C4 TOOLBOX by EKINEX

CONFIGURATION GUIDE

Product:	EKINEX C4 TOOLBOX
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DOC Version:	002

Any information container in the document can be modified at any time without notice.

Summary

OVERVIEW

Introduction

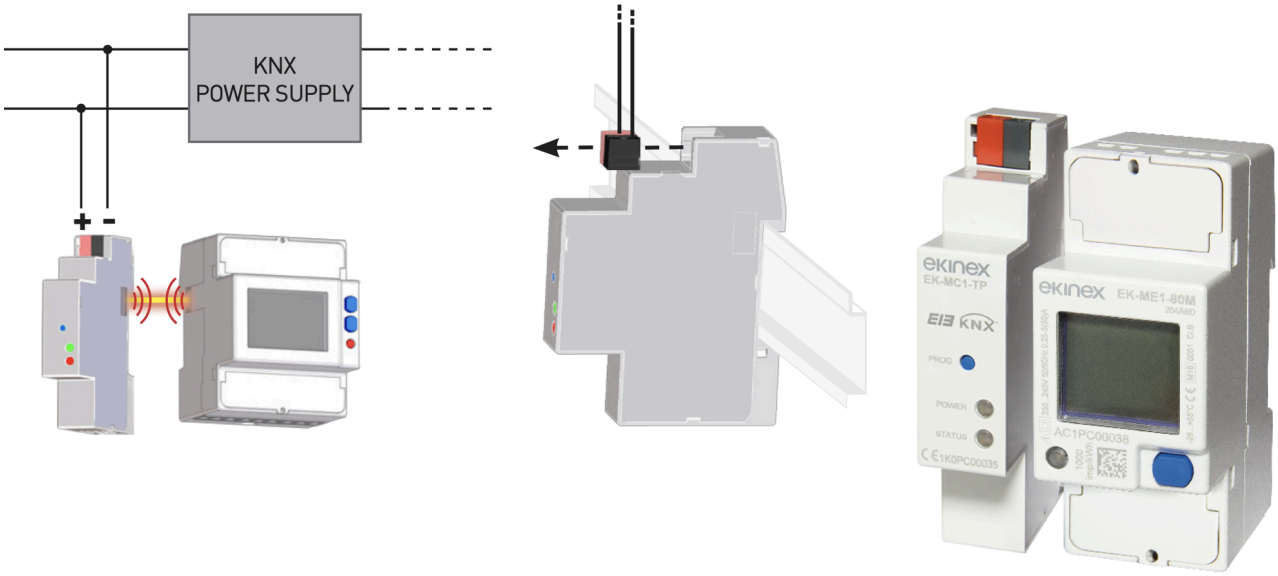
C4 TOOLBOX is a webserver designed to offer a suite of connectivity and functional services to a CONTROL4 supervision system, when used in combination with EKINEX KNX devices.

With C4 TOOLBOX it is possible to:

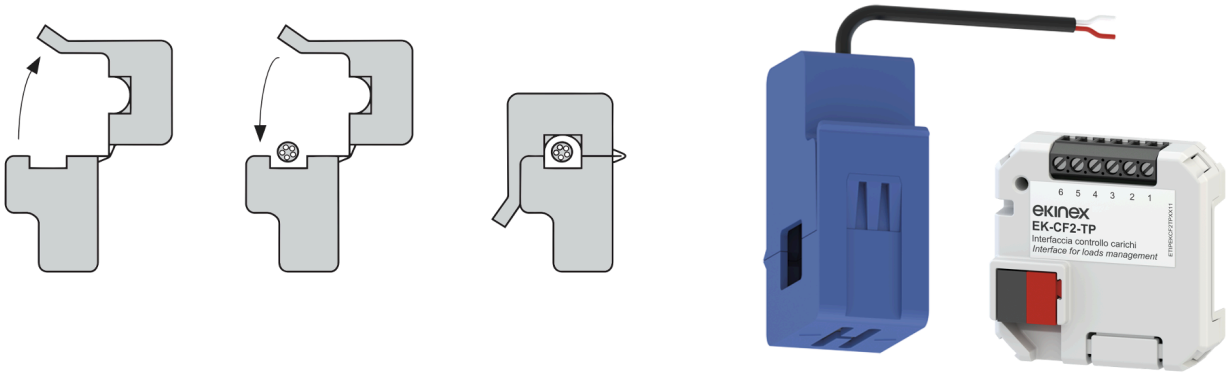
- Send commands and receive information from KNX devices in the CONTROL4 system
- Monitor the building energy consumption and control loads accordingly with the overall absorption with a dedicated graphic driver for Composer
- Make a continuous diagnostic check on the KNX devices and receive notifications in case of malfunctions
- Define command sequences (scenes) and execute them with simple connections in Composer with 3rd party drivers
- Perform logics configurable with a graphic editor and executed in background
- Send notifications to CONTROL4 in case of malfunctions or configurable events on the bus

The following picture offers an overview of the connection and communication between Control4 and KNX devices:

For energy metering specific purposes, C4 TOOLBOX can be used in combination with several product models available in Ekinex catalogue, both for DIN-rail mounting (oriented to professional applications)...



… and wall-mounted, more flexible and suitable for residential installations:



Mounting

The device has degree of protection IP20, and is therefore suitable for use in dry interior rooms, using 3 different mounting options:

Rail-mounting support

The device can be mounted on 35 mm rail (according to EN 60715) with the support **EK-SMG-35**.

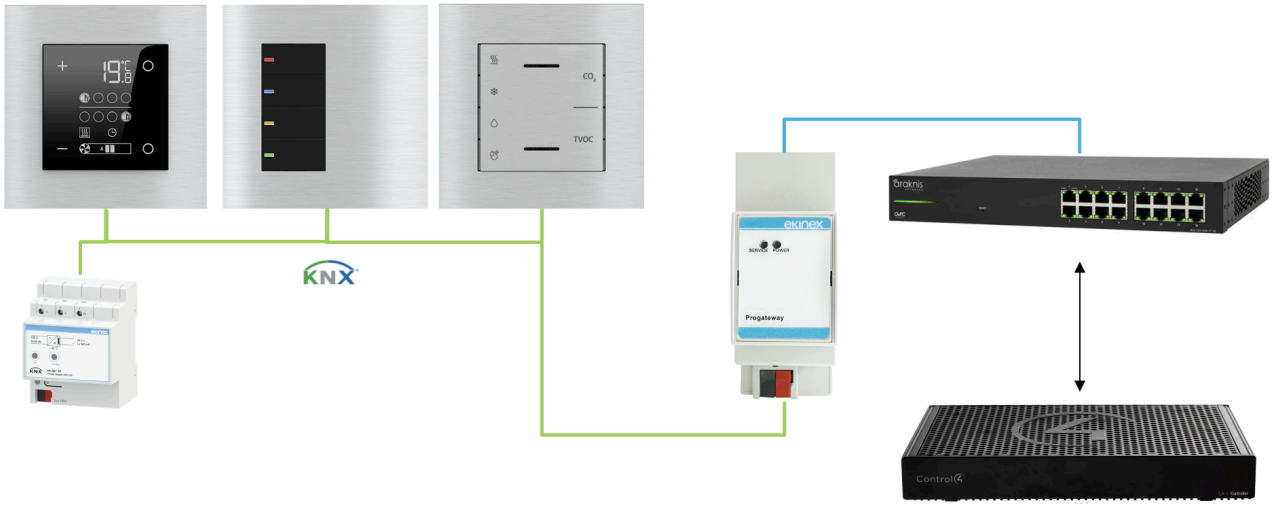
Flush-mounting wall boxes

The interfaces can be housed inside the boxes near the controls (round, 502 and / or 503), or in appropriately dimensioned junction boxes.

Spring for hooking on wall-mounting devices

The device can be hooked on the back of some ekinex® wall-mounting devices by means of the spring **EK-MAR**.

Besides the specific energy metering aspect, any other kind of KNX device can be used in combination with C4 TOOLBOX, by using it as communication channel for Control4, as represented in the following picture:



Information exchanged with the KNX devices can be used inside C4 TOOLBOX to perform command sequences (scenes) and powerful logics, and to inform the user about specific events, in a way detailed in the following of this document.

Purpose of this document

This manual contains all necessary information for a correct installation and configuration of C4 TOOLBOX in combination with the COMPOSER PRO software.

A good knowledge of COMPOSER PRO and ETS programming software for KNX technology is supposed to be a prerequisite for the described operations, and is not covered as a topic in this document.

Open Source Software

C4 TOOLBOX contains open source software, such as the Linux operating system and its kernel. These software components are subject to various open-source licenses, including:

- GNU General Public License (GPL), https://www.gnu.org/licenses/gpl-2.0.html
- GNU Lesser General Public License (LGPL), https://www.gnu.org/licenses/lgpl-2.0.en.html

If you are in possession of a product, for a period of 3 years from the last date of production, you can request from ekinex the source code of the software components licensed under the GNU General Public License (GPL) or the GNU Lesser General Public License (LGPL), and use, distribute and modify them in accordance with their respective licenses.

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For further information, please contact the ekinex technical support service.

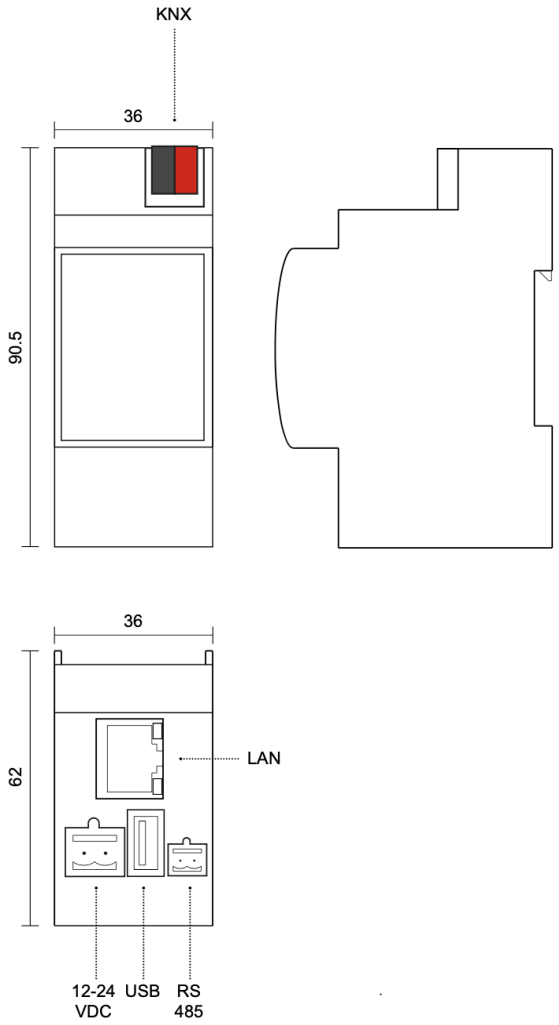
SETUP

Installation

C4 TOOLBOX is designed to be installed on a DIN rail, by requiring a 2 module-size free space. The following connections are required:

- 12 / 24 V DC power supply
- Ethernet connection to LAN
- KNX (standard red-black TP 2-wire connector)

The server offers also an USB and RS485 port, prepared for future use (not available at the present moment in the configuration process).



C4 TOOLBOX is supposed to be connected to the same LAN as the CONTROL4 controller(s); in

case of different installations, please refer to the IT manager in order to ensure the proper communication.

The front LEDs offer the following signaling:

- POWER: indicates the presence of 12-24 Vdc power supply at terminals
- SERVICE: Normally off, steady or flashing during recovery sequences

First access

C4 TOOLBOX comes with the following predefined IP address:

192.168.0.110

Please adjust temporarily the network configuration of the PC / MAC in order to match this address (255.255.255.0 as network mask, different IP address e.g. 192.168.0.100 assigned to the PC, 192.168.0.110 as default router) and point a standard web browser to the following URL:

http://192.168.0.110

> Google Chrome is highly recommended as the browser to be used for the operations described in this manual, although C4 TOOLBOX is compatible with other web browsers commonly in use.

When requested, enter the following credentials (to be changed later, as described in the chapter dedicated to the users management):

USERNAME	admin
PASSWORD	admin

The following page is finally displayed:

The left side offers a tree menu, containing all the items necessary for the configuration, and a search engine, that allows a quick finding of the elements previously configured.

The top-right portion of the page contains a toolbar, with the following buttons:

	SAVE ON FLASH	It allows the saving of the database on the persistent flash memory of C4 TOOLBOX, guaranteeing the persistence of the data even after a system shutdown. The button turns red to indicate the presence of unsaved changes; persistent saving occurs automatically every 5 minutes, so it is not necessary to force saving unless it is necessary to shut down the system before this happens.
	CLEAR CACHE	Force the erasure of all cache mechanisms. Use this button only when necessary, if the on-screen content does not reflect the configuration made.
	BASIC / ADVANCED	It allows you to set the level of visibility of functions and properties of objects within the pages; the BASIC level offers access to the most common items and only those set as "VISIBLE", the ADVANCED level allows you to manage all the parameters and access to hidden objects.
	OPEN / CLOSE SIDE PANELS AND LOWER	Allow you to expand or hide the left side panel (MENU), right side panel (OWN) and bottom side panel (MESSAGES CENTRE) respectively.
	LOGOUT	Allows you to close the work session and authenticate with a different user.
	FRONTEND	Allows you to switch to the supervision environment for end users and see the result of the configuration done.

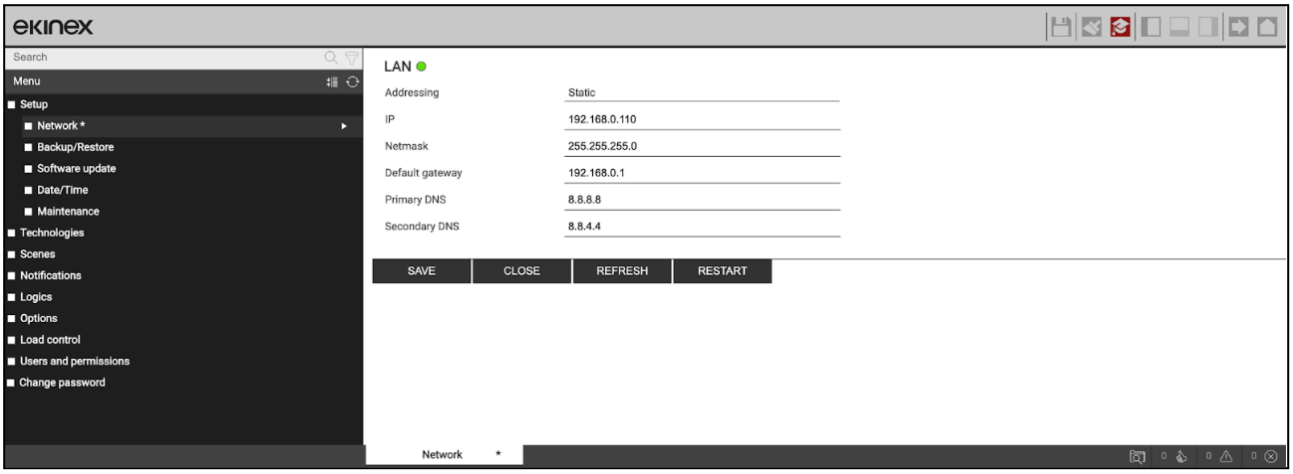
Network

In order to adjust the network settings for C4 TOOLBOX, please follow the instructions below:

- Open the SETUP section of the side menu
- Press NETWORK and wait for the page to load the actual network configuration
- Change the IP address, network mask, default router, primary and secondary DNS addresses accordingly to the configuration of the LAN where the webserver must be installed
- Double-check that the entered information is correct, in order to avoid the malfunctioning of the device
- Press SAVE and wait until the configuration page opens with the new IP address

In case the new configuration belongs to a different subnet addressing, only when the procedure is finished and the browser tries to connect to the new IP address, adjust the network configuration of

the PC / MAC, and reload.



Backup / Restore

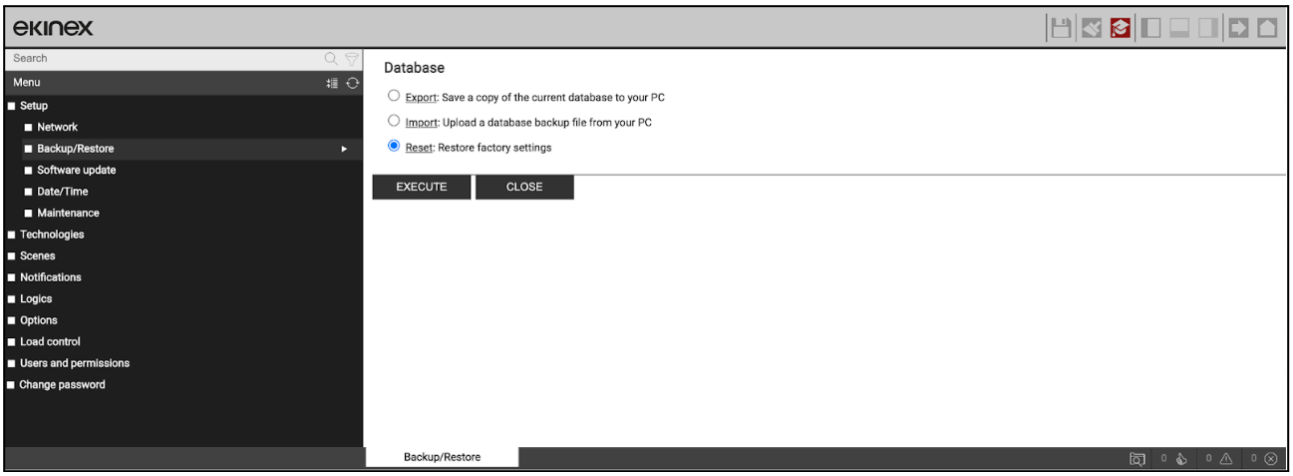
It is possible to save the configuration of C4 TOOLBOX and load it later in the same device, or in another server. The page

SETUP > BACKUP / RESTORE

offers the possibility to:

- save a copy of the project into a folder on your PC / MAC
- import a backup previously saved
- restore the initial configuration

In case of restore, any eventual configuration previously done goes lost; the IP configuration, as opposite, is kept saved, not being part of the backup itself (the same in case of import of a backup done in another device).



