Operating instructions for X2 devices with button display

The X2 operating system was designed for universal controllers and sensors. Devices based on the X2 operating system contain a multitude of standardized functions and application possibilities. From simple ventilation controllers for domestic applications to HVAC system solutions for entire buildings. There is a suitable solution for almost every application. With the EasySet program, the controllers can be conveniently read out, programmed and transferred to other controllers.

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3 General Operation ____ **6**
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1 Overview

1.1 Applications

These operating instructions apply to devices of the X2 series with integrated control unit, as well as to devices of the OPA2 and OPU2 series.

In addition, the various product descriptions and the programming instructions for technicians are contained in separate documents. This should facilitate the work with the different controllers and operating levels.

2 Display and Operation

2.1 User Interface

2.1.1 TCX2 / TCI2 series X2 devices

Figure 1: TCX2

Figure 2: TCI2

Button Symbol	Function	Description
⏻	Operating mode	Operating mode selection (On / Off, Occupied / Unoccupied mode) Menu navigation: Back to the previous menu Long press: Off if occupation mode is configured
⮌	Return Back	Menu navigation: Return to top menu Menu navigation: Back to the previous menu
●	Right (Confirm)	Menu navigation: Next menu point Alarms: Confirm the alarm
△	Up (+)	Adjust temperature set points and control parameters
▽	Down (-)	Adjust temperature set points and control parameters

2.1.2 OPA / OPU / OPC2-S / SDC2 / SOC2 series X2 devices

Figure 3: OPA

Figure 4: OPU

Figure 5: OPC2-S / SDC2 / SOC2

Button Symbol	Function	Description
⏻	Operating mode (Back)	Operating mode selection (On / Off, Occupied / Unoccupied mode) Menu navigation: Back to the previous menu Long press: Off if occupation mode is configured
▷ ●	Right (Confirm)	Menu navigation: Next menu point Alarms: Confirm the alarm
△	Up (+)	Adjust temperature set points and control parameters
▽	Down (-)	Adjust temperature set points and control parameters

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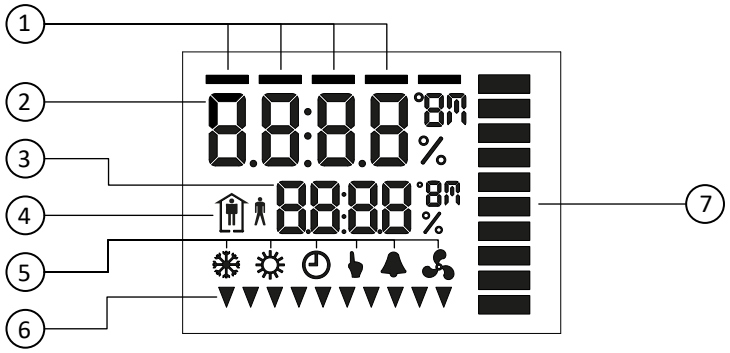
2.2 LCD Display

Overview

This section explains the meaning of the symbols on the LCD Display of the different operation terminals.

2.2.1 TCX2 / TCI2 / OPA / OPU / OPC2-S / SDC2 / SOC2 series Display



1	Control loop indication - When changing setpoints, the top bar indicates the control loop (1-4) that is being changed.
2 3	Large digits Small digits - The large and small digits are used to show current input values, acting setpoints, alarms and errors, submenu text or setup and configuration values, depending on the operating state of the controller.
4	Operating Mode - See chapter 2.3
5	Controlling Mode - See chapter 2.4 Alarm - See chapter 2.6 Fan is active / fan auto mode - In auto mode fan speed is automatically regulated by the controller.
6	Triangle indication - In idle display, the triangles in the display indicate active digital outputs. - In parameter setting, the triangles in the display are used for setting weekly time schedules indicating the days of the week the schedule is active.
7	Indication side bar - The side bar represents the analog indication of a value while 1 bar represents a small value and all bars active represent the maximum value. - No side bar is displayed if in configuration disabled. - When creating schedules, the sidebar serves as a navigation aid for the corresponding steps.

