

NCN5140xSGEVB Installers Manual

UM70043/D



ON Semiconductor®

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USER MANUAL

PREFACE

This manual is an example and shows how a final installers manual could look like for an OEM derived product. For more information how to build a derived product based on the NCN5140xSGEVB boards, consult the corresponding user manuals.

INTRODUCTION

The NCN5140xSGEVB KNX switches can have up to eight buttons that can be used to perform different functions. Every button is lit up by an RGB LED. It is possible to assign a different color per button and to dim the individual LEDs. This also makes it possible to change the color of the buttons depending on state/functionality, dim the buttons at night,...

Everything can easily be configured through the official KNX ETS software. This manual describes all the ETS parameters that can be configured and how. Also all group objects which are available in the device are listed here with their respective functions.

SPECIFICATIONS

Switch Dimensions

- Width = 88 mm
- Height = 88 mm
- Depth = 13 mm (including KNX connector)

Technical Data

Communication Bus: Ambient Temperature: Storage Temperature:	KNX / EIB -20°C to 55°C -40°C to 70°C
KNX Specifications Voltage: Bus Current Consumption: Connector Type:	21 V to 32 V DC SELV 14 mA (max) KNX connector type 5.1

FUNCTIONAL DESCRIPTION

The NCN5140 switches can be configured to have 1 to 8 buttons, that can be either touch or tactile. Each of these buttons can have a different function and can be operated individually. Every button can perform a variety of different functions, for example, switch lights on and off, dim the lights, recall a scene...

The complete functionality is listed below:

- Switching (on/off/toggle)
- Dimming (1-/2-button control)
- Shutter
- Sending a value
 - ◆ 1-/2-byte values
 - ◆ 3-byte RGB values
 - ◆ ASCII strings
 - ◆ Set blind position
- Recalling and saving scenes
- Lock functionality (ignore switch presses/touches)
- Logic and timer functions
 - ◆ Delayed switch on/off using a timer
 - ◆ Impulse timer
 - ◆ AND/OR/XOR/...logic
- Supports long and short button presses

All the functionality and related parameters are explained in detail in the *ETS Parameters* section.

INSTALLATION

The switches are designed for installation in a regular switch wall mounting box. They are fully powered from the KNX-bus and require no additional power supply.

Programming Mode

The device can be put into or brought out of programming mode by pressing the dedicated programming button on the back ①. Once the device is installed, the programming button on the back is no longer accessible. In this case the programming mode can be accessed by pressing the button of CH1 ③ and any other button simultaneously for at least 5 s.

Once the device enters programming mode, all the LEDs on the front will start blinking.