Software Update

The section

SETUP > SOFTWARE UPDATE

offers the opportunity to bring the device to the latest version. By entering this page, an automatic check for new versions is done; alternatively, it is possible to load manually an update package, previously downloaded in a folder on your computer.

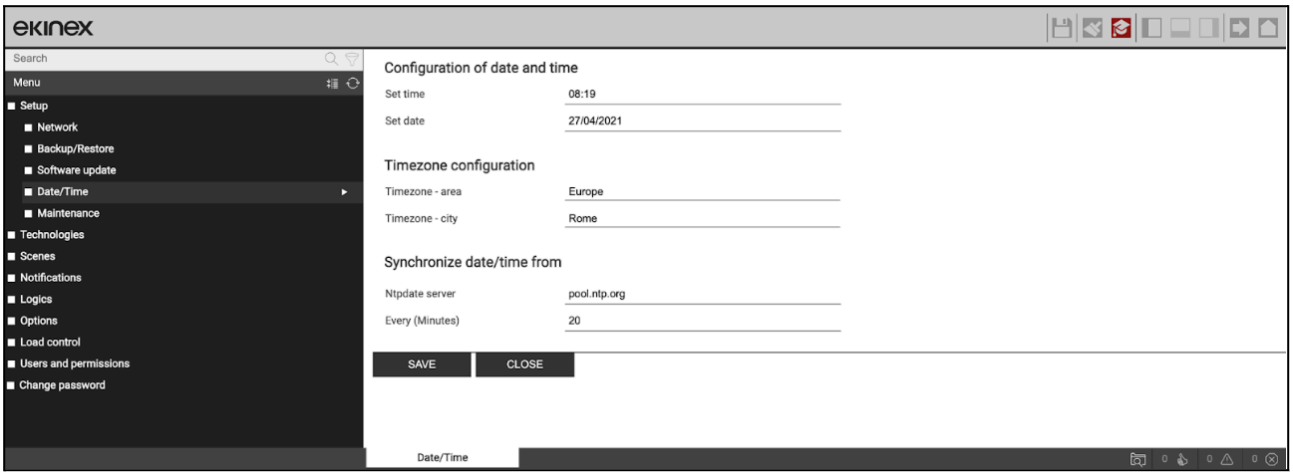
Once the UPDATE button is pressed, the software upgrade procedure starts, and can take up to 15/20 minutes to complete, according to the starting version and the configuration project. Do not close the browser, do any other operation, or switch off the power supply, to avoid the risk of malfunctioning of the webserver.

Date / Time

When connected to a LAN with internet access, C4 TOOLBOX automatically updates its internal clock. As an alternative, it is possible to setup date, time and time zone manually, by entering the corresponding details in the following page:

SETUP > DATE / TIME

Once pressed the SAVE button, please wait for the procedure to complete, without closing the browser or switching off the device.



Maintenance

The following page

SETUP > MAINTENANCE

gives an overview of the working state of the device, its serial number and hardware code, and a synthesis of the hardware resources.

Additionally, the following operations can be done:

- Restart the communication services
- Remotely reboot the system

Device reset

DEFAULT IP ADDRESS RESTORE

If necessary, you can restore the factory IP address of the server C4 TOOLBOX using the RESET available. Follow the procedure below:

- open the front panel of the server C4 TOOLBOX using a small slotted screwdriver, and exerting a slight leverage effect in one of the side slots
- locate the RESET button on the back of the vertical card
- press the button for at least 10 seconds until the SERVICE LED on the front of the device starts flashing, then release the button.
- within the next 5 seconds, press and release the button for 1 second; within a couple of seconds the front LED will light up solidly for a couple of seconds
- when the LED goes out, the device can be reached at the factory IP address (**192.168.0.110**).

If the LED goes out after long press (10 seconds) before short press, repeat the whole procedure. This procedure resets the IP address and retains all data relating to the configuration previously carried out on the automation system.

COMPLETE RESTORE

It is possible to restore the factory conditions by resetting the IP address and emptying the configuration project with a different procedure. In such a case, please do the following steps:

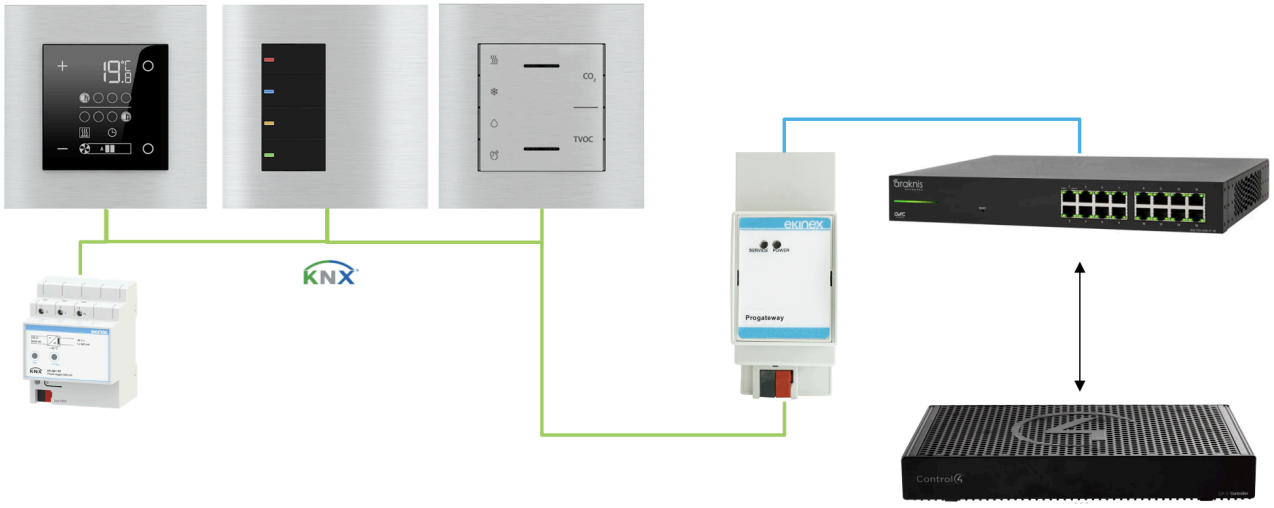
- Open the front panel of the server C4 TOOLBOX using a small slotted screwdriver, and exerting a slight leverage effect in one of the side slots
- Locate the RESET button on the back of the vertical card
- Press the RESET button for at least 10 seconds until the SERVICE LED on the front of the device starts flashing, then release the button.
- Within the next 5 seconds, press and hold the button for at least 10 seconds
- When the LED is solidly lit, release the button and wait for it to go out.
- When the LED goes off, remove and restore the power supply

Wait about one minute and log in to the server with the factory IP address (192.168.0.110).

KNX

Introduction

C4 TOOLBOX can be used as IP gateway for CONTROL4, in order to make the COMPOSER PRO to communicate with KNX devices:



This specific functionality does not require any configuration in C4 TOOLBOX, and can be easily reached with a standard KNX communication driver offered by Control4, as better explained in the dedicated chapter “CONTROL4 INTEGRATION” in the following of this document.

Besides this basic communication service, C4 TOOLBOX offers additional functionalities, that require a proper configuration; this chapter is dedicated to this configuration, and will enable the following additional services:

- diagnostic monitoring of the installed KNX devices
- energy monitoring and load control
- scenes management
- logic engine
- notification services

ETS Import

The automatic import of the ETS project (version 4 and later) is an indispensable tool to facilitate the entire project cycle of the KNX automation system, from the preliminary version to the as-built version. The system integrator can associate automatically imported group addresses to define the functionalities of the webserver:

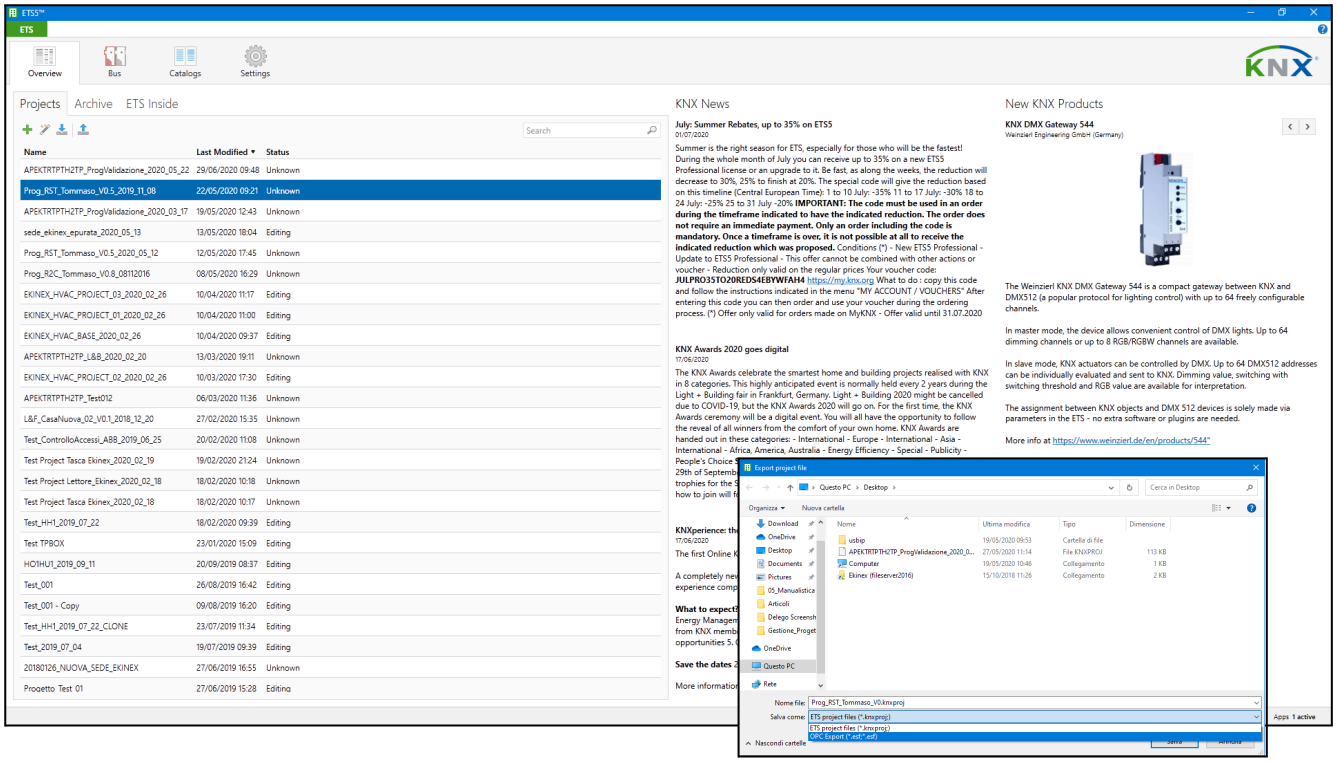
- ETS project format: OPC Export (Open Platform Communications) extractable with ETS4 and later versions
- Importing group address structure (1-3 levels), descriptions, and KNX communication object type
- Support for subsequent imports and/or manual introduction with merging of new group addresses
- Configuration acceleration tools with automatic detection of status feedback addresses by matching names and filters on group addresses
- Copy of functional components by offset on group addresses: this function allows to automate the supervision project by creating copies of the graphic components with the communication objects appropriately translated.

Once the project has been imported into the C4 TOOLBOX webserver, the group addresses are available in the menu on the left and can be dragged manually into the definition of the graphic components. During the association of the objects in the graphic components tabs, convenient drop-down lists allow to automatically select the objects with compatible data type.

To make the most of the C4 TOOLBOX import options, read this chapter carefully. The adoption of rules in the definition of main groups / intermediate groups / group addresses as well as the adoption of a shrewd nomenclature in the descriptions of group addresses in the ETS project allows to speed up the creation of the supervision project.

The ETS import is not strictly necessary in order to configure the KNX widget. In case of small projects, it is possible to skip this procedure, and proceed directly to the manual configuration of the widgets; the project import is highly recommended anyway, and it is necessary for the diagnostic of the bus.

EXPORT ETS5 PROJECT



OPC export can be done with ETS5 following these steps:

- In the main menu of ETS with the list of projects, select the project to export and press the Export button or by right mouse button select Export
- In the *Export Project File window*, in the *Save As* field, select the OPX Export option (*.esf; *.esf)
- Choose the file name and press the *Save* button in the *Export Project File* window

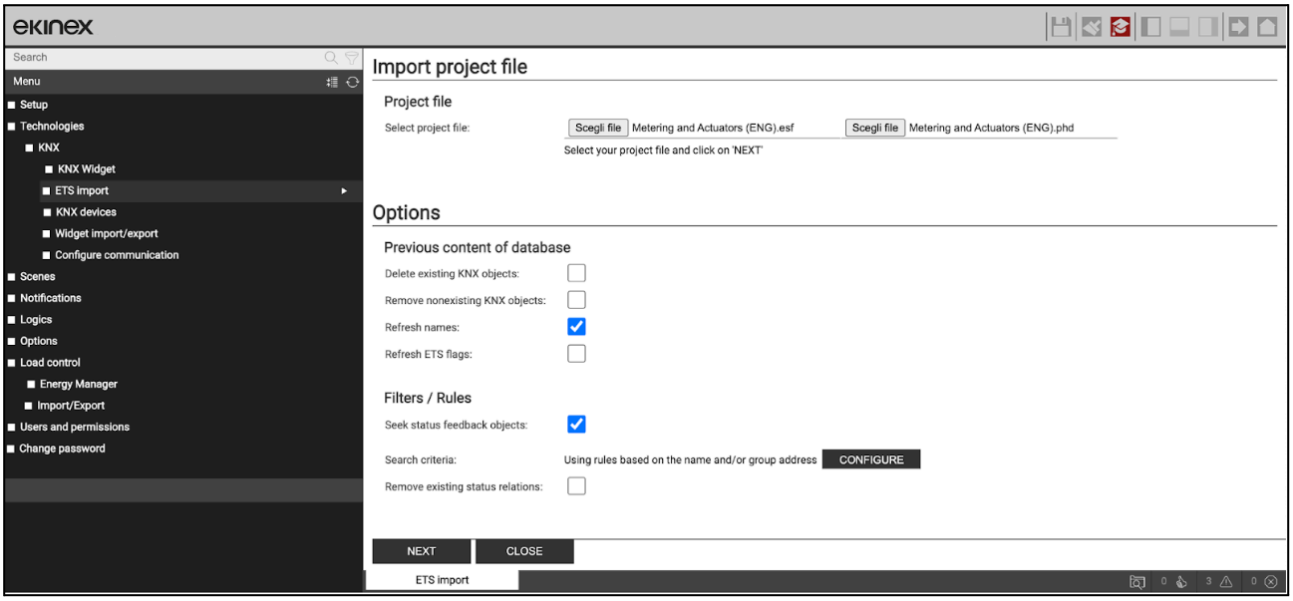
2 files will be generated: one with the extension .esf and one with the extension .phd.

