER key again so as to leave the menu and return to the group selection. Press POWER while in the group selection to return to normal operation.
9. The unit will return to normal operation if no key is pressed for more than 5 minutes.

The copy feature

It is now possible to backup and refresh the entire parameter set to a second onboard memory (default memory) or a plug-in memory.

Removable plug-in memory

The plug-in memory is an accessory that can be plugged in on the side of the TCX2. Once connected the power LED should light up. The memory can hold up to 4 individual parameter sets. It is thus easy for a distributor or site engineer to update a variety of standard installations.

Auto-load

While copying a parameter set to eeprom, the user may choose the auto-load feature. With this feature set, the parameters load automatically when powering up the controller. It is thus possible for a non-technical person to perform a parameter update.

Procedure to copy parameter sets

1. Login to engineering parameters as described above.
2. Press UP or DOWN until COPY is selected
3. Press the OPTION key. Select copy source: These are the options:
    0. CLR ⇨ The target will be erased
    1. RUN ⇨ Run time memory
    2. DFLT ⇨ Default: On board backup memory
    3. EEP1 ⇨ External plug-in folder 1
    4. EEP2 ⇨ External plug-in folder 2
    5. EEP3 ⇨ External plug-in folder 3
    6. EEP4 ⇨ External plug-in folder 4
4. Press OPTION key. Now select copy destination: These are the options:
    1. RUN ⇨ Run time memory
    2. DFLT ⇨ Default: On board backup memory
    3. EEP1 ⇨ External plug-in folder 1
    4. EEP2 ⇨ External plug-in folder 2
    5. EEP3 ⇨ External plug-in folder 3
    6. EEP4 ⇨ External plug-in folder 4
5. Press OPTION key. Your selection is shown on the large digits: source ID to target ID. For example run time memory to eep1 is shown as 1to3. After confirming the selection choose YES or AUTO to start the copy process. Select NO to abort. AUTO is only available if the target is the external plug in. By selecting AUTO: The parameters will load automatically when power up the controller. The parameter set with the smallest index will be loaded, if in one plug-in several parameter sets have the auto flag set.
6. Press the OPTION key to conclude the selection. The Data LED on the plug-in should light up in case it is copied to or from. PEND is shown while the copy process takes place.
   There are several possibilities for the result:
    - Good: The copy process was successful
    - Fail: Err5, Communication problem. The plug in module is either damaged or missing
    - Fail: Err6, Checksum mismatch. The checksum of the source data was incorrect. Data corruption. This may happen if the plug-in has not been written to before or data corruption took place.

UI: Universal Input configuration (8 universal inputs 01u - 08u)

Parameter	Description	Range	Default
01 u0	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
01 u1	Signal display minimum value	-50…205	0
01 u2	Signal display maximum value	-50…205	100
01 u3	Range of universal inputs (For analog inputs only) 0 = x1 1 = x10 2 = x100 3 = square root 4 = square root x 10 5 = square root x 100	0 – 5	0
01 u4	Unit of universal input (For analog inputs only): 0 = no unit 1 = % 2 = °C /°F 3 = Pa	0 – 3	1
01 u5	Samples taken for low pass filter	0…100	3
01 u6	Calibration	Range dep	0
01 07	Select input function. Average, min and max functions work between UI1 and the current UI. Differential is between the current UI and the next lower UI. For example UI2-UI1. 0 = Not active 1 = Average function (UI 1…UI n) 2 = Minimum function(UI 1…UI n) 3 = Maximum function(UI 1…UI n) 4 = Differential UI(n)-UI(n-1)	0…4	0

UI: Virtual Input configuration (2 virtual inputs 09u – 10u)