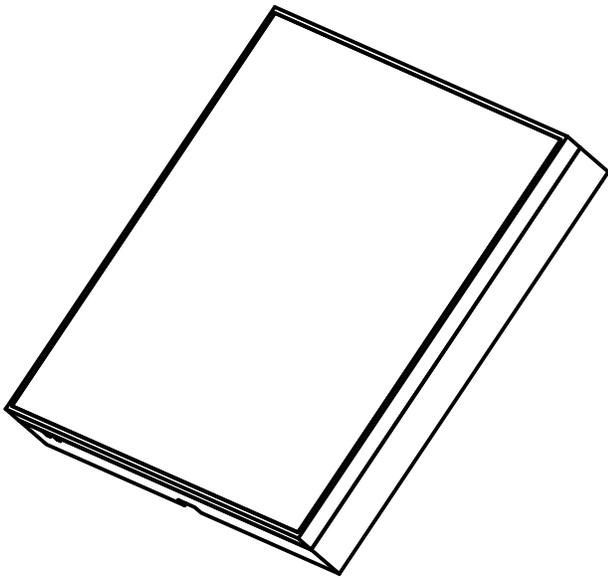


Figure 1. Front View of the Touch Switch

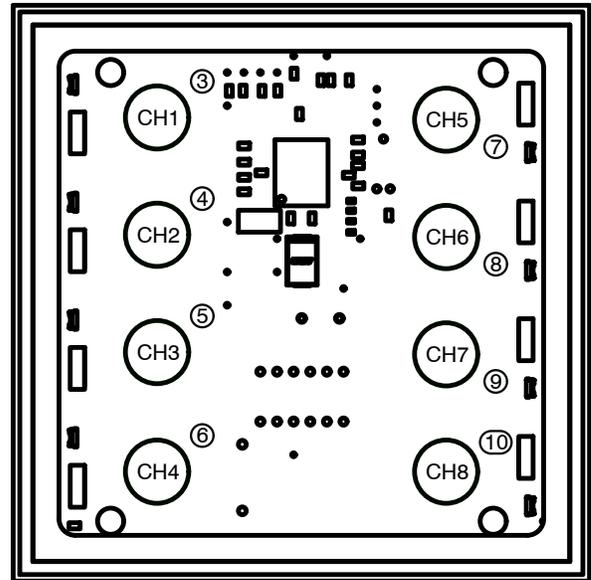


Figure 3. A Front View of the Board Showing All the Buttons

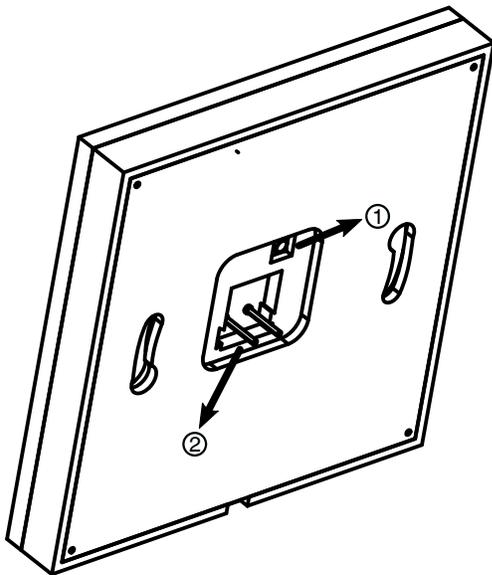


Figure 2. Back View of the Touch Switch

Connecting to the bus

On the back side, near the middle of the board, there are two pins ② which are used to connect the board to the KNX-bus. Make sure to connect the mating terminal block correctly. A proper enclosure must use the guiding tabs on the terminal block to ensure proper orientation when plugging it in. Figure 4 shows how to correctly connect the switch to the bus. The plus is normally painted red on the terminal block. The outline of the mating terminal block is drawn on the PCB to avoid wrong connections.

Incorrect connection of the power supply will result in the device not functioning.

ETS PARAMETERS

There are many parameters which configure how the device behaves and what functions it fulfils. Here all the parameters which can be configured through ETS are listed.

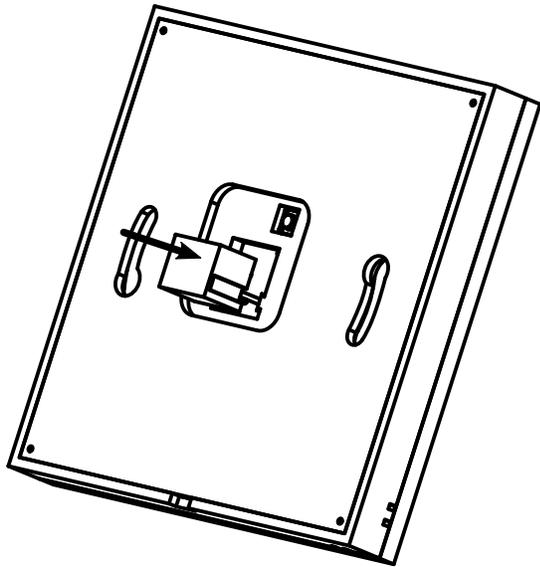


Figure 4. How to Connect the Board to the KNX bus

General Settings

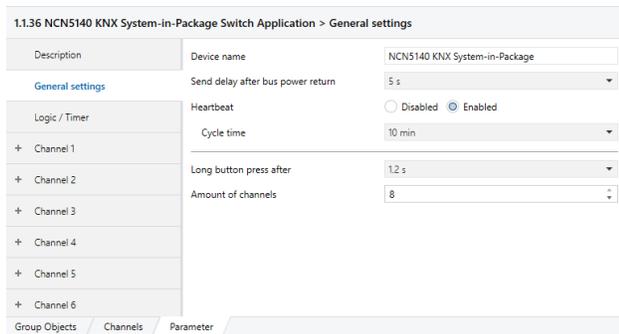


Figure 5. Device General Settings

Device Name (30 Characters)

An arbitrary name that can be assigned to the NCN5140 switch. A meaningful device name should be chosen, e.g. “Living Room”. This helps to keep a good overview in the overall ETS.

Send Delay after Bus Power Return

A delay to start sending telegrams after the bus voltage returns can be set via this parameter.

This avoids a bus overload once the bus power returns. Other functions such as receiving telegrams or querying of the inputs are not affected by this parameter.

Heartbeat

Cyclic sending of a value to the KNX-Bus, to indicate that the device is operational. For the *Cycle time* values between 1 min and 24 h are selectable.

Table 1. HEARTBEAT GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 1 Heartbeat — Trigger	1.001	1 Bit	Out

Long Button Press After

The time for detection of a long button press can be set here, this time is valid for all input channels.