For the correct import of ETS project files into the web-server C4 TOOLBOX, the file name must NOT contain special characters

IMPORT IN C4 TOOLBOX: PRELIMINARY PHASE

To import a new ETS project, go to the appropriate page:

TECHNOLOGIES > KNX > ETS IMPORT



The page contains the following options:

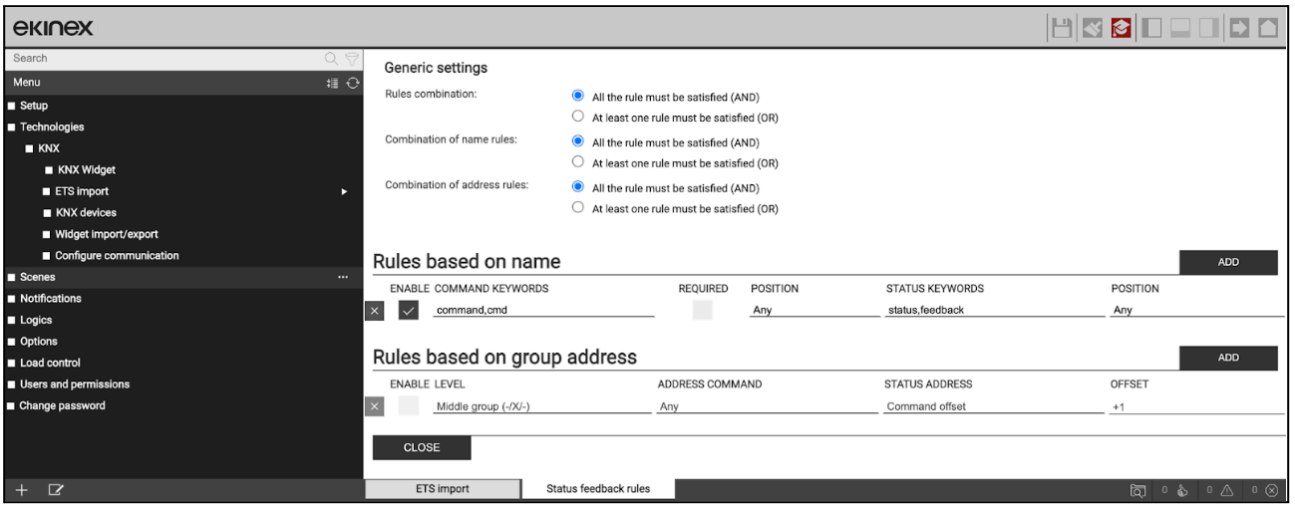
PROJECT FILE	Using the *Choose file* button, you can select the file with the extension *.esf* in the folders of your PC. The file must be previously exported from ETS selecting the OPC Export mode: this export mode automatically generates 2 files: a file with *.esf* extension containing the descriptions and type of group addresses used in the project and a file with .phd extension containing the list of physical addresses of the devices. Once the *.esf* file has been selected, a second button *Choose file* appears automatically, through which you can select the *.phd* project file in the folders of the PC.
FILTERS/RULES	Status feedback search: by enabling this option it is possible to activate the automatic search for command addresses and corresponding feedback addresses, through special rules on the name or group addresses

When you enable ADVANCED mode, you can also specify the following with the ADVANCED button in the toolbar at the top:

PREVIOUS CONTENT OF DATABASE	The *Delete objects not present in the project* option allows you to delete all objects from the web-server that are not already present in the project to be imported. There are other settings to be selected with flags:

	▪ update labels: updates the descriptions of a previous import for already defined objects ▪ update ETS flags

By pressing the CONFIGURE button at the status feedback search rules, the following page is shown:



The correct configuration of these rules is very important, in order to greatly speed up the subsequent work of configuring widgets. If C4 TOOLBOX is not correctly instructed on the relationship between command and feedback addresses, in fact, it cannot pre-compile the selection of these address pairs when creating a new widget.

The general settings on this tab are:

RULES COMBINATION	Options: ▪ All rules must be fulfilled (AND) ▪ At least one rule must be satisfied (OR)
COMBINATION OF NAME RULES	Options: ▪ All rules must be fulfilled (AND) ▪ At least one rule must be satisfied (OR)
COMBINATION OF ADDRESS RULES	Options: ▪ All rules must be fulfilled (AND) ▪ At least one rule must be satisfied (OR)
RULES BASED ON NAME	The following options are available: ▪ DELETE RULE ▪ ENABLE RULE ▪ KEYWORD COMMAND: example *command*, *cmd*. Keywords can be separated by comma or inserted as new rules

	▪ MANDATORY ▪ POSITION (command rule): Start, End, Any ▪ KEYWORD STATUS: example status, feedback, st. As for the command, the different rules can be separated by comma or inserted as new rules ▪ POSITION (status rule): Start, End, Any
RULES BASED ON GROUP ADDRESS	The following options are available: ▪ DELETE RULE ▪ ENABLE RULE ▪ LEVEL: main group (X/-/-), intermediate group (-/X/-), group address (-/-/X) ▪ COMMAND ADDRESS: ▪ STATUS ADDRESS: ▪ OFFSET:

It is possible to create two types of rules:

RULES BASED ON NAME	Status feedback is searched among objects whose name differs from the command for one or more keywords.
RULES BASED ON GROUP ADDRESS	Feedback is searched for based on the KNX address, which must be related to the respective command in some way.

Rules can be defined and not activated by unchecking the "ENABLE" selection box; in this case, their definition remains stored in the project, but is not used during import.

If several rules are defined (and activated), it is possible to decide whether they should work in OR or AND, using the appropriate options at the beginning "COMBINE RULES"; it is possible to establish an AND/OR criterion within the rules by name (if more than one), by address and cumulatively between the two types of rules, for maximum flexibility.

The name-based rules work like this: you can specify one or more words to be searched for in command objects and they will be removed to search for the corresponding status; if these words must necessarily be present, the "mandatory" option must be selected. Then you have to specify one or more words to be searched in the status objects, specifying (as in the case of keywords on commands) if they must be at the beginning, at the end or in any position of the ETS name.

The search automatically ignores a series of "special" characters:

- Space

- -
- _
- +
- ,
- ;
- .

The rules based on the address, on the other hand, provide first of all a filter on the command address; choosing "any" all is fine, otherwise it is possible to establish a filter on the command address (depending on the level - 1, 2 or 3 - of the KNX address on which the rule operates). The status address can be "any", "equal to command" or "offset on command", in the latter case a positive or negative offset must be chosen.

Some examples:

- equal name with "status" or "feedback" in addition (possibly replacing "command" or "cmd");
- KNX address shifted by 1 to intermediate address with the same "main group" and "address group" (the first and third address number, for example).

By combining more rules you can get more powerful filters, for example: if you have created a project where the states are shifted by 1 as an intermediate address and 10 as a group address, i.e.

0/0/1 -> 0/1/10

0/0/2 -> 0/1/11

you can create two address type rules, putting AND as a combination.

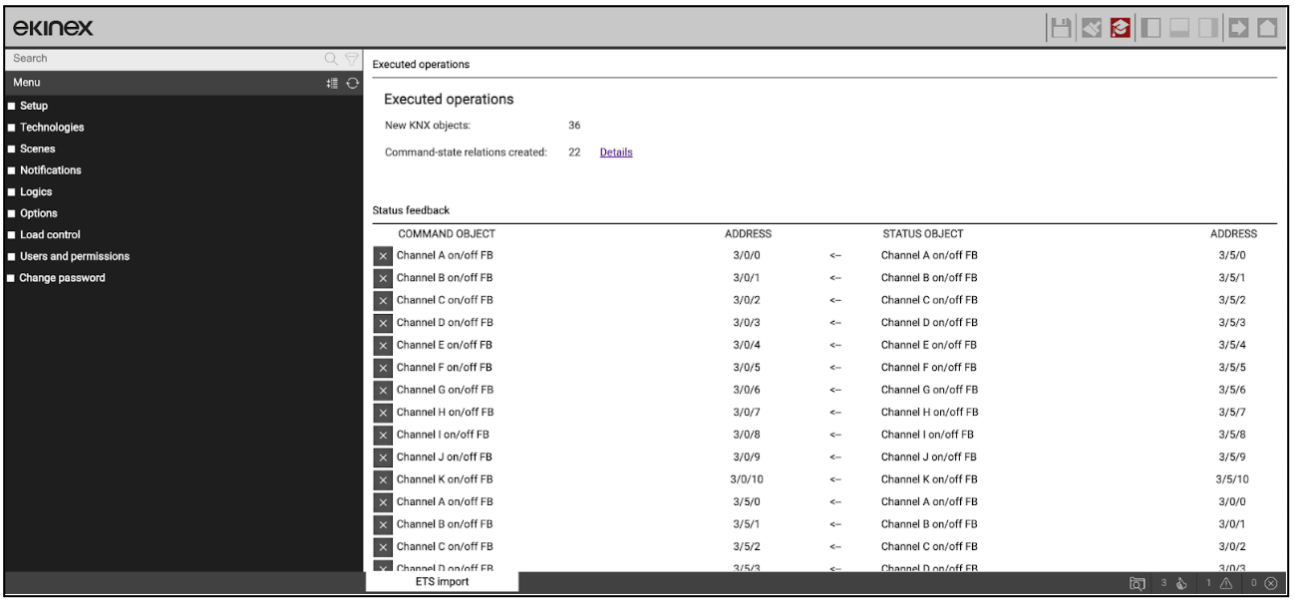
IMPORT IN C4 TOOLBOX: FINALIZATION

After specifying the import options, pressing the NEXT button will start the actual import. The following operations are performed during this procedure:

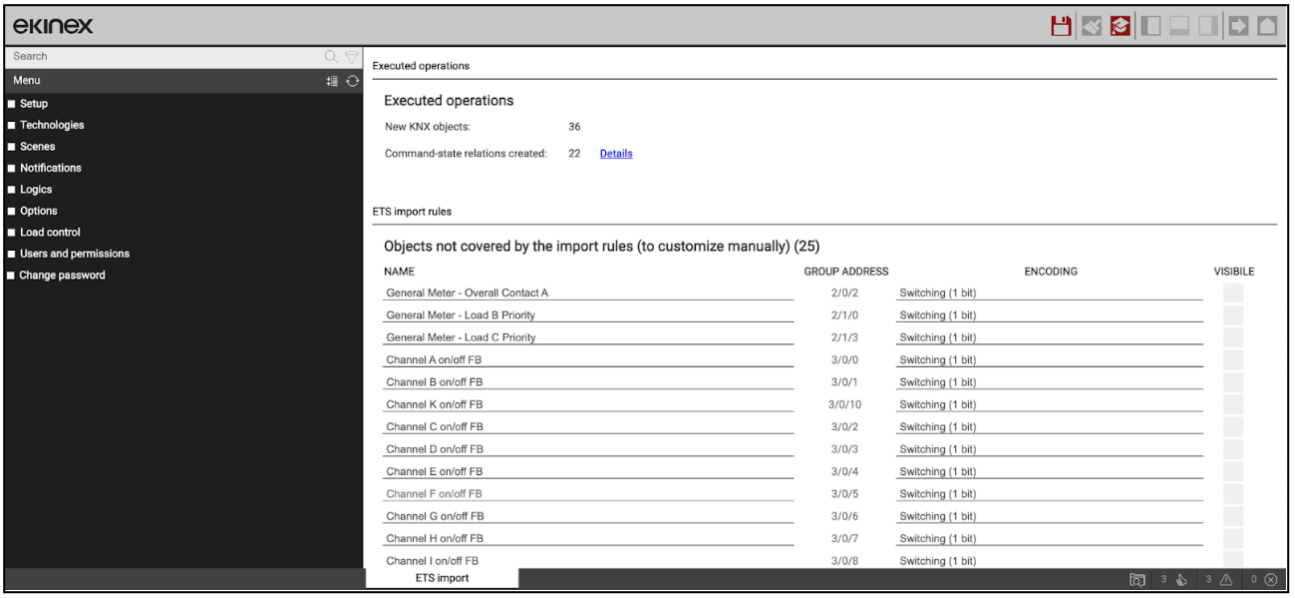
- For each of the KNX addresses present in the project, an entry is created in the side menu of C4 TOOLBOX, which can then be used for *drag & drop* in the creation of the widgets. These items are also used to populate the address shortcut lists, as shown below

- Each KNX address is associated with a specific data encoding, category and pre-selection of the function performed, using for this purpose a list of preset ETS RULES. If an address does not respond to any of these rules, it must be customized at the end of the procedure.
- Possible relations between KNX group addresses are searched, in order to associate a command address to the corresponding status feedback, using the rules previously seen

At the end of the import procedure, a detailed summary of all the status-command associations performed is proposed first (by pressing the DETAILS link), as exemplified in this screenshot:



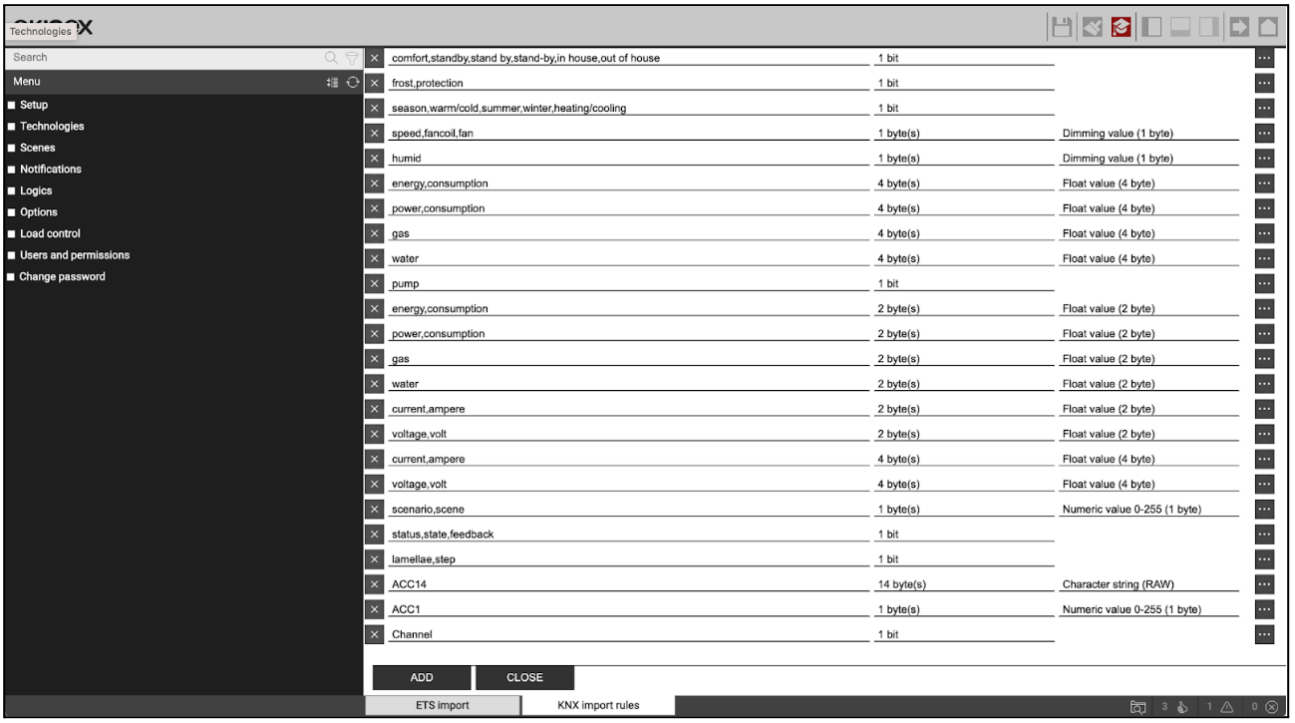
If the ETS project contains group addresses that do not comply with ETS rules, moreover, they are listed at the end of the import, in order to allow their customization before finishing the procedure:



It is possible to proceed in two ways:

- Configure the single address, choosing the exact encoding, the function of belonging (not mandatory) and the most appropriate icon to represent it
- In case of multiple addresses that could be managed with a rule, press CHANGE RULES and create an ad hoc ETS rule

In this second case, you are taken to the following page, containing a list of predefined rules:



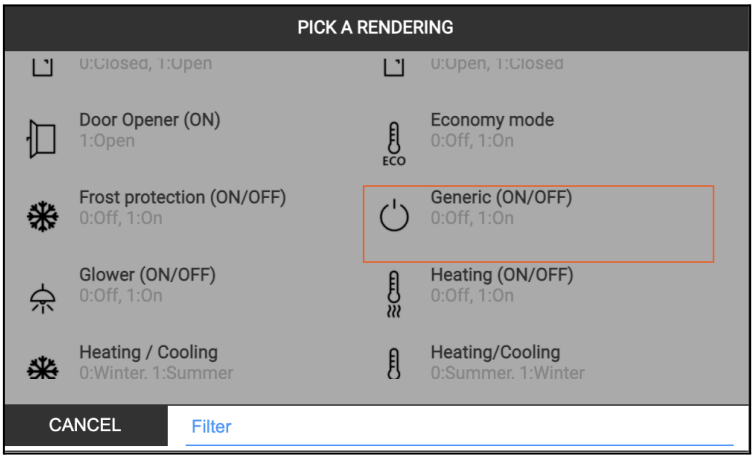
The rules look for one or more keywords within the group address names and automatically assign the correct data encoding (necessary for proper supervision) and the graphical appearance of the corresponding objects.

Each rule consists of the following informations:

KEY	One or more words (or pieces of words) to search within the names assigned in ETS to group addresses. To specify more than one word separate them with the comma; the space is searched within the ETS project, thus allowing a greater granularity in the composition of the rules
TYPE	Length (in bits/bytes) used in the KNX addresses to search within the ETS project
CODING	Type of coding to be used in C4 TOOLBOX to correctly interpret the data in transit on the KNX bus (depends on the data length specified in the "TYPE" field)

FUNCTION	Category in which to insert the objects created by C4 TOOLBOX during the import of KNX addresses that meet the search criteria of the ETS rule
ICON	Icon (or set of icons) to be used for the graphic representation of objects that meet the rule's search criteria

The rule must be interpreted in the following way: if C4 TOOLBOX finds a group address that contains in the name at least one of the KEYWORDS specified in the rule, and that includes the data length specified as TYPE, adopts the CODE specified in the rule to write/read information on the KNX bus, automatically assigns the chosen FUNCTION and adopts the chosen ICON for the graphic representation of the corresponding object.



Once the rules are integrated, return to the ETS import tab and press REPLACE RULES. Repeat the operation as many times as necessary, to manage the whole list of addresses present in the project; it is possible to leave unmapped KNX addresses from this list, but they may not be managed correctly in the following KNX widget configuration phases.

Press NEXT to complete the import procedure, at the end of which the page is reloaded, and the imported group addresses are ready to be used as support in the following steps of configuration.