2.3 Operating Modes

Display	Mode	Description
	Occupied (Comfort)	The X2 device maintains the occupied (comfort) temperature set points defined within each control loop. In occupied mode, the fan can be set to auto or manual fan speed.
	Unoccupied (ECO)	The X2 device maintains the unoccupied (ECO, economy) temperature set points defined within each control loop.
OFF	Protection (Holiday)	The X2 device runs in standby. The system is protected against overheating and frost if enabled. Inputs are monitored for alarms.

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2.4 Controlling Modes

Display	Mode	Description
❄	Cooling	Cooling mode activates cooling equipment for temperatures above the set point.
☼	Heating	Heating mode activates heater for temperatures below set point.
☝	Manual	Manual override mode
🕒	Clock / Schedules	Set clock, change time schedules or indication of set time schedules
🌀	Fan	The side bars show the fan speed.

2.5 Operation Status

Display	Status	Description
🔔	Alarm	Alarm / Error active (see chapter 2.6 and 2.7)
LED on / flashing	Normal	Status LED is on or blinks briefly once every 5 seconds
LED blinking	Alarm / Error	Status LED blinks every second in case there is an alarm or error condition

2.6 Alarm messages

If an alarm is active, the alarm symbol 🔔 is set and an alarm message is shown on the small digits.

Some alarms can be confirmed by pressing the "Right" button.

Small Digits	Alarm condition
ALA1 ALA2 … ALA7 ALA8	Up to 8 different alarms can be displayed. The alarm condition is programmable and must be defined when configuring the controller. See separate alarm list for the meaning of the programmed alarms. The list is provided by the configurator of the X2 device.

Sample display:

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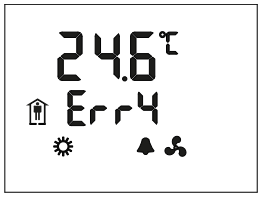
2.7 Error messages

If an Error is active, the alarm symbol is set and the Error messages are shown on the small digits.
Some errors can be confirmed by pressing the "Right" button.

Small Digits	Error condition
Err1	Communication error between operating terminal and controller
Err2	Internal error: Firmware version of the memory does not match firmware.
Err3	Internal error
Err4	Configuration error: An assigned input is not activated or has failed. Check all settings and ensure that all inputs used are activated and functional.
Err5	Copy error: Communication error with external memory AEC-PM1 or AEC-PM2. The plug-in module is either damaged or missing.
Err6	Copy error: Checksums of the data record are incorrect. The data record is invalid.

Sample display:



2.8 Status LED

Most devices have a status LED. The position of the status LED is defined in the product data sheet.

In normal operation, the LED flashes briefly once every 5 seconds.

In an alarm or error condition, the LED flashes every second.

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3 General Operation

3.1 Turning the X2 Device On and Off

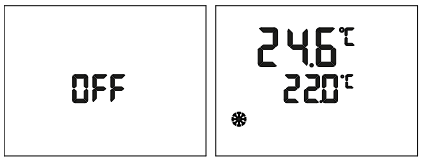
To turn the X2 device on, press the (⏻) button. Press the (⏻) button again to turn the X2 device off.

ⓘ The system may be configured so that it cannot be turned off.

Note on turning off the X2 device

ⓘ If turned off, the X2 device runs in standby. In standby the system is protected against overheating and frost if enabled.

Sample display Off / On:



3.2 Changing Setpoints

Overview

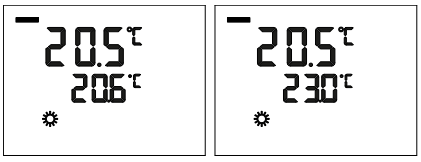
This section describes how to change the set point of a control loop.

The large digits show the input value. The small digits show the set point. Horizontal bars top left show which loop is being displayed. It is possible to omit the display of the current value. In this case the setpoint will be shown on the large digits and nothing is shown on the small display.

ⓘ The X2 device allows for various ways of user access and display screen configurations. The actual display my differ from the samples below.

Procedure

1. Press the (△) or (▽) button briefly to go to the first control loop.
   ➔ Input value and setpoint are displayed.
   ➔ Top bar indicates control loop (1-4).
2. Change the setpoint with the (△) or (▽) button.
   The setpoint is automatically saved after 2 seconds.
3. Press the (▷ / ●) button to go to the next control loop.