Amount of Channels

The installer has to configure how many channels the switch has. Changing this parameter will make the settings for the selected amount of channels appear in ETS. This parameter must correspond to the amount of channels the manufacturer configured into the device.

Channel x: General

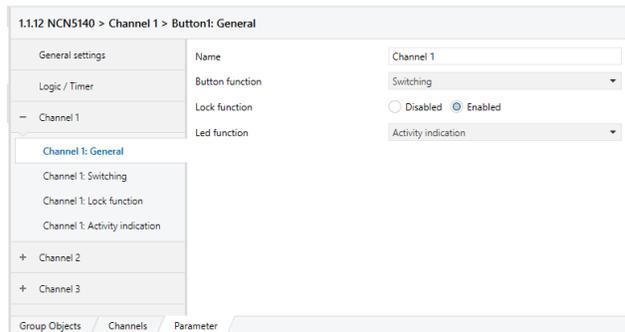


Figure 6. General Settings per Channel

Name

An arbitrary name can be assigned to each channel. The name can be composed of 30 characters maximum. This name should be clear and meaningful. It makes it easier to work with the associated group objects, as the name is displayed there as a label. If no name is assigned, the group objects are named *Input x*, with x the channel number. The first channel is described below, the functioning of the other seven channels is the same.

Function

This parameter defines the functionality of the corresponding button. The following options are available:

- Disabled
- Switching
- Dimming
- Shutter
- Send value
- Scene

A more detailed description of the different functionalities is given in the following sections.

Lock Function

With this parameter the lock function can be enabled. If this functionality is activated, the associated group objects as well as the parameter page *Channel x: Lock function* are displayed for further configuration. See section *Channel x: Lock function*. If the lock has been activated via the group object, no telegrams are triggered by pressing the associated buttons.

Table 2. LOCK FUNCTION GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 16 Input A1 Lock – Activate	1.001	1 Bit	In

LED Function

The board contains 8 RGB LEDs which can be used for state indication. Every LED is associated with a button and can display the current state of the function which is selected for that button. If for example *Switching* is selected, the LED will indicate if the actuator is currently switched on or off.

It is possible to set a predefined color and brightness depending on the state. Every button can have a different color even when using the same functionality.

- **Disabled**
- **Activity Indication**

The LED can be given a different color/brightness while the button is actuated and when it isn't. See section *Channel x: Activity indication* for more information.

- **State Indication**

The state indicated by the LED comes externally from the bus. See section *Channel x: State indication* for more information.

Table 3. STATE INDICATION GROUP OBJECT

Group Object	KNX Type	Size	Direction
GO 17 Channel x: Led function – Switch	1.01	1 Bit	In

- **External Operation**

The LED color and brightness is fully controlled by the KNX-bus. A three byte group object comes available to set the RGB-value over the bus.

Table 4. EXTERNAL OPERATION GROUP OBJECT

Group Object	KNX Type	Size	Direction
GO 17 Channel x: Led function – RGB color value (3 byte)	232.600	3 Byte	In

Channel x: Lock Function

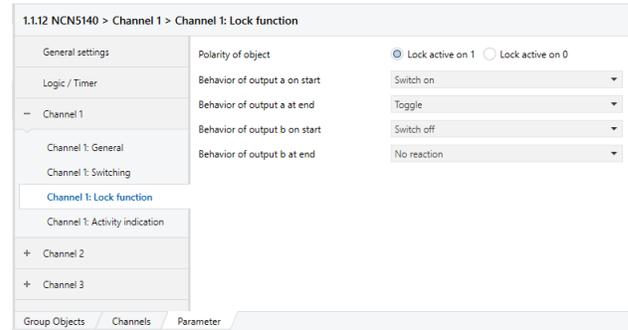


Figure 7. The Lock Function Settings for the Buttons

Polarity of Object

This parameter defines if the lock should be activated when receiving either 1 or 0. The following options are selectable:

- Lock active on 1
- Lock active on 0

Behavior of (...) on Start

Which telegram is sent when the lock is activated, can be configured here.

Behavior of (...) at End

Which telegram is sent when the lock is deactivated, can be configured here.

Channel x: Activity Indication

When a button is actuated, it can be given a different color and brightness to indicate it is pressed.

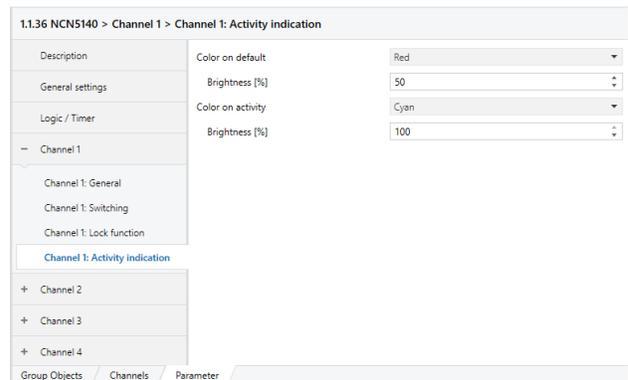


Figure 8. Activity Indication Settings for the LEDs

Color on Default

A default color can be set that is always displayed when the button is idle.