Widgets

The basic blocks for the advanced functions of C4 TOOLBOX are called *widgets*; they represent a KNX functional block, made of one or more KNX group addresses and, eventually, additional virtual objects.

At the present moment, C4 TOOLBOX offers the following widgets:

- energy meter (for the measurement of energy consumption of photovoltaic production)
- load (for the automatic control of an appliance according to the energy demand)

- single (for the representation of a single KNX group address inside C4 TOOLBOX)

Additional templates will be added in future versions for the management of lighting, automations, climate control etc… in combination with drivers for COMPOSER PRO.

The management of the widgets can be done in the following page:

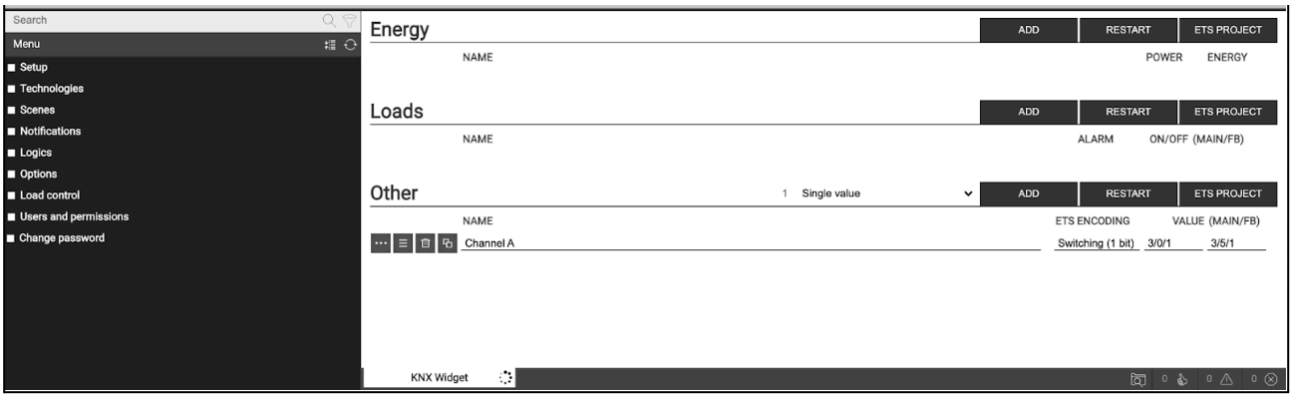
TECHNOLOGIES > KNX > KNX WIDGET

CREATING A WIDGET

In order to add widgets to C4 TOOLBOX, do as follows:

- identify the section corresponding to the type of widgets to be created
- enter the number of widgets to be created (leave empty to create a single widget)
- choose the desired template, if multiple options are available
- press the ADD button and wait for a while

In the following example, a single widget has been created to represent the first channel of an actuator:



For single widgets, the following parameters must be set in order they to work properly:

- ETS encoding: choose the most appropriate encoding for the data transferred on the bus on the corresponding command (and optionally status feedback) address
- Main group address for value (left text field named “MAIN”)
- Status feedback address for value (right text field named “FB”)

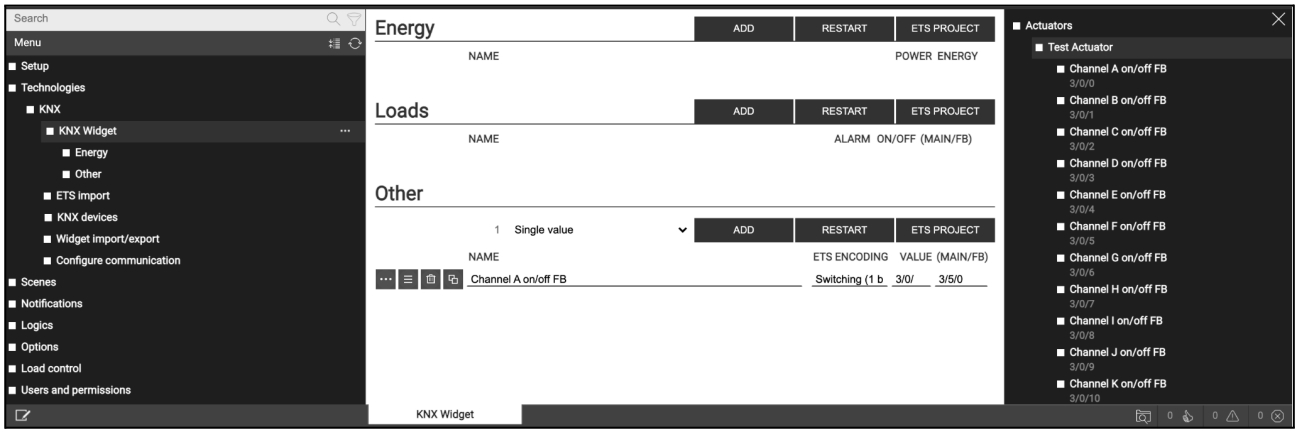
In the example, the address “3/0/1” has been assigned to the command address, and “3/5/1” to the feedback. When C4 TOOLBOX will send commands to this widget, the first address will be used; when a value will be received on the same address or the status feedback one, the internal value of the widget will be updated accordingly, and any eventual automation associated to it, will be triggered.

A more detailed list of attributes for the associated sub-object of the widget is available in the widget edit page, reachable by pressing the edit (three dots) corresponding button:

Besides the main and feedback addresses and the ETS encoding already seen in the previous view, the following attributes can be set in this page:

WRITE	When set, the widget can be commanded by C4 TOOLBOX
READ	When set, the widget can be read by C4 TOOLBOX
SCEN	In case of multiple objects (for other types of widget then the single template), this flag determines which one must be commanded when the widget is added to a scene Please refer to the chapter dedicated to the scenes for additional information
STATE	Gives a real-time representation of the widget and allows the sending of commands for testing purpose

The addresses imported from ETS can be used to support the configuration of the widgets. By pressing the ETS PROJECT button, the ETS project tree is opened on the right, as in the following example screenshot:



The imported group addresses can be drag & dropped into the MAIN and FB fields; it is suggested to start with the main (command) address. If the command-status rules have been properly configured during the ETS import process, the status feedback is automatically filled as soon as a command address is dropped.

Additionally, in case of single value widgets, the name of the imported command address is automatically set as widget name, if a custom label has not been set previously.

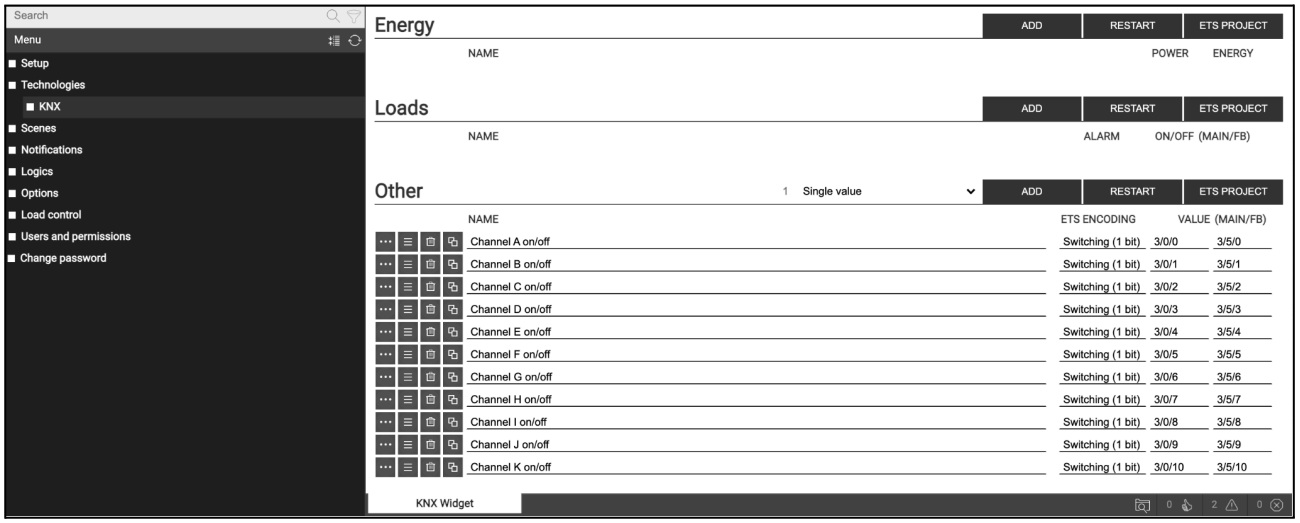
DUPLICATE WIDGETS

In case of multiple functions with the same characteristics and KNX addresses that follow specific numbering criteria (e.g. the last number that increases by a specific offset), it is easy to create the corresponding widgets by duplicating the first one.

By pressing the CLONE button the following form is presented:

The number of widgets and the offset criteria for the automatic duplicate procedure can be entered, in the form of an offset (positive or negative) for each token of the three-level KNX addresses.

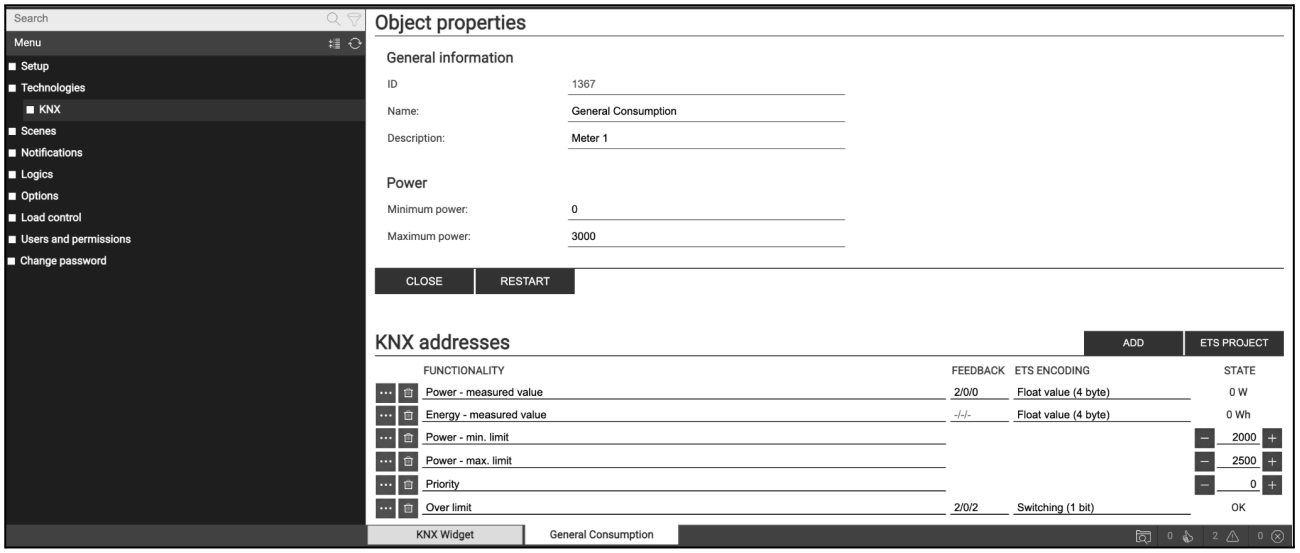
If the group addresses obtained by duplication are found in the ETS project, the corresponding status feedback and naming are automatically set, like in the following example:



When changes to the KNX widgets configuration have been completed, press any occurrence of the RESTART button in order for the communication driver to make them operative.

ENERGY METERING WIDGETS

By creating an energy meter in the ENERGY section, and entering its detail page, the following interface is displayed:



The following KNX sub-items are available:

POWER - MEASURED VALUE	Instantaneous electric power measurement
ENERGY - MEASURED VALUE	Accumulated electric energy measurement
OVER LIMIT	Alarm set to 1 when the load control is in action (and the energy meter is its reference)

Being all of these items in read-only, only the FEEDBACK (status) group address can be set. If the default ETS encoding for the measurements is not suitable (4 byte floating point), change it with the corresponding drop-down menu, by activating the EXPERT visualization with the button in the toolbar on top of the page.

The following additional virtual-only sub-items take part of the meter:

POWER - MIN LIMIT POWER - MAX LIMIT	If the meter is used as reference for the load control, they represent the upper and lower limits for the automatic switch-off of the loads
PRIORITY	The current priority for the load control

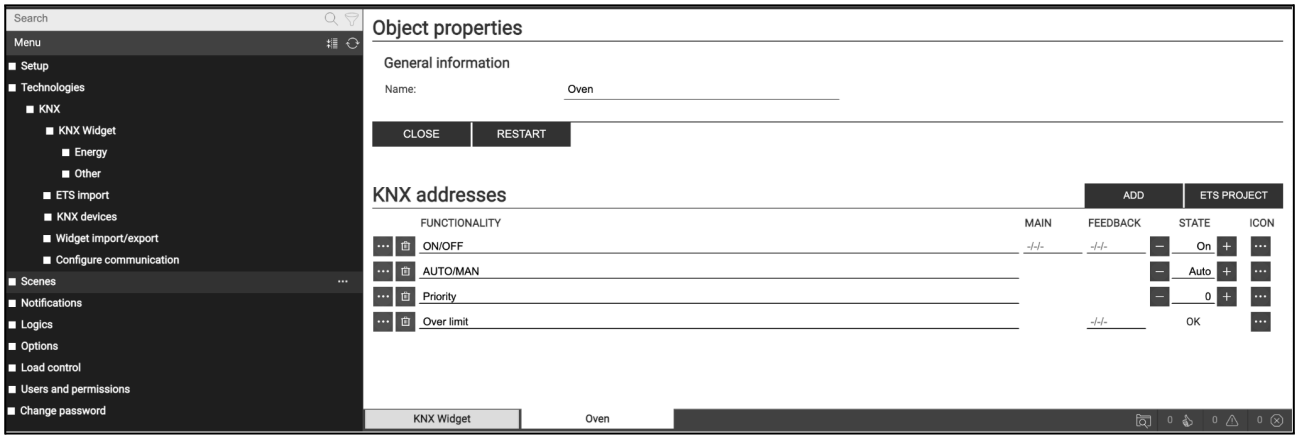
In the eventuality that the virtual sub-items (limits and priority) must be exchanged as telegrams on the KNX bus, it is possible to manually add them as KNX sub-items in the following way:

- remove the existing virtual sub-item with the corresponding trash bin button

- press the ADD button at the beginning of the list
- choose the same FUNCTIONALITY as the deleted item in the drop-down menu
- fill the new item with the requested KNX group addresses and other flags

LOAD WIDGETS

In a similar way, widget representing the loads to be controlled can be added in the LOADS section; the details page is similar to the following example screenshot:



The following KNX sub-items are available:

ON/OFF	The actuator output connected to the appliance
OVER LIMIT	Alarm set to 1 when the load control is in action (and the energy meter is its reference)

The following additional virtual-only sub-items take part of the load:

AUTO/MAN	Allows to switch between normal mode (AUTO) controlled by the load control system, and the manual (MAN) mode, where the load is ignored by the load control
PRIORITY	The priority given to the load (can be changed by user in visualization)

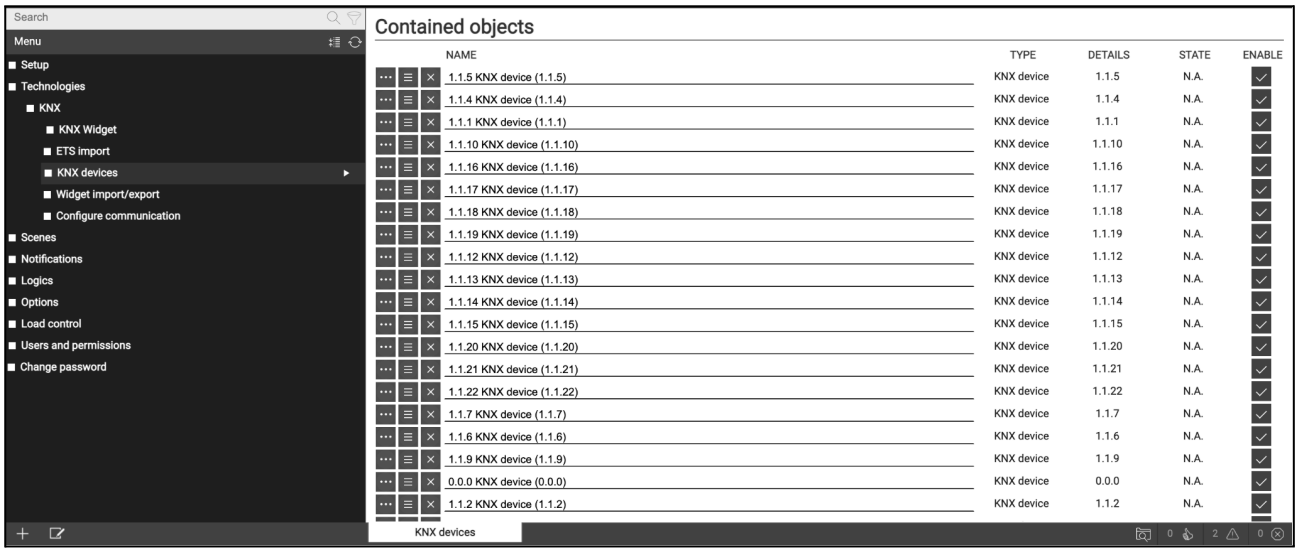
KNX Devices Diagnostics

If the PHD file has been imported, C4 TOOLBOX is aware of the installed KNX devices, and can make a diagnostic check that they respond correctly.