3.3 Manual Controlling Mode

The hand symbol is displayed during a pending delay, if a time schedule is overridden or a fan is in manual.

In case a start-up delay is active: - The controller remains switched off and displays the hand symbol until the delay has elapsed. Then the controller switches on and the hand symbol goes out.

3.4 Protection (OFF) Operating Mode

The X2 device runs in protection mode. The system is protected against overheating and frost if enabled. Inputs are monitored for alarms.

3.5 Holiday Mode

If an annual time schedule is active, the X2 device runs in standby. The system is protected against overheating and frost if enabled. Inputs are monitored for alarms.

3.6 Power Failure

All parameters and set points are memorized and do not need to be re-entered. The switch-on behavior on return of the power supply is set by the technician.

If a real-time clock is present, the clock and time schedule settings are retained for 48 hours after the device has been powered for at least 10 hours.

For additional information see chapter 5.1, page 8.

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4 Applicationspecific Operation

The X2 device allows for various ways of customized operation, user access and display screen configurations.

4.1 Idle Display

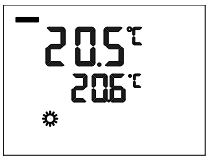
The idle display is activated when no key has been pressed for 30 seconds.

The idle display can be deactivated by the technician.
If deactivated, the display will remain in the last used window.

4.2 Fan Coil Mode

In "Fan Coil Mode" there is just one control loop and one active fan.

Procedure

1. Press the (△) or (▽) button briefly to go to the control loop. ➔ Input value and setpoint are displayed. 2. Change the setpoint with the (△) or (▽) button. The setpoint is automatically saved after 2 seconds.	
3. Press the (▷ / ●) button briefly to change the fan speed. ➔ The side bar indicates the actual fan speed. The fan speed will alternate between FSP0 -> FSP1 -> FSP2 -> FSP3 -> AUTO –> FSP0 FSP0 may be disabled by settings, the number of available fan speeds may be different.	

FSPx = FanSpeed 0-3

4.3 Override of secondary set point in cascade control

If cascade control is active (with VAV for example) or if the setpoint is controlled by an input, the user can manually select the set point (the loop is then changed to constant air volume mode). This function is helpful for tuning the VAV system. While the secondary loop is displayed change the set point with UP/DOWN. The hand symbol appears. Change setpoint again to cancel cascade override. The hand symbol disappears.

With cascade control or if the setpoint is controlled by an input, manual override of the setpoint can be deactivated. This is defined by the technician in the controller settings.
If manual override for cascade controls is deactivated, the secondary control loop will not be shown on the display.

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5 Extended Operating Level

5.1 Clock Operation

Overview

This section gives an overview of the clock and the available timed functions of the X2 controller.

Note on Accuracy

Warning: The TCX2-40863 and X2 devices with a "C" addition (e.g. TRI2-FU-TH-221.202**C**) have a real-time clock. This clock is accurate to two seconds a day.

Other TCX2 series devices may have no time functions or if they do, they calculate the time based on the processor's internal clock speed. This time source is accurate to approx. 2 minutes per day. If the controller uses its time program functions, it is therefore necessary to synchronize the time of these controllers at least every 24 hours with an exact time base.

Time Programs

The TCX2-40863 and devices with a "C" addition (e.g. TRI2-FU-TH-221.202**C**) have a real-time clock with a maintenance-free power backup.

Up to 12 time and weekday programs or annual holidays can be programmed (Pr01 to Pr12). Schedules can change the operating mode of the controller (on, off, occupied, unoccupied), change the fan status, position an output directly or change a setpoint.

The summer/winter time changeover can be activated by the technician via user parameters.

A flashing clock indicates that the time has not been set or that the terminal has been without power for more than 48 hours. The time must be set for the schedules to work.

5.2 Clock Setting

5.2.1 Setting time and date of clock

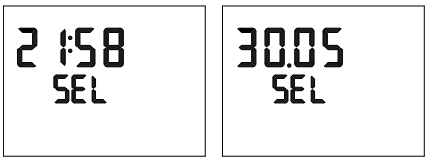
Overview

This section describes how to set the time and date of the X2 system clock.