The following color options are available:

- **Off**
- **White**
- **Red**

- Green
- Blue
- Cyan
- Yellow
- Magenta
- Orange

Color on Activity

The selected color will be displayed while the button is activated. As long as the user keeps pressing the buttons this color will be visible.

The color options are the same as for *Color on default*.

Brightness [%]

This setting is used to select a brightness from 0% to 100% for the LED. The brightness can be set separately for both the default and activity state.

Channel x: State Indication

When using state indication, a group object becomes available which allows to alter the state of the LED through the bus.

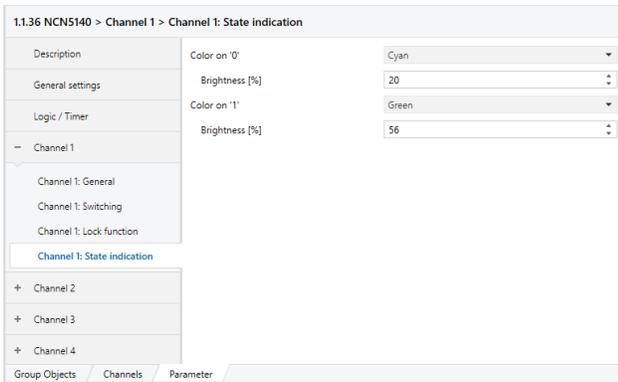


Figure 9. State Indication Settings for the LEDs

With this group object it is possible to let the LED display the status of another actuator connected to the KNX-bus. For example, when a light is being switched on, it can be configured to send a telegram on the bus indicating that the light is now on. When the switch receives this through the object listed in Table 3, it can switch on the LED. If the corresponding button is also used to switch this light on and off, the LED serves as an indication to the user whether the light is on or off.

Color on '0'

Which color the LED should have when a 0 is received from the bus.

All the color options are the same as for *Color on default*.

Color on '1'

The color the LED will display when a 1 is received from the bus.

All the color options are the same as for *Color on default*.

Brightness [%]

This setting is used to select a brightness from 0% to 100% for the LED. The brightness can be set separately for both states.

Channel x: Switching

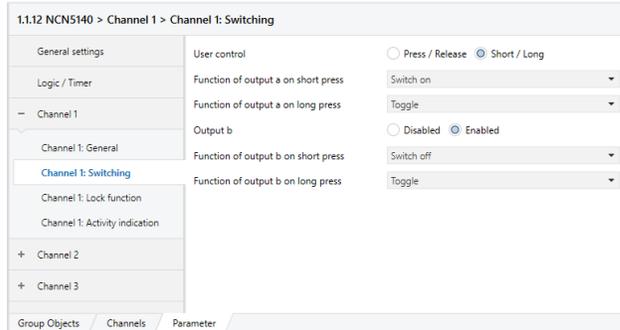


Figure 10. Switching Settings for the Buttons

If the switching function is selected, up to 2 binary switching telegrams can be sent via the group objects listed in Table 5.

Table 5. SWITCHING GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Output a – Switch	1.001	1 Bit	Out
GO 12 Channel x: Output b – Switch	1.001	1 Bit	Out

Output b is only visible when activated by the corresponding parameter.

User Control

This parameter determines whether telegrams are sent only when the button is pressed shortly (e.g. key switches) or also when the button is held for a longer time¹ (e.g. switching/dimming switches).

Function of (...) on Short/Long Press/Release

For each object it is possible to select which telegram is sent on a short/long button press.

- No reaction
- Switch on
- Switch off
- Toggle

¹ This time is determined by the Long button press after parameter.

Output b

Here it is possible to show/hide the parameters and object for output b.

Channel x: Dimming

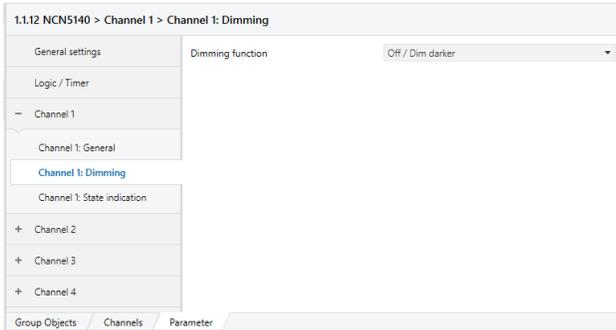


Figure 11. Dimming Settings for the Buttons

When the dimming function is selected, the group objects listed in Table 6 become available.