The following page

TECHNOLOGIES > KNX > KNX DEVICES

gives an overview of the imported KNX devices, like in the following example:



If a specific device must be excluded from the control, the corresponding ENABLE flag must be de-flagged. In order these changes to enter in action, when done, the communication services must be restarted in the

SETUP > DIAGNOSTIC

page, as previously described.

As soon as a device responds to the keep-alive check, its status is set to OK; if it later stops answering for three consecutive times, the status goes to ERROR, and an automatic notification is raised. Notifications can be handled in CONTROL4 as better explained in the CONTROL4 INTEGRATION chapter in the following of this document.

Widget Import / Export

This page offers the possibility to export the configuration of a widget, thas has been previously configured, into a CSV on a local folder of the computer. This file contains the list of sub-items and the associated group addresses.

Once the file has been saved, it can be imported back into the same C4 TOOLBOX, or another device; the procedure is similar to the one shown during the duplicate process.

Configure Communication

This page permits the configuration of the communication stack with the KNX bus. The following

options are available:

PHYSICAL ADDRESS	The physical address assigned to the webserver; it is used when sending telegrams onto the bus. A valid address must be entered in the form X.Y.Z; leave the default 0.0.255 if a “wildcard” addressing is suitable for the specific installation.
COMMUNICATION CHANNEL	C4 TOOLBOX can use the internal TP interface (default) or an external IP router; in such a case, select the corresponding item in the drop-down menu and save
ROUTING COUNTER	The routing counter of the telegrams sent by C4 TOOLBOX to the bus (default: 6). The lower number is set, the shorter list of line couplers can be trespassed. Set 7 (never expire) only in specific cases.
ENABLE INTEGRATED KNXNET/IP ROUTER	Flag this option in order to enable the integrated IP router functionality; when set, all telegrams received from the TP (physical cable) are router to the IP network and vice versa. Do not enable this function if another IP router, connected on the same physical bus, is already installed.

LOAD CONTROL

Introduction

C4 TOOLBOX can be used for the monitoring of the energy demand of the building and the energy production, in case of a photovoltaic system. C4 TOOLBOX can also take control of a list of appliances, by switching them OFF by following a specific priority list, in case of excessive power demand, in order to avoid the cut-off of the energy supply; when the power demand returns back to normality, the loads are reverted to their original state.

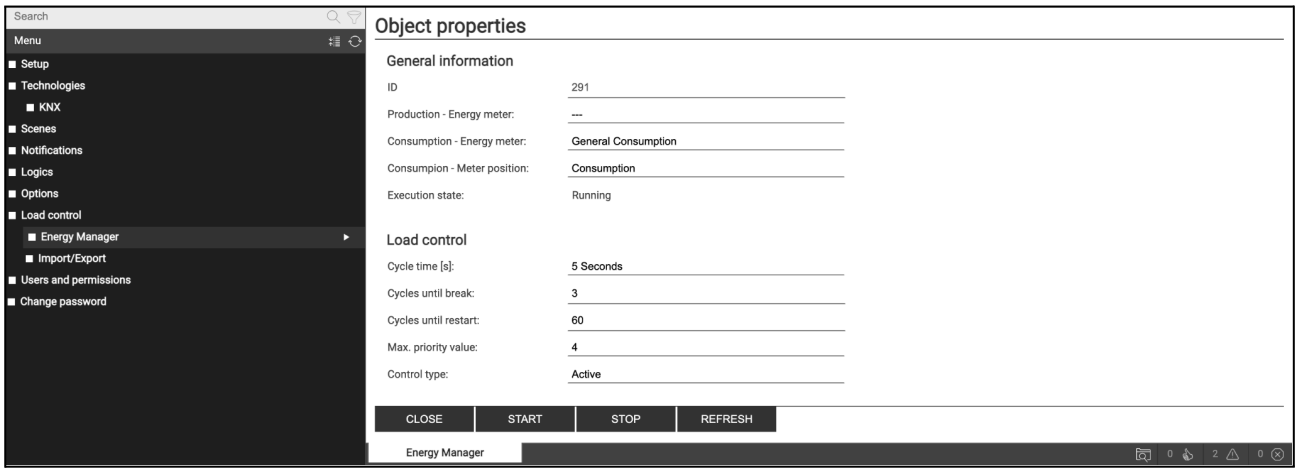
The configuration of the integrated load control makes use of the meters and load WIDGETS configured in the previous chapter.

Energy Manager

By accessing the section

LOAD CONTROL > ENERGY MANAGER

it is possible to configure all the necessary parameters necessary for the load control system to work properly. The following details form is presented:



The following information must be entered:

GENERAL DATA

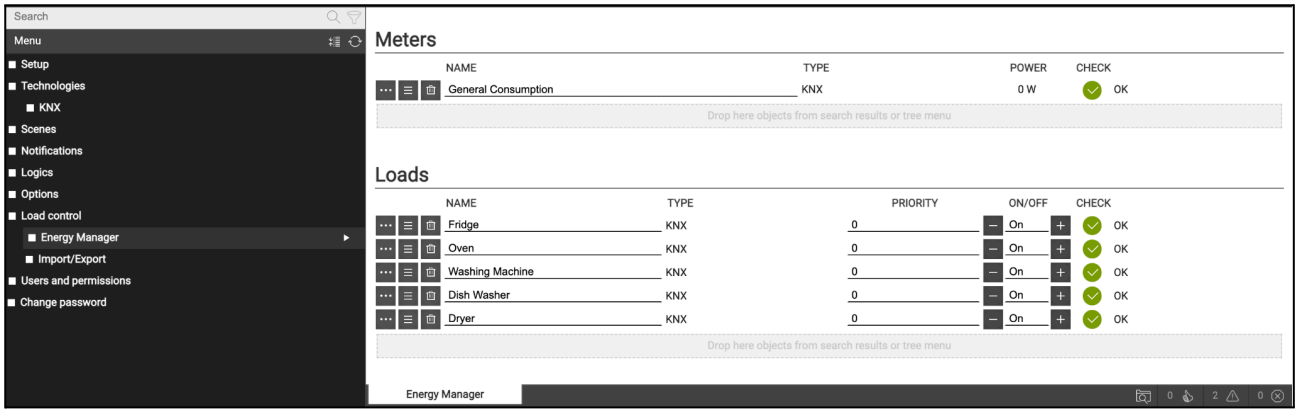
PRODUCTION ENERGY METER	Select which meter to use for photovoltaic production, if any

CONSUMPTION ENERGY METER	Select which meter to use for general consumption
CONSUMPTION METER POSITION	Allows you to determine whether the consumption meter is positioned on the exchange meter or at the entrance to the building panel.
EXECUTION STATE	Indicates whether the energy manager logic is running or not

LOAD CONTROL

CYCLE TIME [s]	Time (in seconds) of the "basic cycle" of the load control logic; at the end of this time, the absorption value is checked and compared with the thresholds, in order to determine the action to be taken
CYCLES UNTIL BREAK CYCLES UNTIL RESTART	Number of basic cycles (the duration of which depends on the previous parameters) that the system waits for before increasing the priority (thus disconnecting the loads of the next priority) if the absorption condition above the threshold persists, or - vice versa - the number of cycles that the system waits for before reducing the priority, restoring the corresponding loads. Usually, a reduced number of cycles is inserted for disconnection and a high number of cycles for restoration, in order to reduce the risk of stress on the users and the creation of a sort of "loop" that does not solve the problem of excessive absorption.
MAX PRIORITY VALUE	Maximum number of priorities managed by the load control logic; the system does not rise above this number, thus not managing loads with subsequent priorities
CONTROL TYPE	Specify whether C4 TOOLBOX should actually manage the load control logic in active (default) or passive mode; in the latter case, the presence of an external load control device is assumed, and C4 TOOLBOX merely displays the information made available (e.g. on the KNX bus) by the latter

In the METERS section the meters configured previously are summarised, while in the LOADS section the controlled consumers are listed:



Import/Export

This section allows you to export energy data in CSV format, or to import them after saving them.

SCENES

Introduction

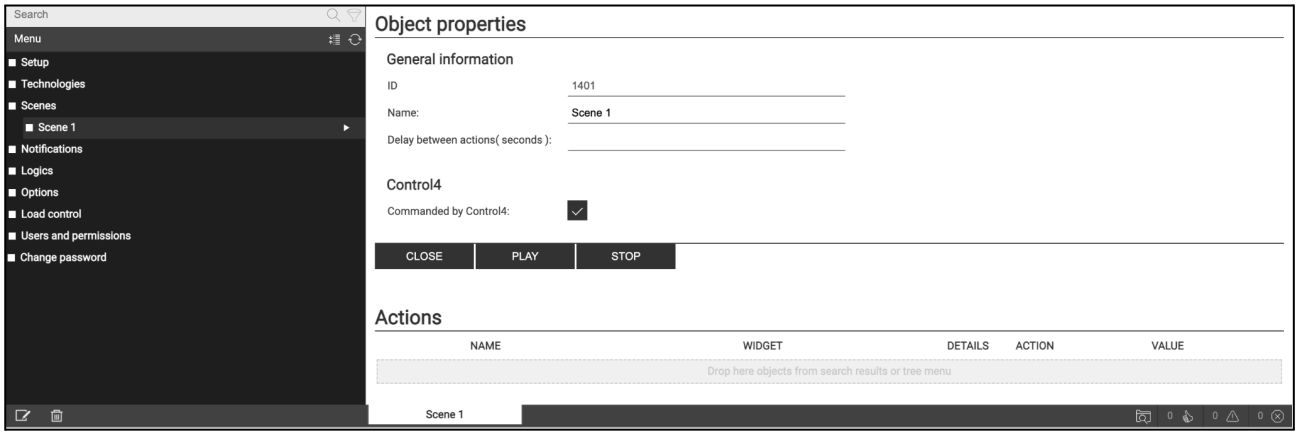
C4 TOOLBOX can perform sequences of KNX commands called SCENES; once configured, the scenes can be triggered in COMPOSER PRO by means of the dedicated driver, as better described in the chapter dedicated to the CONTROL4 INTEGRATION.

Create a new scene

To create a new scene in the configuration environment, proceed as follows:

- Access the C4 TOOLBOX CONFIGURATION environment
- Select SCENES from the navigation menu
- Press the "ADD" button to create a new scene

The new scene is available in the (initially empty) list of scenes; subsequently accessing its tab will show a page similar to the following one:



The following properties can be set:

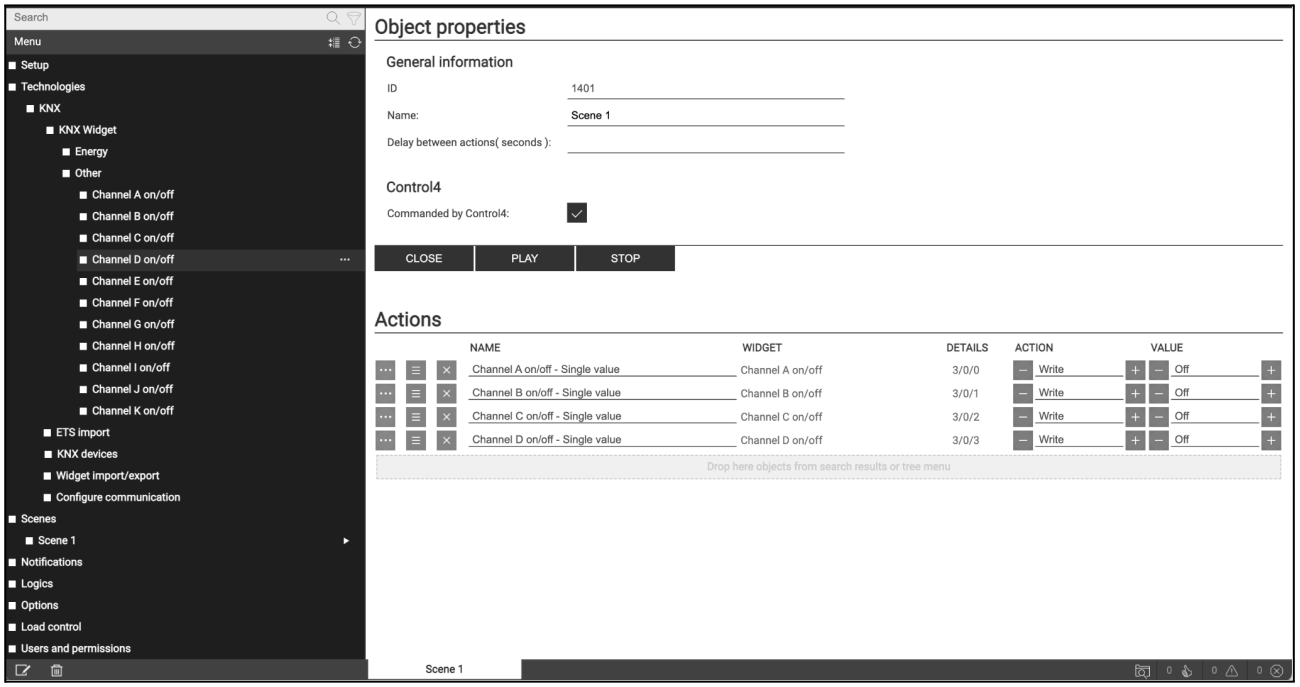
NAME	Identification name of the scene
DELAY BETWEEN ACTIONS	If set, a fixed delay is added among each action of the sequence. A number in seconds, even fractional, can be entered (use the “dot” for decimal digits).
COMMANDED BY CONTROL4	Set this flag in order to enable the scene to be discovered and commanded by CONTROL4, by means of the dedicated driver

Adding actions

Once a scene has been created, it is necessary to associate one or more actions to it:

- Identify the "ACTIONS" section
- Search for the KNX widgets you want to control with the scenario through the SEARCH ENGINE or in the tree menu under the KNX WIDGETS section
- Drag the widget within the "ACTIONS" list, taking care to position them in the same order in which you want the sequence of commands to occur
- For each object dragged, specify the ACTION to be performed and - if required - the VALUE to be sent. In the case of KNX objects, select "WRITE" as the action and the value - among those proposed, according to the type of object - to be sent on the bus when the scenario is executed.

The following example picture shows a list of commands sent by the scene to several KNX widgets, representing different channels of an actuator:



Timed scenes

It is possible to interpose between the command actions of a scene, one or more waiting commands, which delay the execution of the following actions (according to the point in the sequence where the delay is placed) and therefore allow to realize sequences articulated in time.

Waiting commands are full-fledged objects, and as such they can be inserted within the command sequence of a scenario by dragging them into the "ACTIONS" list after being searched with the search engine. C4 TOOLBOX has a series of "standard" delays that can be concatenated to obtain the desired timing:

- 1,2,5,10,15,20 and 30 second
- 1,2,5,10,15,20 and 30 minutes
- 1,2,3,6,12 and 24 hours

All waiting commands have the name "Wait (...)" where in parenthesis is indicated the relative waiting time; they can therefore be searched for by indicating "wait" as a keyword.

Since the wait commands are system objects, are stored in the database in English, they cannot be searched for by specifying exactly the Italian word that appears on the screen; if you want to search for a particular wait command, type not only "wait" but also the number corresponding to the waiting time followed by the suffixes "sec", "min" or "hour".

Scenes with timing, once sent in execution, can be stopped while they are in a waiting state; for this purpose the “PLAY” and "STOP" buttons are present in the details section at the beginning of the form.

Stopping a running scenario interrupts its sequence, which is therefore not completed; however, the original state of the system is not restored before the execution of the scenario itself, for this purpose it is necessary to prepare other commands and/or scenarios.

NOTIFICATIONS

Introduction

C4 TOOLBOX can send notifications when specific events occur (specific KNX addresses go to a predefined value). Notifications can be sent as email to given addresses, or transferred to the dedicated driver in COMPOSER PRO, in order to visualize them in the CONTROL4 visualization.