Procedure

1. Press the (▷ / ●) button longer than 2 seconds.

   ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.



2. Press the (▷ / ●) button briefly to start changing the time and date:

   Minutes flashes: (△) (▽) button for adjustment, (▷ / ●) button to save.

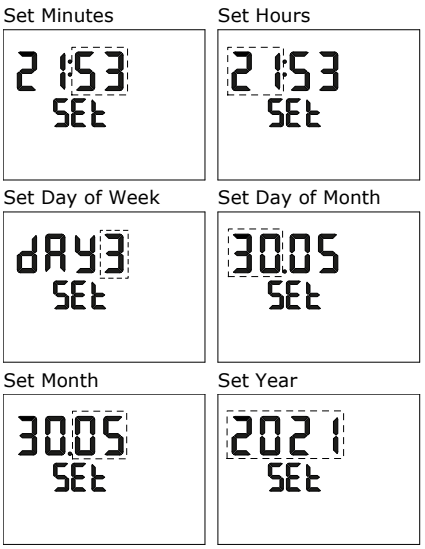
   Hours flashes: (△) (▽) button for adjustment, (▷ / ●) button to save.

   Day of the week flashes: (△) (▽) button for adjustment, (▷ / ●) button to save.
   Note: Monday is day 1 of the week.

   Day of the month flashes: (△) (▽) button for adjustment, (▷ / ●) button to save.

   Month flashes: (△) (▽) button for adjustment, (▷ / ●) button to save.

   Year flashes: (△) (▽) button for adjustment, (▷ / ●) button to save.



Press the (⏻) button (1x) to go back to the previous submenu.

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5.3 Set Time Schedules

Overview

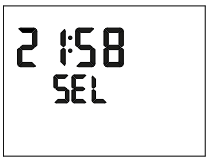
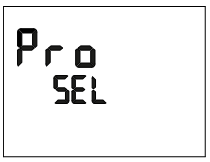
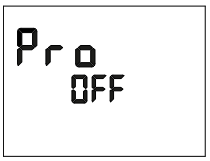
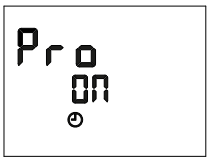
Up to 12 time and weekday programs or annual holidays can be programmed (Pr01 to Pr12).

5.3.1 Time schedule enable/disable

Overview

This section describes how to generally enable/disable timed events (schedules) on a X2 device.

Procedure

1. Press the (▷ / ●) button longer than 2 seconds. ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.	
2. Press the (△) button briefly to go to the scheduler submenu. ➔ **PRO** and **SEL** is displayed.	
3. Press the (▷ / ●) button: Schedule status indicates whether it is **OFF** or **ON**. Press the (▷ / ●) button to change the status. ➔ When schedule is ON, 🕘 is displayed.	 
Press the (⏻) button (1x) to go back to the previous submenu.	

5.3.2 Set weekly time schedules

Overview

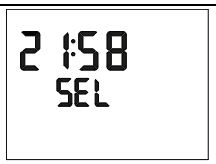
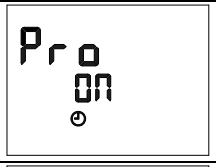
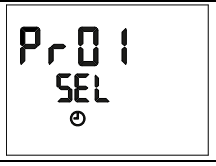
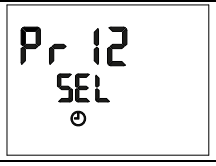
This section describes how to set a daily, weekly repeated action/function.

Up to 12 time and weekday programs can be programmed (Pr01 to Pr12).

Requirements

Time schedule is enabled (see chapter 5.3.1).