Table 6. DIMMING GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Dimming on/off – Switch	1.001	1 Bit	Out
GO 12 Channel x: Dimming relative – Brighter/Darker	3.007	4 Bit	Out

Dimming Function

The *Dimming function* parameter determines whether the button is used for switching and dimming in one direction or for 1–button control.

- **On/Dim Brighter**
Short press: Switch on
Long press: Dim brighter
- **Off/Dim Darker**
Short press: Switch off
Long press: Dim darker
- **Toggle Direction (1–button control)**
Short press: Toggle between switch on/off
Long press: Toggle between dim brighter/darker

If the input detects a short button press, a switching telegram is sent via object 11. On long button press, a relative dimming command is sent over the entire dimming range to object 12. When releasing after a long button press, a dimming–stop telegram is sent via object 12.

The time for detection of a long button press can be set on the *General Settings* page.

Channel x: Shutter

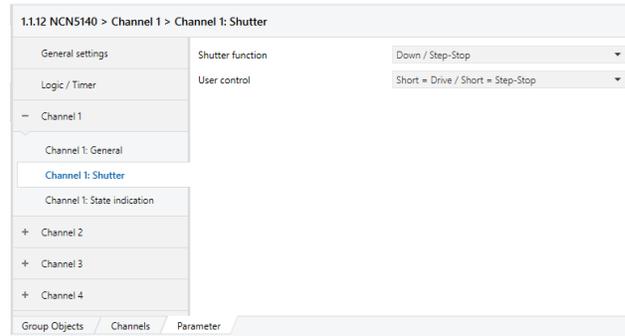


Figure 12. Shutter settings for the buttons

When the shutter function is selected, the group objects listed in Table 7 become available.

Shutter Function

This parameter determines which direction the shutters move when sending a drive command or if 1–button control is to be used:

- **Up/Step–Stop**
- **Down/Step–Stop**
- **Toggle direction (1–button control)**

Table 7. SHUTTER GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Drive start – Up/Down	1.008	1 Bit	Out
GO 12 Channel x: Drive stop – Step/Stop	1.007	1 Bit	Out

User Control

This parameter determines the sending of telegrams on short and long button presses:

- **Long = Drive – Short = Step/Stop**
Long button press: Send a drive command via object 11.
Short button press: Stop/step command via object 12.
- **Short = Drive – Short = Step/Stop**
Alternately send a drive command via object 11 and a stop/step command via object 12 on a short button press. Long button presses are ignored.
- **Pressed = Drive – Released = Stop**
When the button is pressed, send a drive command (alternately up/down) via object 11. When the button gets released a button stop/step command is sent via object 12.

The time for detection of a long button press can be set on the *General Settings* page.

Channel x: Send Value

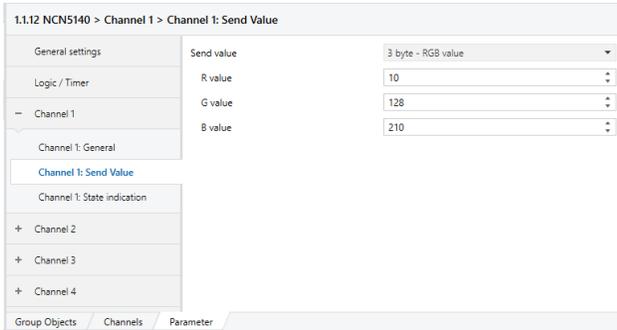


Figure 13. Send Value Settings

The *Send value* function can be used to send any of the following values when a button gets pressed.

Send Value

- 1 byte – Percent value

Table 8. 1 BYTE – PERCENT VALUE GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send percent value (1 byte) – Set value	5.001	1 Byte	Out

- 1 byte – Integer value

Table 9. 1 BYTE – INTEGER VALUE GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send integer value (1 byte) * Set value	5.010	1 Byte	Out

- 2 byte – Integer value

Table 10. 2 BYTE – INTEGER VALUE GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send integer value (2 byte) – Set value	7.001	2 Byte	Out

- 2 byte – Float value

Table 11. 2 BYTE – FLOAT VALUE GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send float value (2 byte) – Set value	9.001	2 Byte	Out

- 3 byte – RGB value

Table 12. 3 BYTE – RGB VALUE GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send RGB color value (3 byte) – Set value	232.600	3 Byte	Out

- 14 byte – ASCII string

Table 13. 14 BYTE – ASCII STRING GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send ASCII string (14 byte) – Set value	16.000	14 Byte	Out

- Shutter

Table 14. SHUTTER GROUP OBJECTS

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Send blind position – Set position	5.001	1 Byte	Out
GO 11 Channel x: Send slat position – Set position	5.001	1 Byte	Out

Value

A field for entering the value to be sent on a button press is displayed. The group objects associated with the selected data type will also become available.