Control4 notifications

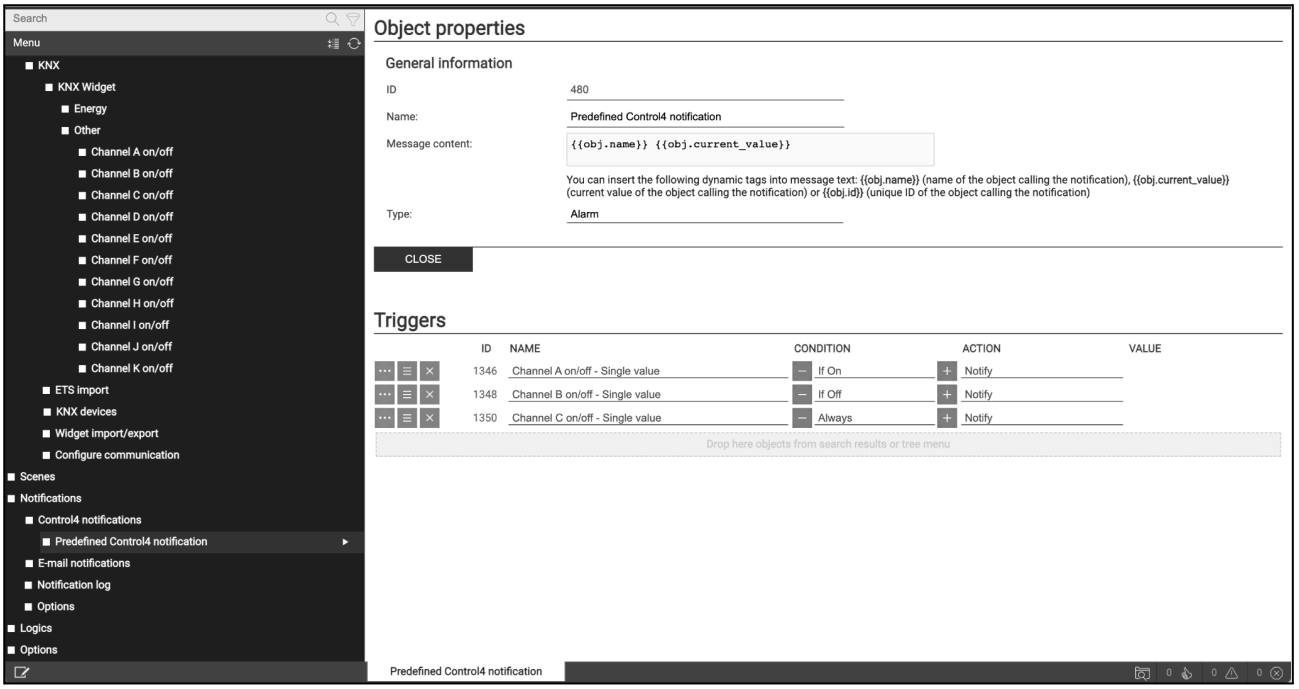
A predefined notification is already present in the system, and can be used for multiple notification messages; on other end, custom notifications can be created as follows:

- Access the configuration environment
- Select NOTIFICATIONS → CONTROL4 NOTIFICATIONS
- Press the ADD button on the toolbar
- Access the new object tab

The following informations are required:

NAME	Identifies the notification within the project
MESSAGE CONTENT	Message that will be displayed in the VIEW
TYPE	Select the type between "alarm", "warning" or "information".

Once a notification has been created, it is necessary to associate it to at least one other object, by dragging it into the TRIGGERS section; KNX widgets are suitable to be dropped here, as in the following picture:



In this example, the following events trigger the notification:

- A value “1” is received on the KNX address associated to “channel A” (condition: “IF ON”)
- A value “0” is received on the KNX address associated to “channel B” (condition: “IF OFF”)
- Any value is received on the KNX address associated to “channel C” (condition: “ALWAYS”)

On-screen notifications can be created with dynamic text, i.e. a message in which the message automatically inserts information about the object to which the notification is linked.

To make the text of a notification dynamic, the following parameters must be inserted into the message:

{{obj.name}}	It will be replaced with the name of the object that triggers the notification
{{obj.current_value}}	It will be replaced with the current value of the reference object
{{obj.id}}	It will be replaced with the unique id of the object that triggers the notification

Email notifications

Email notifications are email messages that C4 TOOLBOX sends to one or more recipients against predetermined events. To create an email notification:

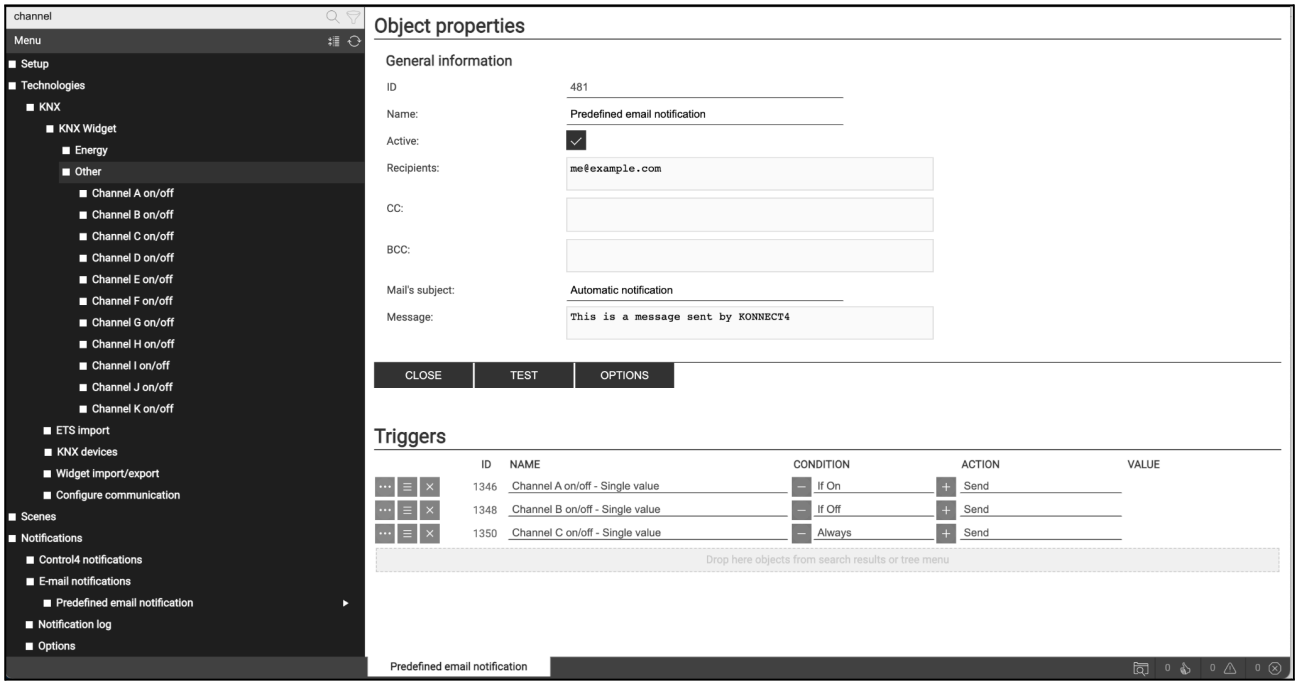
- Access the configuration environment
- Select NOTIFICATIONS → EMAIL NOTIFICATIONS
- Press the ADD button on the toolbar
- Access the new object tab

The following informations are required:

NAME	Identifies the notification within the project
RECIPIENTS	One or more email addresses (separated by comma or semicolon) to send the notification to
MAIL'S SUBJECT	Subject of the email
MESSAGE	Message inside the email

In ADVANCED mode you can also enter CC and CCN addresses.

Once a notification is created, in the same way already seen for CONTROL4 notifications, it must be bound to other widgets by dragging them into the TRIGGERS list, and providing for each of them a valid condition (value received that triggers the event):



E-mail notifications can be sent only if a valid SMTP server is configured, by pressing the OPTIONS button and entering the following details:

SMTP SERVER	Address or name of the SMTP server to which to support the sending of emails
PORT	Port with which to communicate with the SMTP server
USE SSL PROTOCOL	Enabling SSL encryption as required by SMTP server
ACTIVATE AUTHORIZATION	Activation or not of authentication on the server (usually required)
USERNAME PASSWORD	Credentials to authenticate on the SMTP server

FORWARDER (E-MAIL ADDRESS)	Specify the sender address with which the emails should be displayed if different from the one you authenticate with on the server (if allowed by the SMTP server)

Example of configuration for GMAIL:

SMTP SERVER	smtp.gmail.com
PORT	465
USE SSL PROTOCOL	yes
ACTIVATE AUTHORIZATION	yes
USERNAME PASSWORD	*Enter your full Gmail address and your login password*
FORWARDER (E-MAIL ADDRESS)	*Re-enter your full Gmail address, or leave it blank*

In order to send email notifications via a GMAIL account, you also need to do the following: access the "PERSONAL ACCOUNT" section of your Google account, identify the "ACCESS AND SECURITY" item and activate the option *Allow less secure apps*.

The same email configuration settings can be reached with the tree menu item

OPTIONS > EMAIL SETTINGS

Notification log

This page allows you to consult a history of all the notifications sent by C4 TOOLBOX, with the relative date/time and the message sent to the users. The list can be consulted online and exported in CSV.

LOGICS

Introduction

C4 TOOLBOX allows you to create logics between objects previously created for different technologies managed. The integrated logic module of C4 TOOLBOX is based on a Lua script, automatically generated by the graphical interface, running continuously in the background.

The script keeps the output objects in the state established by the logic, according to a set of rules that will be described in detail in this chapter.

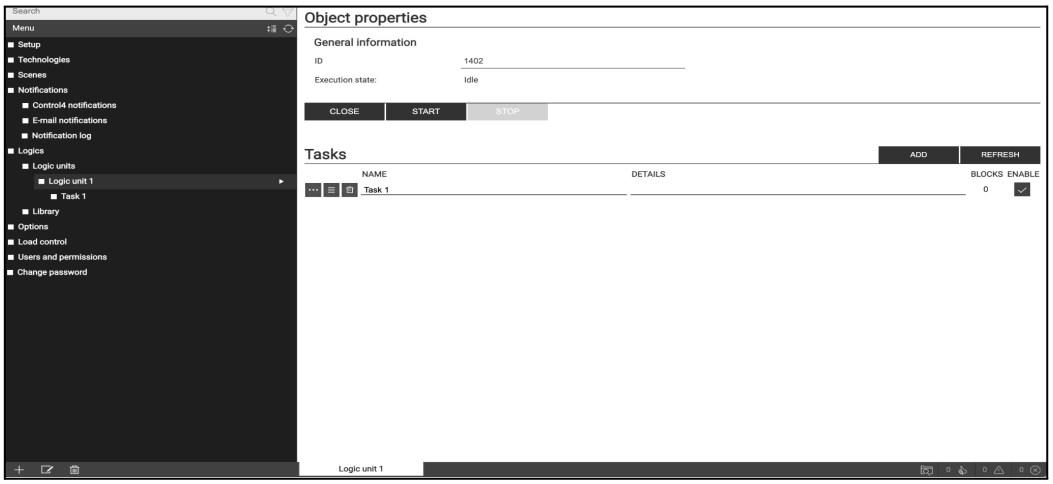
Logic units

C4 TOOLBOX offers the possibility to create one LOGIC UNIT, which is a program running in background and executing a LUA script generated with the graphical block-based interface described in the following.

The logic unit can contain one or more TASKS, each characterized by a graphic page in which to create a logical network; to create a new task, first create the logic unit by pressing the ADD (+) button highlight the item

LOGICS > LOGIC UNITS

and press again the ADD (+) button on the new object to create a task; the following picture shows an example of logic unit with a single empty task:



Each task is represented by a graphic page, where you can drag and drop technological objects (from the side menu or search results), and logical blocks available in the LIBRARY.

Toolbar

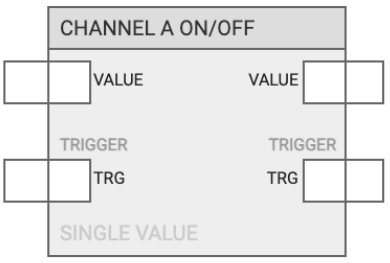
When working on a task, an additional toolbar is displayed, containing the following buttons:

	START/STOP	Start or stop a program
	SIMULATION PLAY	Start the simulation in real-time mode
	SIMULATION PLAY STEP-BY-STEP	Start the simulation in step-by-step mode
	SIMULATION STEP	Stop the simulation in progress
	AUTOMATIC BLOCK REORDER	Sort the blocks by automatic sorting following the position of the blocks
	ZOOM IN	Enlarges the zoom factor of the work area
	ZOOM OUT	Reduces the zoom factor of the work area

Block types

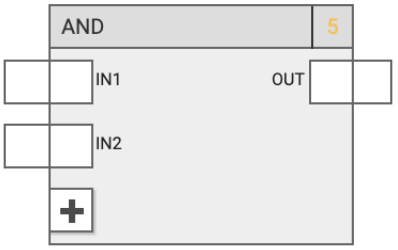
KNX widgets, when dragged into a task, are represented by a technological block. The input and output nodes, whose number and type depends on the type of widget, allow respectively to use the state and to command that particular technological function. The same input node can be connected to multiple blocks, while the same output node cannot be connected to multiple blocks within the same task. Trigger nodes have a very specific role, which will be explained later.

The following picture shows an example of a single channel KNX widget:



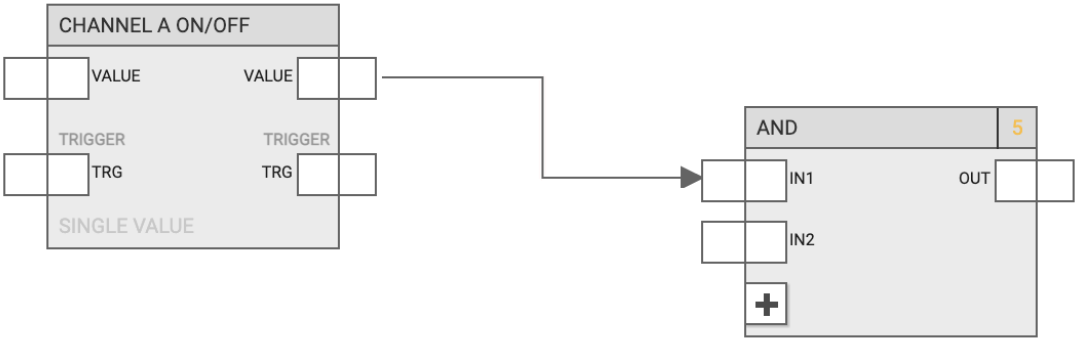
Logical blocks, on the other hand, must be dragged from the LIBRARY in the side menu, and can be used to perform logical operations when connected with the technological blocks; logical blocks can be combined together, of course, in order to create more complex functions.

In some cases the block has a variable number of nodes (input or output); in this case, the "+" button allows you to add nodes to the block, up to the maximum number. The following picture contains an example of logical block with variable number of inputs:



The logic function can be executed correctly only if the nodes are connected to other blocks. Not all nodes are strictly necessary for the correct execution of the logic; if an input node is not connected, its default value is used, editable by selecting the node and opening the corresponding details panel (if it is not possible to set it, it means that the node must necessarily be connected).

A connection between two blocks can be made by dragging the output node of the first, into the input node of the second, by obtaining finally an “arrow” like in the following example:



The input and output nodes of the blocks can be either boolean or numeric. Only coherent nodes can be combined together; certain logical blocks in the library appear twice, being the one dedicated to boolean nodes, the other to numeric ones.

The blocks can be moved in the workspace, by single selection, or by selecting a rectangular area that involves several blocks. To remove a block from the work area, select it and press the DEL key. Connections can also be removed in the same way.

Execution order

During the simulation and compilation phases, the editor generates a Lua script that runs cyclically.

Tasks are concatenated in the script according to their sorting in the logic unit summary page; within each task, even logical blocks have their own order of execution, indicated at the top right for each block.

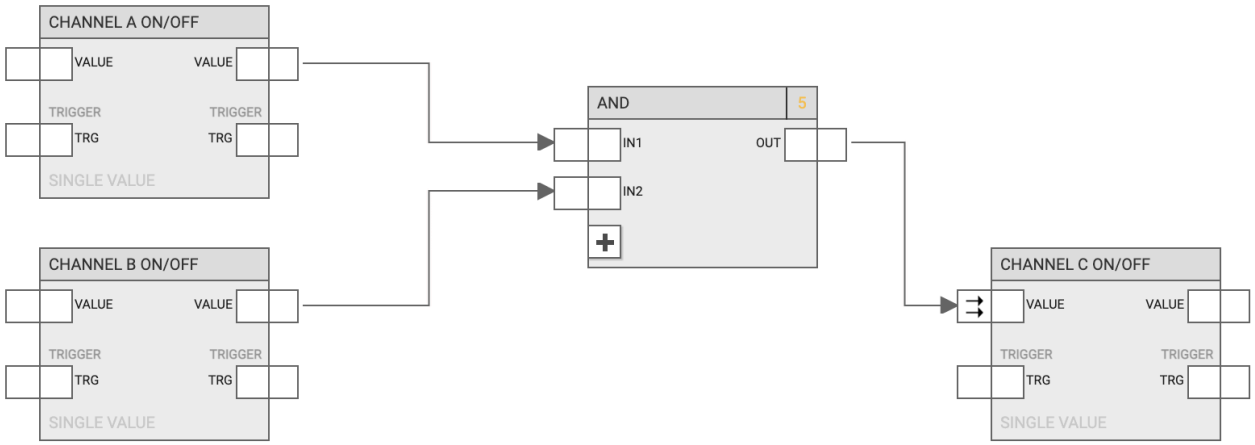
Under normal conditions, blocks are assigned an increasing order according to the order in which they are inserted in the program; however, it is possible to force a different execution order in the following way:

- Select the block concerned
- Open the details panel
- Choose "MANUAL" as sorting
- Enter an order number, taking care to enter a number not yet used

Blocks with manual sorting are highlighted in yellow. Finally, it is possible to sort blocks from top/left to bottom/right using the appropriate button in the toolbar.

Triggers

Under normal conditions, the logic module maintains the state of the output objects according to the state of the logic; as soon as these objects change state (for example, because they receive a command from the bus, external to the logic), their state is immediately restored to that desired by the logic. By considering the following, very simple logic…



… the state of the KNX widget “Channel C” is kept aligned with the AND between the states of “Channel A” and “Channel B”.

This behavior is not always desirable; in many situations, in fact, you want to command an object based on the change of state of other objects, but if this object is commanded externally, you want to keep it in the latter state. In other words, you want to create a logic that reasons "to events".