Parameter	Description	Range	Default
09 u0	Input signal type: 0 = input not active 1 = OPA-X2 2 = Bus Plug-in 3 = not used	0 - 3	0
09 u1	Signal display minimum value	-50…205	0
09 u2	Signal display maximum value	-50…205	50
09 u3	Range of universal inputs (For analog inputs only) 0 = x1 1 = x10 2 = x100 3 = square root x 1 4 = square root x 10 5 = square root x 100	0 – 5	0
09 u5	Unit of universal input (For analog inputs only): 0 = no unit 1 = % 2 = °C /°F 3 = Pa	0 – 3	2
09 u6	Samples taken for averaging control signal	0…100	3
09 u7	Calibration	Range dep	0
09 08	Select input function. Average, min and max functions work between UI1 and the current UI. Differential is between the current UI and the next lower UI. For example UI2-UI1. 0 = Not active 1 = Average function (UI 1…UI n) 2 = Minimum function(UI 1…UI n) 3 = Maximum function(UI 1…UI n) 4 = Differential UI(n)-UI(n-1)	0…4	0

LP: Control parameters (1L to 4L)

Parameter	Description	Range	Default
1L 00	Select controls input: 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0…10	0
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: 4Fu 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 previous 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)

PID Control Sequence

Parameter	Description	Range	Default
1L 09	Offset for heating PID sequence	Acc input	0
1L 10	Offset for cooling PID 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, 0 disables ID part 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 disables I part	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	2.0° (4.0°F)
1L 20	Switching span cooling	Acc input	2.0° (4.0°F)
1L 21	Switching hysteresis X_H	Acc input	0.5° (1.0°F)
1L 22	Switching delay min running time for binary sequences	0…255s	10s
1L 23	Switching delay min stopping time for binary sequences	0…255s	10s

General Control Sequence

1L 24	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 25	Delay for heat – cool changeover in case above parameter is OFF	0…1250s	300s
1L 26	Max allowed setpoint deviation (will generate an alarm if enabled in alarm parameters), Disabled if set to 0.	Acc input	0.0

AL: Alarm function (8 Alarm function 1AL – 8AL)

Parameter	Description	Range	Default
1AL 0	Alarm 1: Select input 0 = not active 1 = Universal input (Select input in 1AL 1) 2 = Max. setpoint deviation for control loop (select loop in 1AL 1) 3 = Maintenance alarm from run time counters 4 = Feedback input for fan 1 5 = Feedback input for fan 2	0…5	0
1AL 1	Define input if 1AL 0 = 1 or 4, 5 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0…10	0
	Define control loop if 1AL 0 = 2, Note: max deviation limit is defined in control loop parameters 0 = all active control loops 1 = loop 1 2 = loop 2 3 = loop 3 4 = loop 4	0…10 (valid entry 0…4)	0
	Define run time counter of which binary output if 1AL 0 = 3, 0 = all binary outputs 1 = Binary output 1 2 = Binary output 2 3 = Binary output 3 4 = Binary output 4 5 = Binary output 5 6 = Binary output 6	0…10 (valid entry 0…6)	0
1AL 2	Alarm or interlock mode OFF = Alarm mode, Alarm shows on display ON = Interlock mode, no display on the screen, no acknowledgment	OFF, ON	OFF
1AL 3	Automatic reset or acknowledge to reset OFF = Alarm condition resets automatically after alarm condition is removed ALA blinks in display. Outputs will switch on again. ON = Alarm condition remains, even alarm condition is removed. Alarm must be acknowledged before outputs return to normal operation.	OFF, ON	OFF
1AL 4	Delay until alarm is active; the delay is in seconds unless setpoint deviation is selected. If AL0 = 2, the delay is in minutes	AL0 ≠ 2: 0…1250 sec AL0 = 2: 0…1250 Min	0
1AL 5	Type of alarm (applies only if 1AL0 = 1) OFF = Low limit alarm ON = High limit alarm	OFF, ON	OFF
	Type of feedback (applies only if 1AL0 = 4,5) OFF = Direct: Fan on, feedback high ON = Reverse: Fan on, feedback low		
1AL 6	Alarm limit (applies only if 1AL0 = 1)	Acc. Input range	10%
1AL 7	Hysteresis for alarm setback (applies only if 1AL0 = 1)	Acc. Input range	5%