Procedure

1. Press the (▷ / ●) button longer than 2 seconds. ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.	
2. Press the (△) button briefly to go to the scheduler submenu. ➔ **PRO** and **SEL** is displayed.	
3. Press the (▷ / ●) button: Schedule status indicates whether it is **OFF** or **ON**. 4. Press the (▷ / ●) button to change the status. ➔ When scheduler is ON, 🕘 is displayed.	
5. Press the (△) or (▽) button to select between programs **Pr 01**…**Pr 12.**	 

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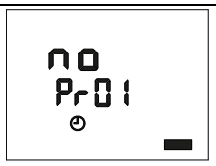
6. Press the (▷ / ●) button and assign one of the following functions to the program with the (△) (▽) button:

   no = Switching time not activated
   OP = Operating mode ON (Occupied), ECO (Unoccupied) or OFF (protective operation)
   LP = Setpoint of a control loop (setting range 0-100%, °C/°F, Pascal)
   AO = Positioning of the analog output (output must be in manual mode!)
   FAN = Fan control (fan stages from FSP0-3 and Auto)
   do = Positioning of the digital output (output must be in manual mode!)
   Hday = Annual time schedule. (holidays)

   ➔ 1 bar indicates setting step 1 is executed.

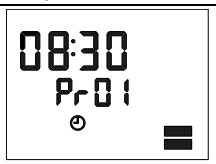


…

For setting a holiday "Hday" see chapter 5.3.3

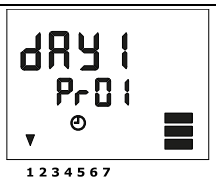
7. Press the (▷ / ●) button and adjust the time from 00:00…23:45 in 15 minutes steps with the (△) (▽) button.

   ➔ 2 bars indicate setting step 2 is executed.



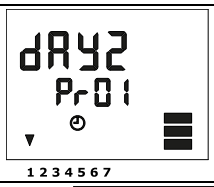
8. Press the (▷ / ●) button to select Monday (Day 1).
9. Press the (△) button to execute the program on Monday (Day 1).
   ➔ A triangle symbol is displayed above the 1.
   ➔ 3 top bar symbols are displayed.
10. Press the (▽) button to **not** execute the program on Monday (Day 1).
    ➔ The triangle symbol above the 1 disappears.
    ➔ The 3 top bar symbols disappear.
11. Press the (▷ / ●) button to go to the next day.
    ➔ **DAY1** (Day 1) and **Pr01** (Program 1) is displayed in this example.

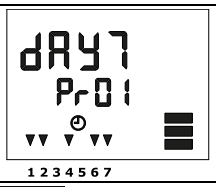
    ➔ 3 bars indicate setting step 3 is executed.



12. Repeat this process to set **DAY2** to **DAY7** (Tuesday to Sunday).

    ➔ Triangle symbol indicate the days of the week the program will be executed.





13. Set the action to be performed by pressing the (△) (▽) and (▷ / ●) button depending on function selected in instruction No. 5:

    a. OP (operating mode):
       ON = Occupied, normal operation
       ECO = Unoccupied, reduced operation
       OFF = protective operation

    b. LP (control loop set point) **LP01**-**LP0x***:
       °C/°F

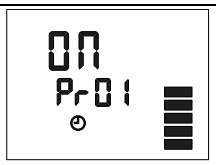
    c. AO (analogue output position) **Ao01**-**Ao0x****:
       0-100%

    d. FAN (fan control, fan speed) **FAN1**-**FAN2**:
       fan speed 0-3 (FSP0-FSP3)
       Auto mode (Auto)

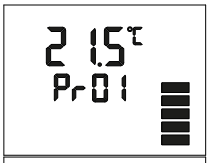
    e. do (digital output position) **do01**-**do0x*****:
       ON = enabled
       OFF = disabled

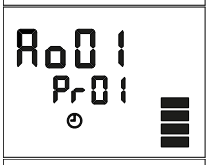
    ➔ 4 and 5 bars indicate setting step 4 rep. 5 is executed.

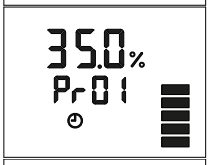
    * The number of available control loops depends on the used X2-controller.
    ** The number of available analogue outputs depends on the used X2-controller.
    *** The number of available digital outputs depends on the used X2-controller.