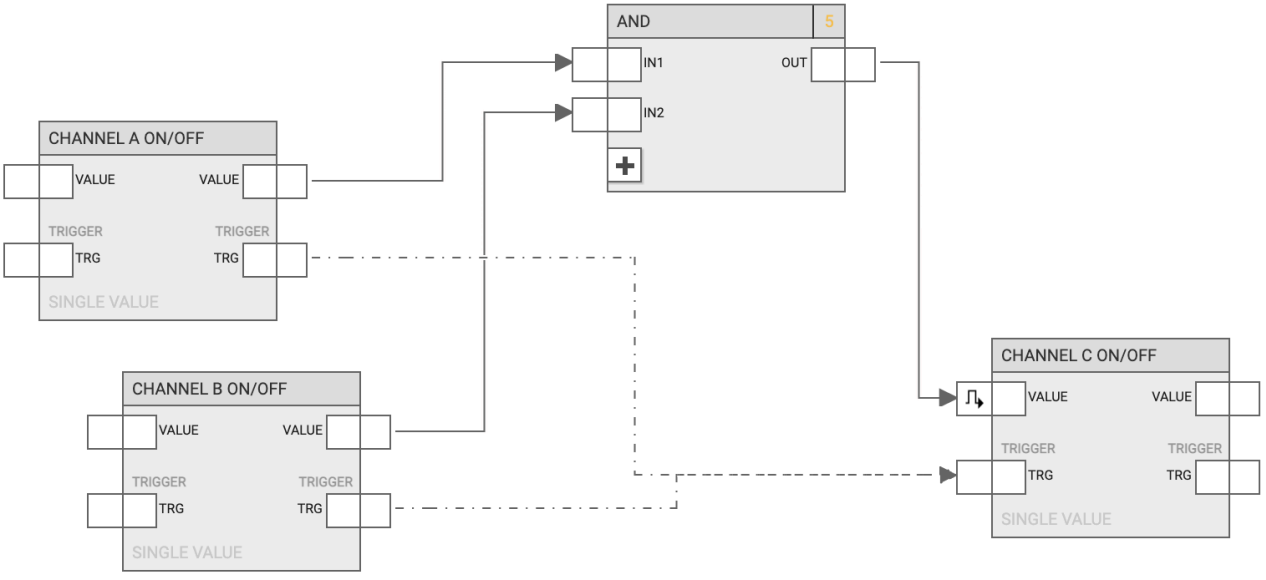
In this case, you must use the input and output TRIGGER nodes. The input triggers emit an impulse (i.e. a value 1 for a single script execution cycle, then return to 0) every time a value is received on a given object.

The output triggers, vice versa, allow you to determine when to issue a command on an object; each time an impulse (value 1) is sent on this trigger, the value of the object is sent on the bus, even if it has not changed since the previous execution cycle.

Therefore, to ensure that the output object is commanded every time the inputs change, but can then change its state, if commanded externally, it is necessary:

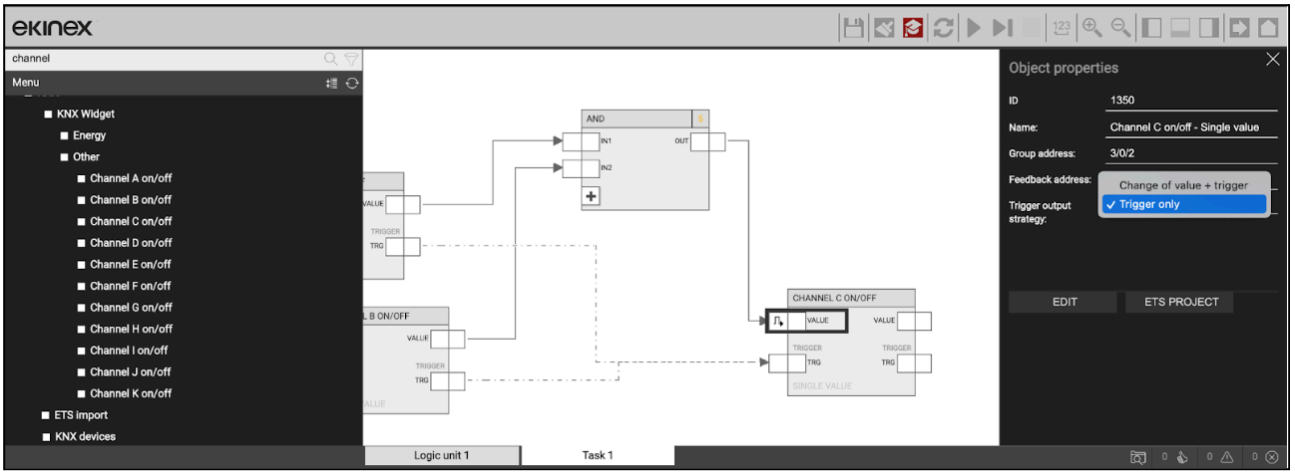
- connect the two input TRG nodes of the first objects, to the output TRG node of the third one
- make sure that the command node has "only trigger" as output strategy (therefore sending the command only when it receives the trigger to change state of one of the inputs)

When you connect the output trigger, the output strategy of the object is automatically set to "trigger only" (and the symbol on the output nodes changes accordingly). The following picture contains an evolution of the previous logic, obtained by connecting directly the two TRG output nodes of the input blocks of the AND logic, and the input TRG of the output KNX widget:

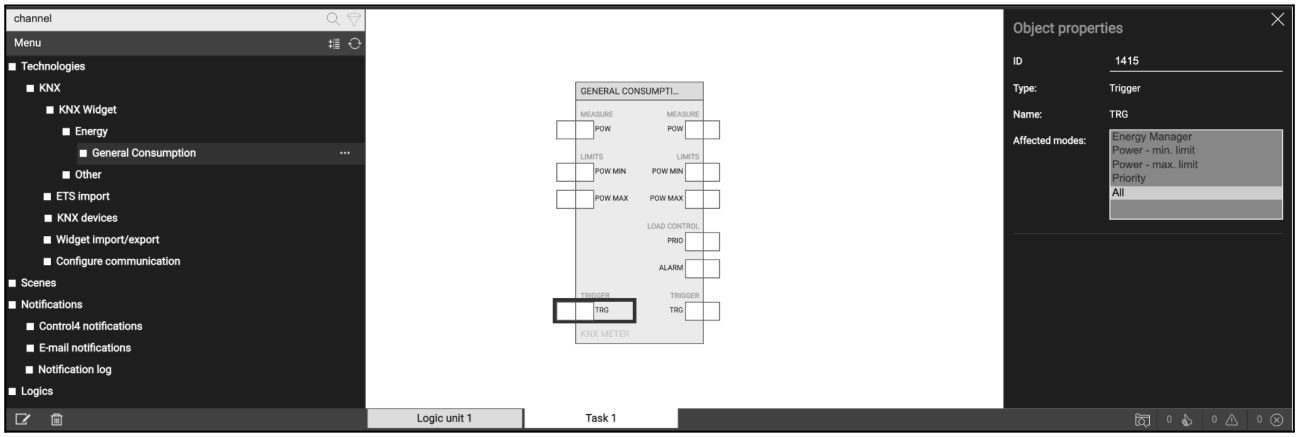


Please take care of the symbol in the input VALUE node, that switched to the TRIGGER symbol due to the fact that a trigger has been connected.

It is however possible to set the strategy manually, to regulate when the command must be sent on the bus; the trigger in fact can also be used to periodically send the value of an output, in addition to its state change, by connecting a periodic logic upstream, a bit like with many KNX devices.



In the case of composite widgets, by opening the details (side panel) on the TRG node, it is possible to filter the nodes that determine the impulse (for input triggers) or that are influenced by the trigger (in output), through the multiple selector. The following pictures contains an example of multiple choice, when the TRG node is selected on a widget containing more than one sub-item:



When selecting one or more nodes instead of the “all” wildcard predefined choices, only commands to those nodes will be forced when a trigger is received (in case of input nodes) or, as opposite, only upon a change of those nodes a trigger will be raised in case of output TRG.

Simulation

Once a logical task has been created, it is possible to simulate its operation inside the editor, manually entering the status of the inputs and verifying in real time the processing of the outputs, even by logical blocks that involve a variation of the outputs over time.

Two types of simulation are available:

- Continuous simulation: the execution of the tasks happens in background and is affected in real time by the state changes of the nodes.
- Step-by-step simulation: each task execution cycle must be launched manually, between one and the other you can change the status of the nodes

The first typology allows a more realistic evaluation of the realized logical networks, the second allows an in-depth and punctual verification of every single passage of values between blocks, and offers a higher level of diagnostics.

By pressing one of the simulation buttons (continuous or step-by-step), the editor window undergoes the following changes:

- The main menu is limited to the PROJECT view only, allowing only the passage between logical programs. It is not possible to create or delete programs.
- The detail panel is closed to provide maximum workspace for the simulation
- Every operation of drag&drop, link, modification or deletion of the content of logical programs is blocked
- The nodes take a coloring according to the state and allow you to force the value manually (as better detailed below)

The color of the knots follows the following convention:

Binary nodes	gray	Value 0 (OFF)
	yellow	Value 1 (ON)
Numerical nodes	blue	Any value

During the simulation, the editor reports in the message area a series of information related to the execution of the programs, to the manual (made by the user) and automatic (detected by the logical blocks) status changes. Moreover, during the simulation step by step, they come brought back many messages of level "debug" that concur a deepened analysis of the execution of the programs, useful above all in case of errors or malfunctions regarding the intentions.

The area messages, normally closed in order to offer the maximum useful space to the simulation, can be opened in order to consult these messages, whose number - in base to the typology - is synthesized in the right part of the bar messages, visible even if closed.

To set manually the state of a node during the simulation:

- Double click the value of the node (the label becomes editable)
- Delete the current value and enter the new value
- Press ENTER

The color of the node (if digital) changes in function of the new value, and this comes passed to the simulator, that propagates it instantaneously (in the case of continuous simulation) or to the successive cycle of execution (in step-by-step mode).

It is possible to stop in whichever moment the simulation pressing the button of stop of the simulation in the toolbar (normally not accessible outside the simulation).

Execution

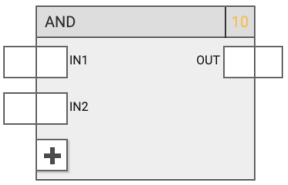
Once completed the realization of the tasks, with the help of the simulation, it is necessary to run the programs, through the appropriate button of the toolbar. During the execution, the tasks cannot be modified.

Library

The following sections give an overview of the library of logical blocks made available in the integrated logic module of C4 TOOLBOX.

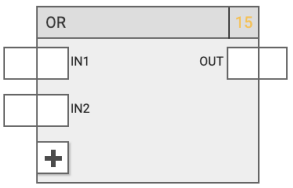
COMBINATORIAL LOGICS

AND

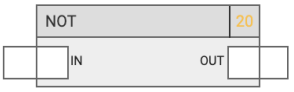
DESCRIPTION:	Perform the AND logic function between two or more binary inputs (up to a maximum of 10).			
PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	IN1 … IN10	Input 1 ... 10 Possible values: 0 → OFF 1 → ON	X	
	OUT	Output Possible values: 0 → OFF 1 → ON		X
	+	Add 1 node	X	
OPTIONS:				

OR

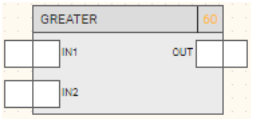
DESCRIPTION:	Perform the OR logic function between two or more binary inputs (up to a maximum of 10)

PREVIEW:				
				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	IN1 … IN10	Input 1 ... 10 Possible values: 0 → OFF 1 → ON	X	
	OUT	Output Possible values: 0 → OFF 1 → ON		X
	+	Add 1 node	X	
OPTIONS:				

NOT

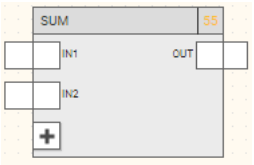
DESCRIPTION:	Perform the NOT logic function of the input			
PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	IN	Input Possible values: 0 → OFF 1 → ON	X	
	OUT	Output Possible values: 0 → OFF 1 → ON		X
OPTIONS:				

COMPARISONS

<table>
<tr><td>DESCRIPTION:</td><td colspan="4">Compares the value of the two inputs, and returns a TRUE/FALSE value on the output according to the specific operator
Operators available:
▪ Major
▪ Equal major
▪ Minor
▪ Minor equal
▪ Equal
▪ Different</td></tr>
<tr><td>PREVIEW:</td><td colspan="4"> 
</td></tr>
<tr><td rowspan="3">NODES:</td><td>TAG</td><td>DESCRIPTION</td><td>IN</td><td>OUT</td></tr>
<tr><td>IN1
IN2</td><td>Input 1, Input 2
Possible values: any numerical value</td><td>X</td><td></td></tr>
<tr><td>OUT</td><td>Result comparison
Possible values:
0 → OFF
1 → ON</td><td></td><td>X</td></tr>
</table>

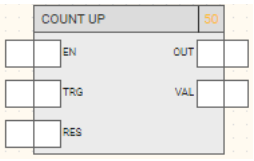
MATH OPERATIONS

DESCRIPTION:	Carries out a mathematical operation on the inputs, according to the type of operator Operators available: ▪ Maximum ▪ Minimum ▪ Media ▪ Sum ▪ Subtraction ▪ Multiplication ▪ Division ▪ Absolute value ▪ Log10 ▪ Integrator

PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	IN1 IN2 (*) ...	Input 1, input 2 ... Possible values: any numerical value	X	
	OUT	Value (result of the operation) Possible values: any numerical value		X

(*) The number of outputs can be limited according to the operation (e.g.: division max 2, absolute value max 1).

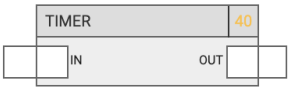
COUNTERS

DESCRIPTION:	Counts the number of pulses received at the input (trigger), increasing or decreasing its value each time (depending on the type of counter). Counter types: counter up, counter down, counter up/down			
PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	EN	Enabling Possible values: 0 → Not enabled 1 → Enabled	X	
	TRG	Trigger Possible values: 0 → OFF 1 → ON (the counter is increased)	X	
	RES	Reset Possible values: 0 → OFF 1 → ON (reset the counter)	X	
	OUT	Output Possible values: 0 → OFF 1 → ON		X

	VAL	Current value Possible values: any numerical value		X
OPTIONS:	Preset	Default value, set when reset is performed or at logic start up Possible values: any numerical value		

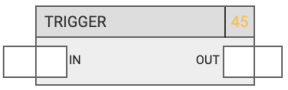
TIMERS & SCHEDULES

TIMER

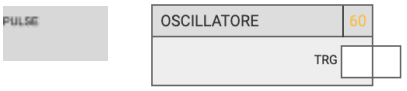
DESCRIPTION:	Delay of a preset time the value received at input When a 1 is received in the IN input (rising edge), an internal counter starts until the time specified as "rising edge delay", after which the output is set to 1; vice versa, when a 0 is received in the input (falling edge), the block waits for the time specified as "falling edge delay" before setting the output to 0.			
PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	IN	Input ON/OFF signal Possible values: 0 → OFF 1 → ON	X	
	OUT	Output ON/OFF signal, delayed by timer Possible values: 0 → OFF 1 → ON		X
OPTIONS:	Rising edge delay	Delay in the propagation of the rising edge received in input Possible values: from 1 second to 24 hours		
	Falling edge delay	Delay in the propagation of the incoming falling edge received Possible values: from 1 second to 24 hours		

TRIGGER / NUMERICAL TRIGGER

DESCRIPTION:	Generates a trigger (cycle duration pulse) on an input detected edge

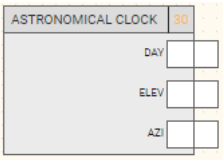
	When it receives an input 1, it sets the output to 1 for the duration of a single processing cycle, then the output is set to 0 again. In this way it is possible to generate a "pulse" for logic blocks that require it (e.g.: scenarios, sequencers etc...) on the rising edge of the input.			
PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	IN	Input edge	X	
	OUT	Pulse of the duration of a cycle		X
OPTIONS:	Edge	Rise or fall front to be detected at the input, in case of digital trigger		
	Condition	In the case of a numerical trigger, it allows you to set the numerical value, against which the block generates the impulse		

PULSE

DESCRIPTION:	Generates a periodic impulse			
PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	TRG	Output Trigger		X
OPTIONS:	Timer	Time after which the trigger is periodically generated		

ASTRONOMICAL CLOCK

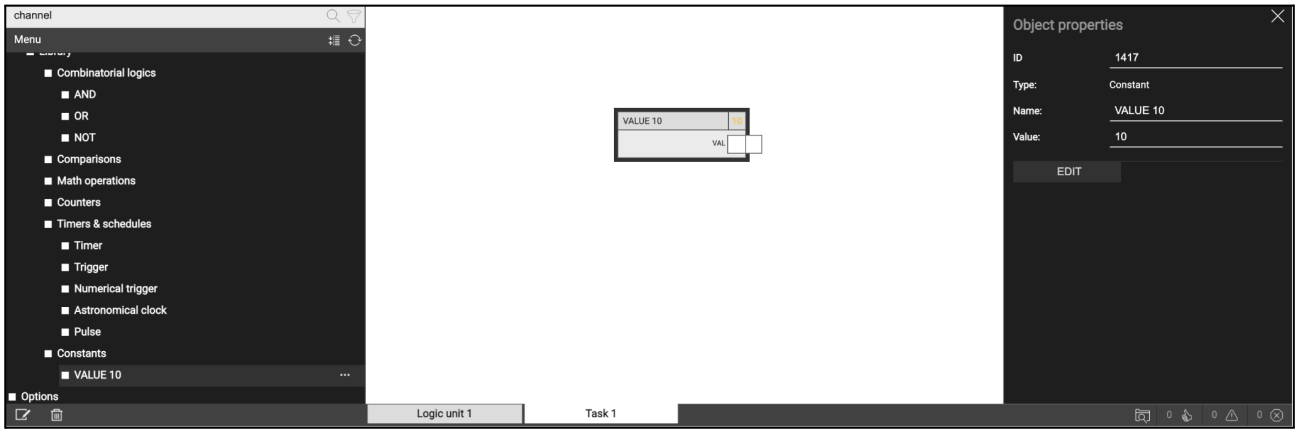
DESCRIPTION:	Generates the following information according to time and location: ▪ day / night (twilight) ▪ height of the sun ▪ azimuth

PREVIEW:				
NODES:	**TAG**	**DESCRIPTION**	**IN**	**OUT**
	DAY	Day / night (1 = night)		X
	ELEV	Sun elevation		X
	AZI	Azimuth		X
OPTIONS:	Latitude Longitude	Coordinates in numerical format (point as decimal separator)		
	Offset	Offset in minutes compared to day/night time		
	Time zone	Time zone of the place where the system is installed		
	Change hour	Disabled: Sunrise time/legal time not active Automatic: automatic solar/legal time Manual: manual daylight saving time setting		

CONSTANTS

This particular section of the library allows the creation of blocks containing a value, that does not change during the execution of the logic.