If shutter is selected as the value to be sent, the predefined height is sent on a button press. The slat position is sent when releasing the button. Both values can be enabled and disabled separately.

Channel x: Scene

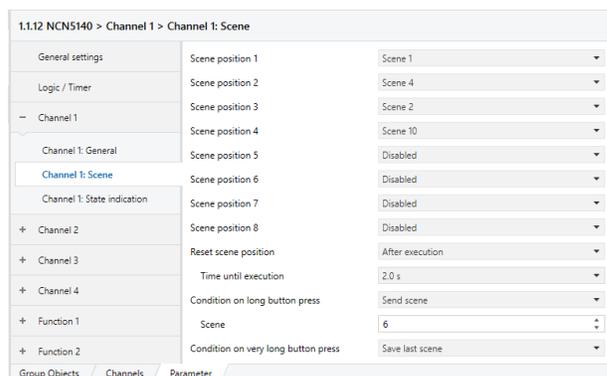


Figure 14. Scene Settings for the Buttons

When the scene function is selected, the group object listed in Table 15 becomes available.

Functionality

Scenes make it possible to quickly configure all the lights, shutters, blinds,...for a certain mood/activity. When watching television, forexample, a scene which dims the lights and closes the blinds would be selected.

Table 15. SCENE GROUP OBJECT

Group Object	KNX Type	Size	Direction
GO 11 Channel x: Scene – Scene control	18.001	1 Byte	Out

In order to select a scene, the switch sends out a scene number. Actuators are configured to take pre-programmed actions, when receiving the respective scene number.

This switch supports up to 8 scene positions. These 8 slots can send out a scene number between 1 and 64. Cycling through the scene positions is done by continuously pressing the button as shown in Figure 15. When the scene number associated to the selected position is sent on the bus depends on the Reset scene position parameter as well as if and when the selected scene position is reset.

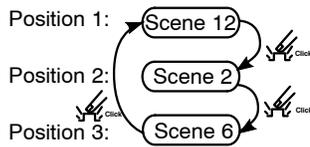


Figure 15. Cycle Through the Scene Positions by Repeatedly Pressing the Button

Scene Position 1– 8

For each position, scene 1 – 64 can be activated. If only one scene position is activated, it is sent on a short button press. If several scene positions are used, the activated positions are cycled with every short button press as depicted in Figure 15.

Reset Scene Position

The behavior for selection and transmission of the scene positions can be determined using this parameter.

• **Never**

Starting with the first scene position, the next scene position in the list is sent with each short button press. When the last scene position has been sent, the list starts again from the beginning. See Figure 16.

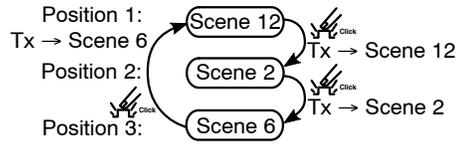


Figure 16. Never Reset the Scene Position and Send Scene Number After Every Press

• **After execution**

Beginning with the first scene position each short button press selects the next scene position in the list, within the execution delay. When the execution delay ends, the currently selected scene position is sent. See Figure 17.

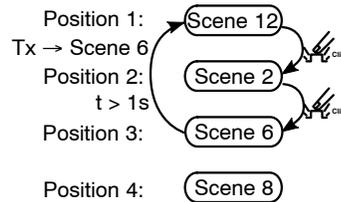


Figure 17. Send the Select Scene Position After a Given Execution Delay and Reset the Scene Position

• **5 Sec – 10 Min**

On each button press the configured delay time is started. Starting with the first scene position, the next scene position of the list is sent with each short button press. When the last scene position in the list has been sent, the list starts again from the beginning. After the delay time has expired, the list starts again at the first scene position on the next short button press. See Figure 18.

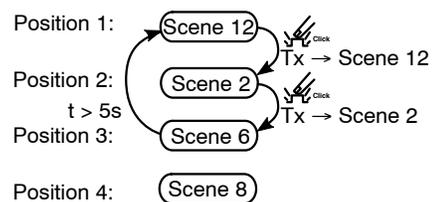


Figure 18. Reset the Scene Position After a Selected Timeout

When the lock function is used, the scene position is always reset when the device is unlocked.

Condition on Long/Very Long Button Press

It is also possible to select how a long and very long button press has to be treated.

- **No reaction**
- **Save last scene**
A *save scene* telegram with the last sent scene is triggered.
- **Send scene**
The scene configured in the corresponding parameter is sent.
- **Reset position**
This function is used to override the behavior as set in the Reset scene position parameter and resets the scene position immediately.