Ao: Analog Output (1Ao to 3Ao)

Parameter	Description	Range	Default
1A 00	Selection of control loop or special function 0 = OFF 1 = Loop 1 2 = Loop 2 3 = Loop 3 4 = Loop 4 5 = Special functions (Dehumidification, Economizer, etc) 6 = Manual override (0 – 100%) 7 = Feedback of universal input	0 – 7	1
1A 01	Configuration of output signal depending on **1Ao 0** If 1Ao 0 = 1…4 (control loop 1…4) 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 (based on feedback min max settings)	0 – 3	0
	Configuration of output signal depending on **1Ao 0** If 1Ao 0 = 5 (Special functions) select function: 0 = Max of loop 1 cooling and loop 2 dehumidifying 1 = Economizer: Outdoor damper actuator, reverse direction on actuator for return air damper	0 – 3	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%. In case of 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%. In case of conflicting alarms, the output will be set to 0% ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1A 09	If 1Ao 0 = 7 (Feedback of input), select feedback source: 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0 – 11	0
1A 10	Feedback minimum	Acc. Input range	0
1A 11	Feedback maximum	Acc. Input range	0

Fan: Fan Output

1FA uses DO1, DO2, DO3; 2FA uses DO4, DO5, DO6

Parameter	Description	Range	Default
1FA 0	Number of fan speeds	0 - 3	0
1FA 1	Selection of control loop for fan 0 = Fan output disabled 1 = Loop 1 2 = Loop 2 3 = Loop 3 4 = Loop 4 5 = Operation mode (on, when operation mode is on) 6 = Manual only	0 – 6	0
1FA 2	Fan outputs select sequence if 1FA 1 = Loop 1 to or Loop 4: 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 = Demand based on Heating, Reverse Y_{H1}, Y_{R1} 4 = Demand based on Cooling, Direct Y_{C1}, Y_{D1} 5 = Demand based on Heating and Cooling, Y_{H1} + Y_{C1}, Y_{R1} + Y_{D1}	0 – 5	5
1FA 3	Mold protection: In automatic fan speed mode, the lowest fan speed keeps running, even the setpoint is reached	ON, OFF	OFF
1FA 4	Startup delay: Delay before opening control outputs when switching on.	0…255s	30s
1FA 5	Switch off delay: Delay to keep fan running when switching OFF.	0…255s	0s
1FA 6	Choose alarm to set output to 100%. In case of conflicting alarms, the output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1FA 7	Choose alarm to set output to 0%. In case of conflicting alarms, the output will be set to 0% ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽

Binary Outputs

Parameter	Description	Range	Default
1d 00	Enable Floating Output (DO1, DO2 Floating) OFF = DO1, DO2 are two binary outputs ON = DO1, DO2 are one floating output DO1 = open, DO2 = close	ON, OFF	OFF
3d 00	Enable Floating Output (DO3, DO4 Floating) OFF = DO3, DO4 are two binary outputs ON = DO3, DO4 are one floating output DO1 = open, DO2 = close	ON, OFF	OFF
5d 00	Enable Floating Output (DO5, DO6 Floating) OFF = DO5, DO6 are two binary outputs ON = DO5, DO6 are one floating output DO1 = open, DO2 = close	ON, OFF	OFF
For floating outputs: In case d00 = ON			
1d 01	Configuration Digital Output 0 = OFF 1 = Loop 1 2 = Loop 2 3 = Loop 3 4 = Loop 4 5 = Special functions 6 = Manual override	0…6	0
1d 02	Floating outputs (1d01 = Loop1 or Loop2) 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 = not used	0…3	0
	Configuration of output signal depending on **do 1** If d01 = 5 (Special functions) select function: 0 = Max of loop 1 cooling and loop 2 dehumidifying 1 = Economizer: Outdoor damper actuator, reverse direction on actuator for return air damper	0 – 3	0
1d 03	Not used	0…6	0
1d 04	Running Time (Time to run from Open to Close)	0 – 255s	90s
1d 05	Switching difference for floating signal	0 – 100s	5s
1d 06	Not used	0 – 1275 s	0s
1d 07	Choose alarm to set output to 100%. In case of conflicting alarms, the output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 08	Choose alarm to set output to 0%. In case of conflicting alarms, the output will be set to 0% ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 09	Not used	ON, OFF	OFF
1d 10	Not used		