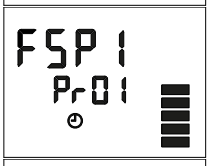


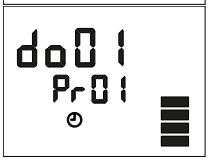
OP ➔

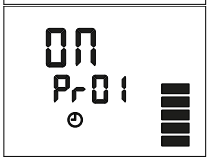












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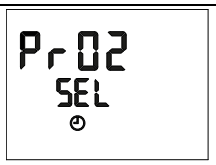
14. Press (▷ / ●) to complete the setting of a timed event.	
15. Now you are back in menu "program selection" (instruction No. 4). Start creating the next weekly schedules for program 2 to 12 as required.	
To go back to the previous submenu, press the (⏻) button (1x).	

5.3.3 Set annual time schedules (holidays)

Overview

This section describes how to set an annual holiday.

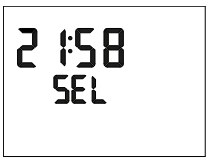
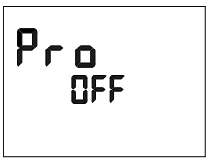
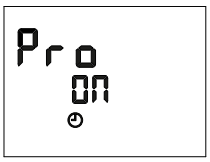
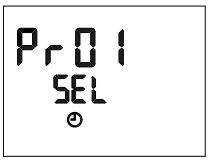
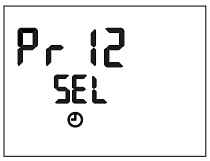
While a holiday schedule is active, the controller will be in the **OFF**-mode! Other weekly schedules will still be active. It will still be possible to manually override the controller while in holiday mode.	

Up to 12 annual holidays can be programmed (Pr01 to Pr12).
Holiday schedules have priority over weekly schedules.

Requirements

Time scheduler is enabled (see chapter 5.3.1).

Procedure

1. Press the (▷ / ●) button longer than 2 seconds. ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.	
2. Press the (△) button briefly to go to the scheduler submenu. ➔ **PRO** and **SEL** is displayed.	
3. Press the (▷ / ●) button: Schedule status indicates whether it is **OFF** or **ON**. Press the (▷ / ●) button to change the status. ➔ When scheduler is ON, 🕘 is displayed.	 
4. Press the (△) or (▽) button to select between programs **Pr 01**…**Pr 12.**	 
5. Press the (▷ / ●) button and assign one of the following functions to the program with the (△) (▽) button: no = Switching time not activated OP = Operating mode ON (Occupied), ECO (Unoccupied) or OFF (protective operation) LP = Setpoint of a control loop (setting range 0-100%, °C/°F, Pascal) AO = Positioning of the analog output (output must be in manual mode!) FAN = Fan control (fan stages from FSP0-3 and Auto) do = Positioning of the digital output (output must be in manual mode!) **Hday** = Annual time schedule (holiday) 1 bar indicates setting step 1 is executed.	 For setting "OP", "LP", "AO", "FAN" and "do" see chapter 5.3.2.

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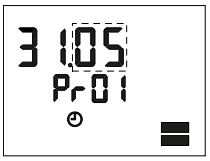
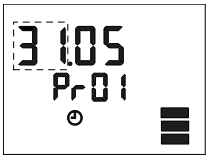
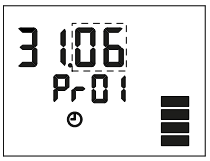
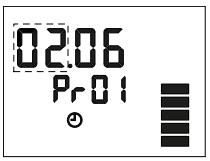
6. Press the (▷ / ●) button and adjust the **month** the holiday **starts** with the (△) (▽) button. ➔ 2 bars indicate setting step 2 is executed.	
7. Press the (▷ / ●) button and adjust the **day** the holiday **starts** with the (△) (▽) button. ➔ 3 bars indicate setting step 3 is executed.	
8. Press the (▷ / ●) button and adjust the **month** the holiday **ends** with the (△) (▽) button. ➔ 4 bars indicate setting step 4 is executed.	
9. Press the (▷ / ●) button and adjust the **day** the holiday **ends** with the (△) (▽) button. ➔ 5 bars indicate setting step 5 is executed.	
10. Press (▷ / ●) to finish the holiday setup.	
11. Now you are back in menu "program selection" (instruction No. 4). Start creating the next holiday schedules for program 2 to 12 as required.	
To go back to the previous submenu, press the (⏻) button (1x).	