The time for detection of a long button press can be set on the *General Settings* page.

Logic/Timer

Function 1–16

There are 16 Logic/Timer channels which can be used to implement additional logic and timing functionality. All 16 channels are identical.

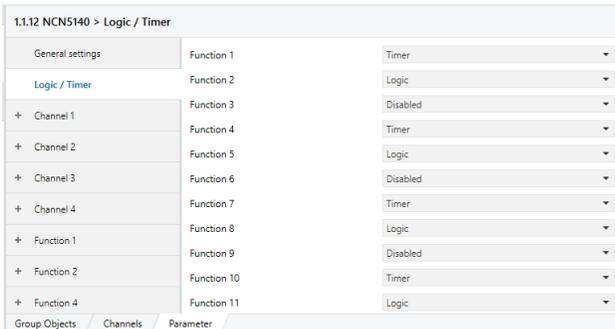


Figure 19. The Logic/Timer tab in ETS

The following options are available:

- **Disabled**
The channel is unused. No timer or logic specific parameters and group objects are available.
- **Timer**
The channel performs timer related functions such as switch-on delay, impulse timer,... See section *Timer* for more information. The timer-specific parameters and group objects become available.
- **Logic**
The channel performs boolean logic functions such as AND, OR, NOT,... See section *Logic* for more information. The logic-specific parameters and group objects become available.

NOTE: These additional logic and timer functions can be linked to one another by means of the associated group objects. This also allows to create complex structures. For this purpose, the output of a function is set to the same group address as the input of the next function.

Timer

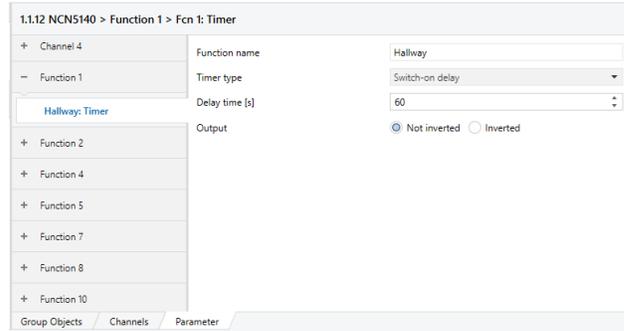


Figure 20. Settings For the Timer Functionality

Function Name

The function name can be chosen freely. A maximum of up to 10 characters is allowed. The name is visible in the group object entry in the ETS software. This makes it easier to work with the associated group objects, as the name is displayed there as a label.

Timer Type

- **Switch-on Delay**
A timer that switches ON after a duration defined by the *Delay time [s]* parameter. The output value can be inverted by the *Output (Not inverted Inverted)* parameter.

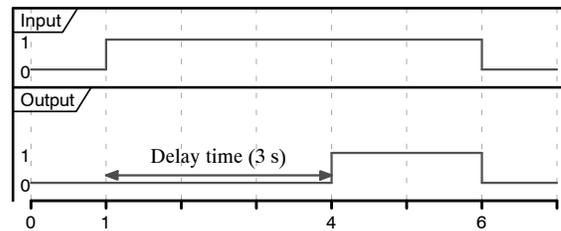


Figure 21. Example of a Timer With a Switch-On Delay of 3 s

Table 16. TIMER SWITCH-ON DELAY GROUP OBJECTS

Group Object	KNX Type	Size	Direction
Timer – Switch-on delayed – Input	1.002	1 Bit	In
Timer – Switch-on delayed – Output	1.002	1 Bit	Out

• **Switch-off Delay**

A timer that switches OFF after a duration defined by the *Delay time [s]* parameter. The output value can be inverted by the *Output (Not inverted/Inverted)* parameter.

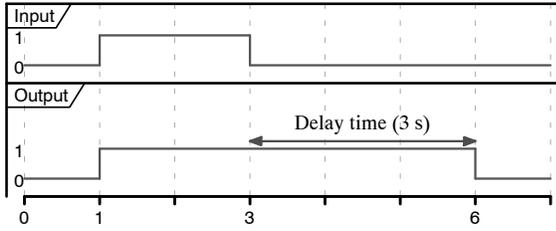


Figure 22. Example of a Timer With a Switch-Off Delay of 3 s

• **Impulse (Staircase)**

Timer with impulse that – after being switched ON – automatically switches OFF after a defined duration defined by the *Delay time [s]* parameter. The output value can be inverted by the *Output (Not inverted/Inverted)* parameter.