For binary outputs: In case d00 = OFF

Parameter	Description	Range	Default
1d 01	Configuration Digital Output (only if floating disabled) 0 = OFF 1 = Loop 1 2 = Loop 2 3 = Loop 3 4 = Loop 4 5 = Dehumidification with priority output of LP1 cooling and LP2 dehumidification 6 = Manual override 7 = State functions	0…7	0
1d 02	Binary outputs (1d00 = OFF): Select sequence if 1d01 = Loop 1 or Loop 2: 0 = Heating, Reverse YH1, YR1 1 = Cooling, Direct YC1, YD1 2 = Heating and Cooling (2 pipe system), YH1 + YC1, YR1 + YD1 3 = not used	0…3	0
	Configuration of output signal depending on **do 1** If d01 0 = 5 (Special functions) select function: 0 = Dehumidifying, Max of loop 1 cooling and loop 2 dehumidifying 1 = Economizer: Outdoor damper actuator, reverse direction on actuator for return air damper	0 – 3	0
	If d01 = 7 (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 – 3	0
1d 03	Select sequence (If Do 0 = 1…4) and if PWM parameter = 0 0 = Operation mode, Output is active when mode is active 1 = binary mode: Stage 1 2 = binary mode: Stage 2 3 = binary mode: Stage 3 4 = binary mode: Stage 4 5 = binary mode: Stage 5 6 = binary mode: Stage 6	0 – 6	0
1d 04	Switch off delay Time the output signal needs to be off, before output switches off	0 – 255s	90s
1d 05	Switch on delay Time the output signal needs to be on, before output switches on	0 – 255s	10s
1d 06	Set PWM cycle time in seconds, 0 deactivates PWM.	0 – 1275 s	0s
1d 07	Choose alarm to set output to 100%. In case of conflicting alarms, the output will be set to 0%. ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 08	Choose alarm to set output to 0%. In case of conflicting alarms, the output will be set to 0% ▽▽▽▽▽▽▽▽ Alarm: 1 2 3 4 5 6 7 8	Selection	▽▽▽▽▽▽▽▽
1d 09	d07 and d08 only function if output is in binary mode: OFF: Do not count run time and reset counter to 0 ON: Count run time in hours while a binary output is switched on	OFF, ON	OFF
1d 10	Trigger function alarm when run time is reached (may be used as maintenance alarm) 0 = alarm disabled	0…12750h	0

Special Functions

1Fu: Remote enable

Parameter	Description	Range	Default
1Fu 0	Select input for remote enable function: 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0…10	0
1Fu 1	Manual override permitted If set to ON, unit may be started in Manual without waiting for delay time	ON, OFF	OFF
1Fu 2	Activation delay (Seconds) = the time the input needs to be within active limits before unit is enabled	0 – 1275 s	0
1Fu 3	In-activation delay (Seconds) = the time the input needs to be inactive before the unit is disabled	0 – 1275 s	300
1Fu 4	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
1Fu 5	Input limit 1 (See 1Fu 4 for description)	Range acc input	10
1Fu 6	Input limit 2 (See 1Fu 4 for description)	Range acc input	90
1Fu 7	Disable in case of alarms	Selection	▽▽▽▽▽▽▽▽