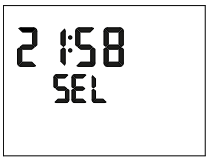
5.4 Heat – Cool – Fan only – Auto selection

Overview

This section describes how to set the controlling mode of the X2 device.

Depending on the configured application, this submenu can have up to 5 different setting options or is deactivated entirely.

Procedure

1. Press the (▷ / ●) button longer than 2 seconds. ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.	
2. Press the (△) or (▽) button until the heat/cool submenu **H-C** and **SEL** or **Auto** is displayed.	

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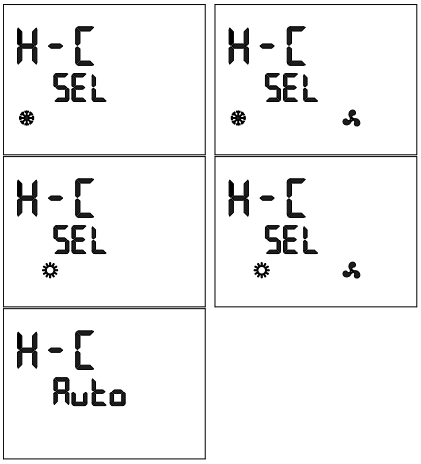
3. Press the (▷ / ●) button and select one of the following functions:

❄	=	Cooling: Cooling only. The controller stays in cooling mode only and will not switch to heating.
❄ + 🌀	=	Fan only cooling: The controller is in fan-only mode. The fan is controlled according to the controller configuration or setpoint. The cooling output is deactivated.
☼	=	Heating: Heating only. The controller stays in heating mode only and will not switch to cooling.
☼ + 🌀	=	Fan only heating: The controller is in fan only heating mode. The fan is controlled according to the controller configuration or setpoint. The heating output is deactivated.
Auto	=	Auto operation: Heating and cooling changes automatically as required.



4. Press the (⏻) button to finish the setup.

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5.5 Display Input and Output States

Overview

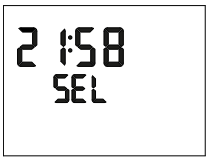
In the input or output submenu there are 4 different display options:

UI = Display of universal inputs (view input values)
Ao = Display of analog outputs (view and set output values)
FAN = Fan display (view and set fan speeds)
do = Display of digital, 3-point or PWM outputs (view and set output signals)

Procedure

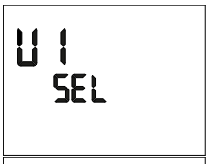
1. Press the (▷ / ●) button longer than 2 seconds.

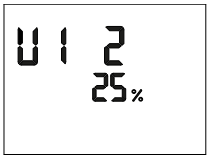
   ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.



2. Press the (△) or (▽) button until the universal input submenu **UI** and **SEL** is displayed.
3. Press the (▷ / ●) button and select one of the universal inputs with the (△) (▽) button.

   ➔ **U-I**, the input number and the value are displayed.
4. To go back to the previous submenu, press the (⮌) button (1x).

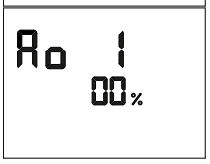




5. Press the (△) button to go to the analog output submenu.

   ➔ **Ao** and **SEL** is displayed.
6. Press the (▷ / ●) button and select one of the analog outputs with the (△) (▽) button.

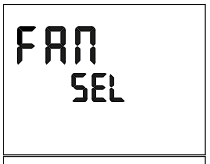
   ➔ **Ao**, the output number and the value are displayed.
7. To go back to the previous submenu, press the (⮌) button (1x).

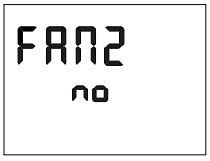


8. Press the (△) button to go to the fan output submenu.

   ➔ **FAN** and **SEL** is displayed.
9. Press the (▷ / ●) button and select one of the fan outputs with the (△) (▽) button.