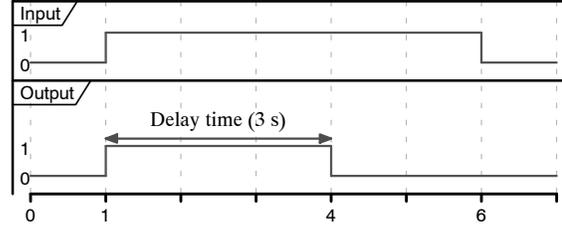


Figure 24. Example of an impulse timer with an impulse delay of 3 s

Table 17. TIMER SWITCH-OFF DELAY GROUP OBJECTS

Group Object	KNX Type	Size	Direction
Timer — Switch-off delayed — Input	1.002	1 Bit	In
Timer — Switch-off delayed — Output	1.002	1 Bit	Out

• **Switch-on and -off Delay**

A timer that switches ON and OFF after a duration defined by the *Delay time [s]* parameter. The output value can be inverted by the *Output (Not inverted/Inverted)* parameter.

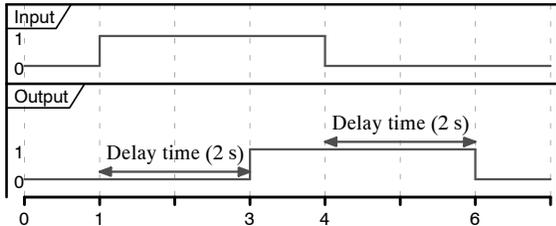


Figure 23. Example of a Timer with a switch-on-off delay of 2 s

Table 18. TIMER SWITCH-ON-OFF DELAY GROUP OBJECTS

Group Object	KNX Type	Size	Direction
Timer – Switch-on-off delayed – Input	1.002	1 Bit	In
Timer – Switch-on-off delayed – Output	1.002	1 Bit	Out

Table 19. TIMER SWITCH-IMPULSE (STAIRCASE) GROUP OBJECTS

Group Object	KNX Type	Size	Direction
Timer – Switch-impulse (staircase) – Input	1.002	1 Bit	In
Timer – Switch-impulse (staircase) – Output	1.002	1 Bit	In

♦ **Important Note**

Each timer can be stopped by sending the opposite value to its input group object. For example, an already started switch on timer can be stopped by sending OFF (0) to its input group object.

Logic

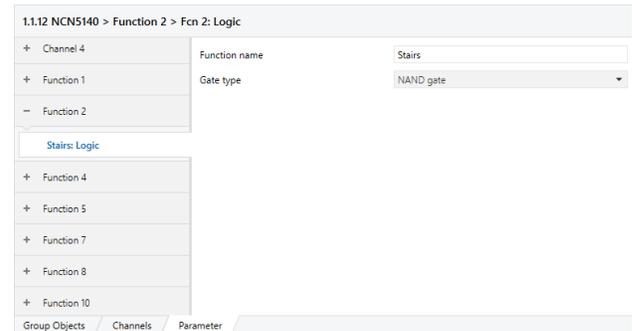


Figure 25. Settings For the Logic Functions

The group objects listed in Table 20 are common for all the available gate types except for the inverter.

Function Name

The function name can be chosen freely. A maximum of up to 10 characters is allowed. The name is visible in the group object entry in the ETS software. This makes it easier to work with the associated group objects, as the name is displayed there as a label.

Table 20. LOGIC GATE GROUP OBJECTS

Group Object	KNX Type	Size	Direction
Logic – Gate input A – Input	1.002	1 Bit	In
Logic – Gate input B – Input	1.002	1 Bit	In
Logic – Gate output – Output	1.002	1 Bit	Out

Gate Type

AND gate

The output is switched on (1), if both inputs are on (1).

OR gate

The output is switched on (1), if at least one input is on (1).

XOR gate

The output is switched on (1), if both inputs are different.

NAND gate

The output is switched on (1), if at least one input is switched off (0).

NOR gate

The output is switched on (1), if both inputs are off (0).

XNOR gate

The output is switched on (1), if both inputs are equal.

INVERTER

Input on (1) is converted into output off (0). Input off (0) is converted into output on (1). The group objects associated with the inverter gate are listed in Table 21.

Table 21. INVERTER GROUP OBJECTS

Group Object	KNX Type	Size	Direction
Logic – Gate input – Input	1.002	1 Bit	In
Logic – Gate output – Output	1.002	1 Bit	Out

SAFETY INSTRUCTIONS



- Installation of the device should only be performed by an authorized electrician.
- Do not connect any voltages other than the KNX-bus to the board. Connecting the mains voltage (230 V) to the board will lead to serious damage and injuries and put the whole KNX system at risk.
- For planning and constructing electrical installations, the relevant guidelines, regulations and standards of the respective country must be followed.
- The prevailing safety rules must be heeded.

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