2Fu: Remote comfort – standby change

Parameter	Description	Range	Default
2Fu 0	Select input for remote comfort – standby change function: 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0…10	0
2Fu 1	Activation delay (seconds) = the time the input needs to be inactive before the controller switches to standby mode.	0 – 1275 s	300
2Fu 2	Input limit 1 (Comfort Mode)	Range acc input	10
3Fu 3	Input limit 2 (Standby Mode)	Range acc input	90

3Fu: Controller heat – cool change

Parameter	Description	Range	Default
3Fu 0	Select input for remote heat – cool change function: 0 = not active or based on control loop, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0…10	0
3Fu 1	If heat – cool is based on a control loop, select control loop here (3Fu 0 must be set to 0) 0 = not active or based on universal input 1 = Based on heat – cool status of control loop 1 2 = Based on heat – cool status of control loop 2 3 = Based on heat – cool status of control loop 3 4 = Based on heat – cool status of control loop 4	0…4	0
3Fu 2	Activation delay (Seconds) = delay before heat – cool mode is switched	0 – 1275 s	300s
3Fu 3	Input limit 1 (Cool limit) applies only if based on input	Range acc input	10
3Fu 4	Input limit 2 (Heat limit) applies only if based on input	Range acc input	90

4Fu: Summer – Winter Compensation

Parameter	Description	Range	Default
4Fu 0	Selection of Compensation Input 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0…10	0
4Fu 1	Type of compensation OFF = Simple shift input signal shifts setpoint one step by step ON = Detailed shift: setpoint is shifted towards loop setpoint min max depending on input signal level.		

Simple shift 4Fu1 = OFF

4Fu 2	Shift is direct or reverse acting OFF = Direct: Value smaller than limit reduces setpoint ON = Reverse: Value smaller than limit increases setpoint	ON, OFF	OFF
4Fu 3	Input span required to shift setpoint one step	Acc input range	10
4Fu 4	Input where setpoint shift is = 0	Acc input range	50

Detailed shift 4Fu1 = ON

4Fu 2	Winter Compensation: OFF = setpoint is shifted negative to lower setpoint limit ON = setpoint is shifted positive to upper setpoint limit	ON, OFF	OFF
4Fu 3	Winter Compensation (Setpoint shift with low compensation signal) Lower Limit: input signal with maximum setpoint shift	Acc input range	0
4Fu 4	Winter Compensation (Setpoint shift with low compensation signal) Upper Limit: Input signal at begin of setpoint shift.	Acc input range	0
4Fu 5	Summer Compensation: OFF = setpoint is shifted negative to lower setpoint limit ON = setpoint is shifted positive to upper setpoint limit	ON, OFF	ON
4Fu 6	Summer Compensation (Setpoint shift with high compensation signal) Lower Limit: input signal at begin of setpoint shift	Acc input range	0
4Fu 7	Summer Compensation (Setpoint shift with high compensation signal) Upper Limit: Input signal with maximum setpoint shift.	Acc input range	0
4Fu 8	Hot / Cool Symbol while compensation is active OFF= Hide symbol ON= Show symbol	ON, OFF	OFF

5Fu: Economizer

Parameter	Description	Range	Default
5Fu 0	Enable economizer function	On, OFF	OFF
5Fu 1	Outdoor air sensor input (Temperature or Enthalpy): 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0..10	0
5Fu 2	Return air sensor input (Temperature or Enthalpy): 0 = not active, 1 = UI 1, 2 = UI 2, 3 = UI 3, 4 = UI 4, 5 = UI 5 6 = UI 6, 7 = UI 7, 8 = UI 8, 9 = U1 9, 10 = UI10	0..10	0
5Fu 3	Temperature setpoint @ 50% humidity if 5Fu2 = 0 or difference between return and outside temperature or enthalpy required to activate free cooling	Acc. Input range	0
5Fu 4	Delay time in minutes to activate additional cooling outputs or switch to mechanical cooling in case supply air set point cannot be reached through free cooling.	0…255	30