   ➔ **FAN**, the output number and the value are displayed.
10. To go back to the previous submenu, press the (⮌) button (1x).

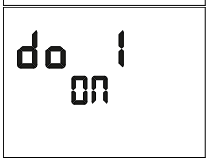


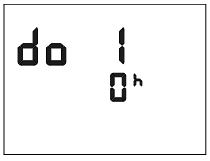


11. Press the (△) button to go to the digital output submenu.

    ➔ **do** and **SEL** is displayed.
12. Press the (▷ / ●) button and select one of the digital outputs with the (△) (▽) button.

    ➔ **do**, the output number and the value are displayed.
13. To go back to the previous submenu, press the (⮌) button (1x).





14. Press the (⏻) button to finish the inspection.

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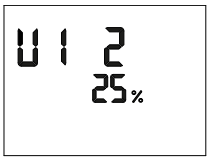
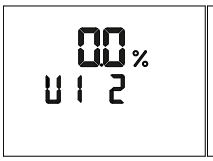
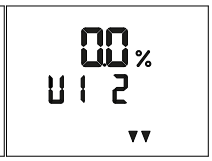
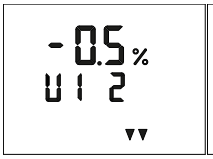
5.6 Calibrate Inputs

Inputs may be calibrated directly in extended operation mode while UI is displayed.

Note: This procedure is available for OP-Versions V1.3 R10 and later and if UP02 = ON.

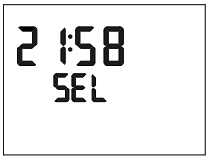
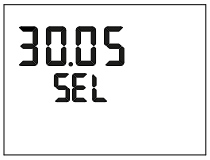
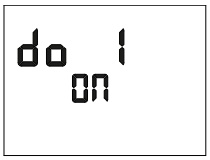
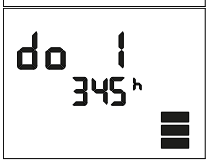
Procedure

1. Display UI following instructions outlined in the previous chapter.	
2. Press the (▷ / ●) button and select one of the universal inputs with the (△) (▽) button. ➔ **U-I**, the input number and the value are displayed.	
3. Press the (▷ / ●) button to display the calibration value for the selected input. 4. Press the (▷ / ●) button again to start changing the calibration value. Two arrows on position 9 10 are displayed while changing mode is active.	 
5. Change the value using the (△) (▽) buttons. 6. Press the (▷ / ●) button to save the value or press the (⮌) button to discard the changes and leave editing mode.	
7. To go back to the previous submenu, press the (⮌) button (1x).	

5.7 Display Total Run Time for Digital Outputs

ⓘ Deactivated outputs are not displayed!

Procedure

1. Press the (▷ / ●) button longer than 2 seconds. ➔ **SEL** and the actual **Date** and **Time** are displayed alternatingly.	 
2. Press the (△) or (▽) button until the digital output submenu **do** and **SEL** is displayed. 3. Press the (▷ / ●) button and select the desired output with the (△) (▽) button. ➔ **do**, the output number and the value are displayed. 4. Press the (▷ / ●) button again ➔ **do**, the output number and the total runtime of the output are displayed. If the runtime is greater than 9999 hours, one bar appears on the side bar for every 10'000 hours. The example on the right corresponds to 30345 hours runtime. Maximum time is 65535 hours = 7.5 years.	 
5. Press the (△) or (▽) button to select the next output.	
6. Press the (⏻) button to finish the inspection.	

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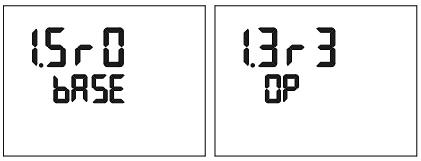
5.8 Display Software Version

Overview

This section describes how to display the software version of the installed X2 operating system and the firmware version of the display / operation terminal.

Procedure

1. Press the (△) and (▽) button simultaneous longer than 2 seconds. ➔ **BASE** and the software version of the X2 system and **OP** and the firmware version of the display / operation terminal are displayed alternatingly.	
2. Press the (⮌) button to go back to the start menu.	

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