Those constants are useful to set fixed values to specific nodes of technological or logical blocks; once dragged into the task, the value can be set by right-clicking on them, and entering the value in the side panel:



CONTROL4 INTEGRATION

Introduction

C4 TOOLBOX offers two independent services to CONTROL4, provided by two different drivers:

- Dedicated driver offering:
  - Visualization of energy management integrated in the visualization
  - Scene management
  - Warning and alarm notifications

- KNX communication with the standard CONTROL4 KNX network drivers

Dedicated driver

INSTALLATION

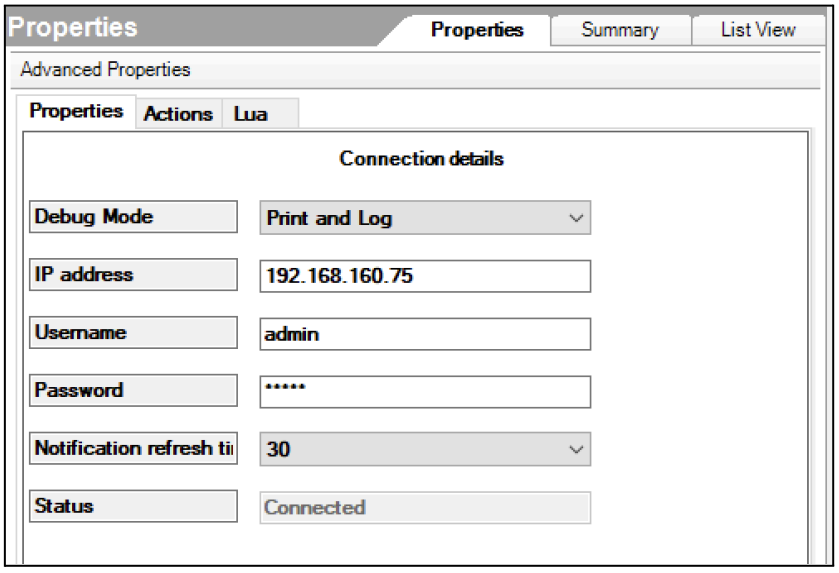
C4 TOOLBOX driver can be downloaded from:

https://drive.google.com/file/d/1ZQ8cfZDj2rmx5BUHCV8NdYsrL1s3rd1J/view?usp=drive_link

You need to import this driver on your COMPOSER PRO installation before proceeding.

PROPERTIES

The dedicated C4 TOOLBOX driver offers the following properties to be set:

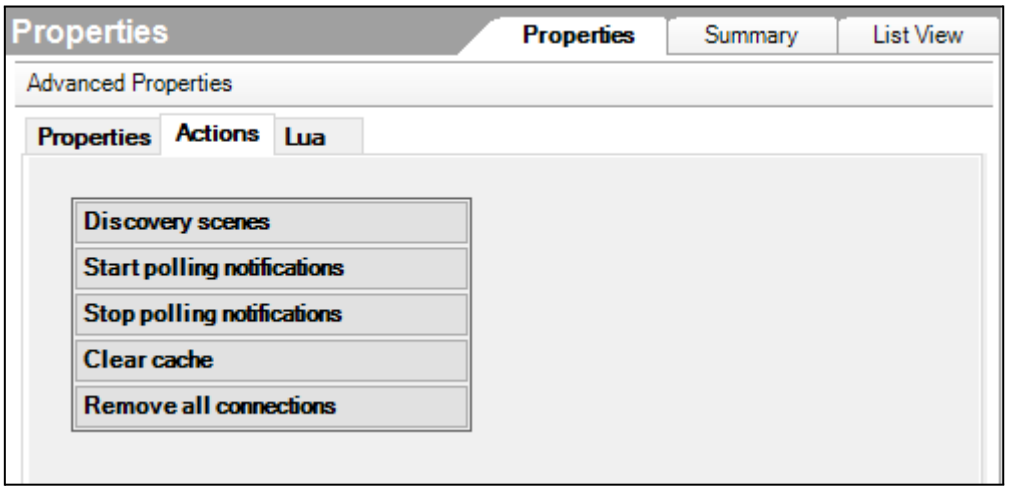


IP ADDRESS	The IP address assigned to C4 TOOLBOX
USERNAME PASSWORD	Access credentials to C4 TOOLBOX
NOTIFICATION REFRESH TIME	Number of seconds of delay between requests to the webserver, for new notifications. Lower number means higher reactivity but higher network load
STATUS	Connection state with the webserver (Read only property)

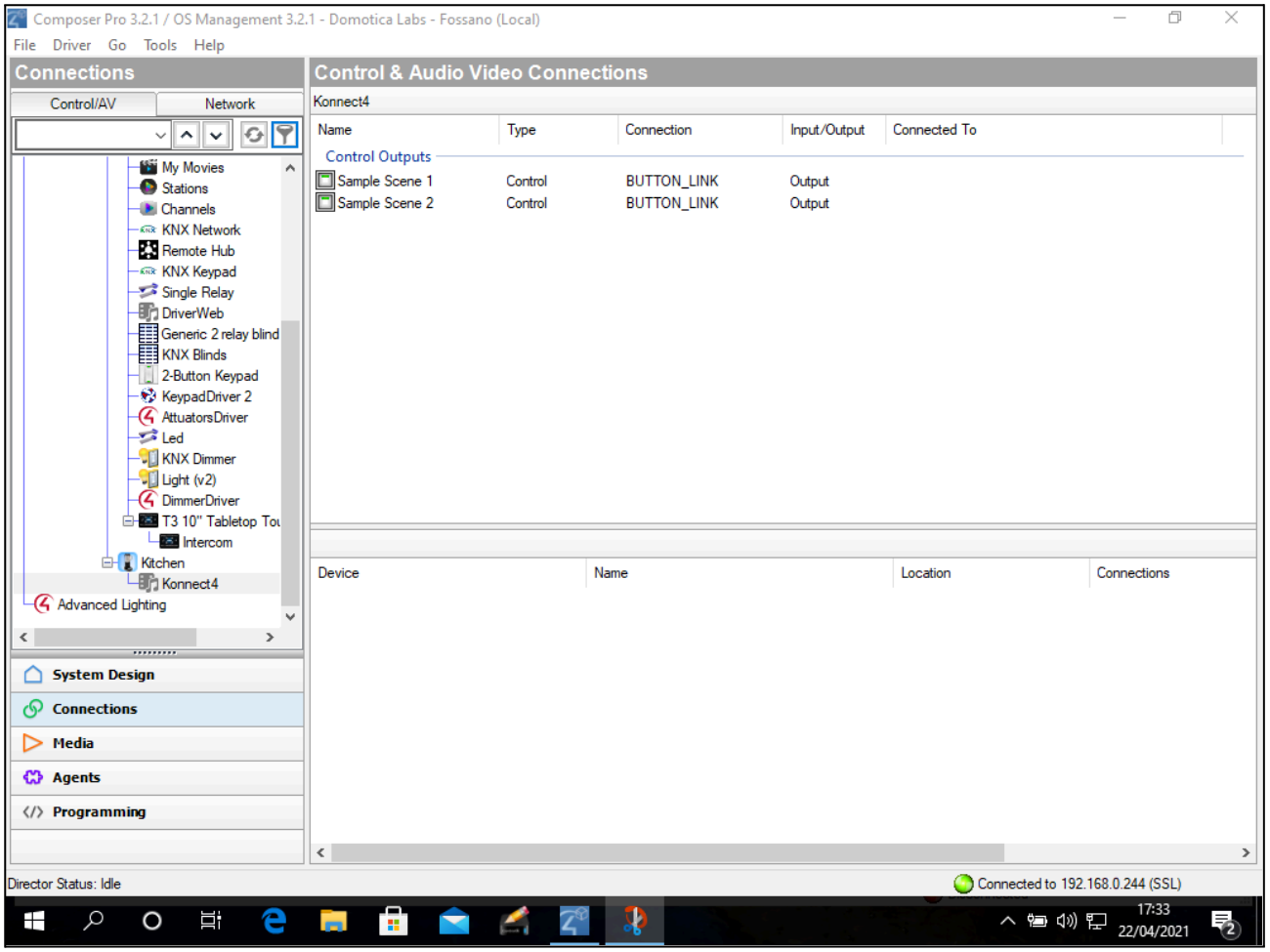
When the IP address and credentials are given, the driver attempts a connection to the webserver and, if successful, updates the STATUS indicator.

ACTIONS

By pressing the button “DISCOVERY SCENES” in the ACTION tabs...



… the driver requests the list of SCENES configured inside C4 TOOLBOX, and creates a CONNECTION for each one. These connections are accessible in the CONNECTIONS pane of the COMPOSER PRO, when the C4 TOOLBOX driver is selected, as in the following example screenshot:



These connections can be bound to other drivers, by offering in this way the possibility to execute the corresponding scene, each time an ON is received on the connection itself. The BUTTON_LINK connection typology is best suited for push buttons, but can be normally associated with other ON/OFF connections available for the majority of drivers.

The action called “REMOVE ALL CONNECTIONS” resets the list of connections for the driver, and detaches any eventual association with other drivers.

The polling for notifications (see below in the PROGRAMMING section) can be activated or deactivated, with the actions respectively START POLLING NOTIFICATIONS and STOP POLLING NOTIFICATIONS.

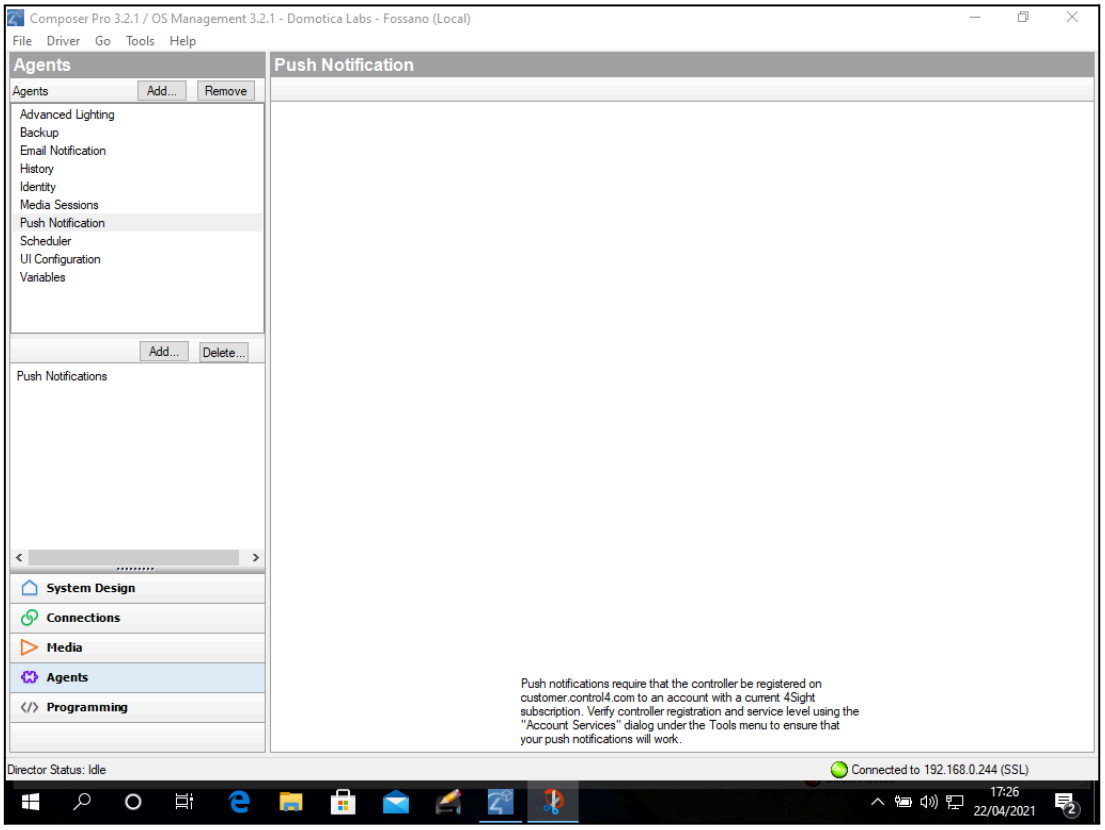
Finally, the CLEAR CACHE action makes a purge of the caches for the webview containing the energy management visualization; press this button in case of old contents still visible in the CONTROL4 touch panels, not automatically refreshed (this should never happen in normal conditions).

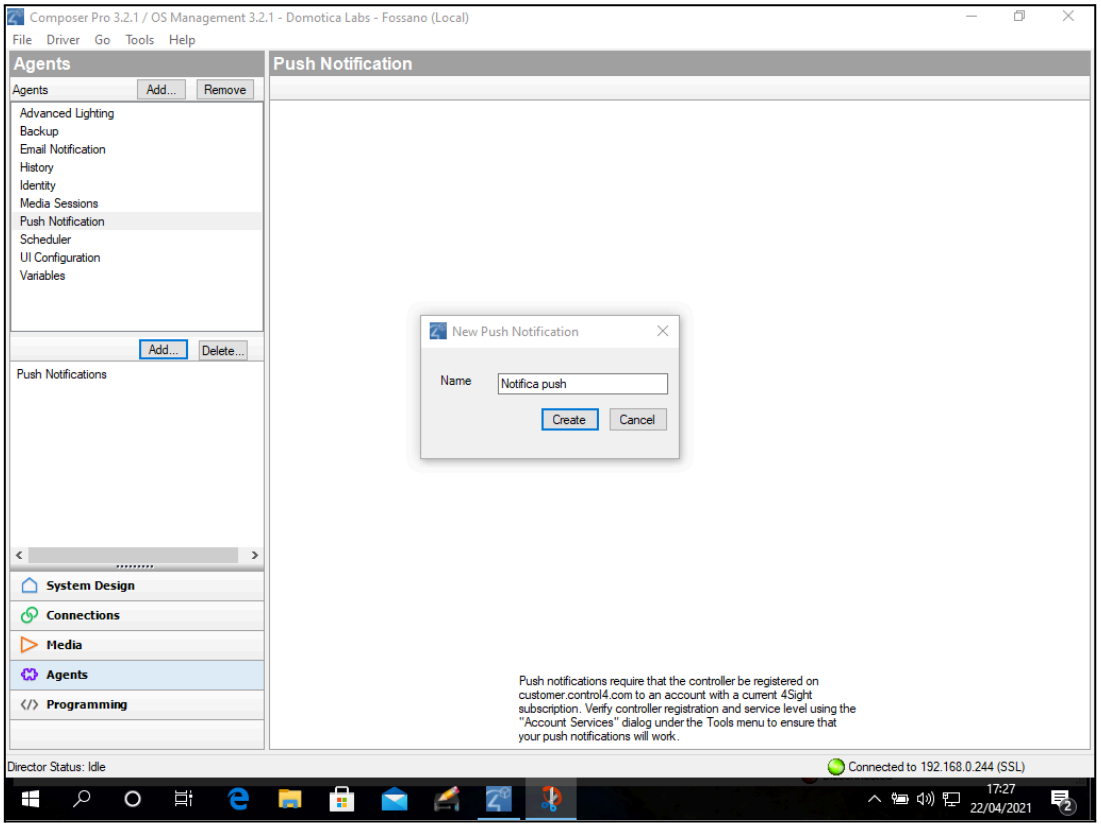
PROGRAMMING

The driver polls periodically the webserver asking if there are any new notifications to be triggered inside CONTROL4. Those messages are enqueued to the HISTORY of messages inside CONTROL4, that can be consulted with the apposite HISTORY button in the visualization (a filter could be necessary to find the messages related to C4 TOOLBOX driver).

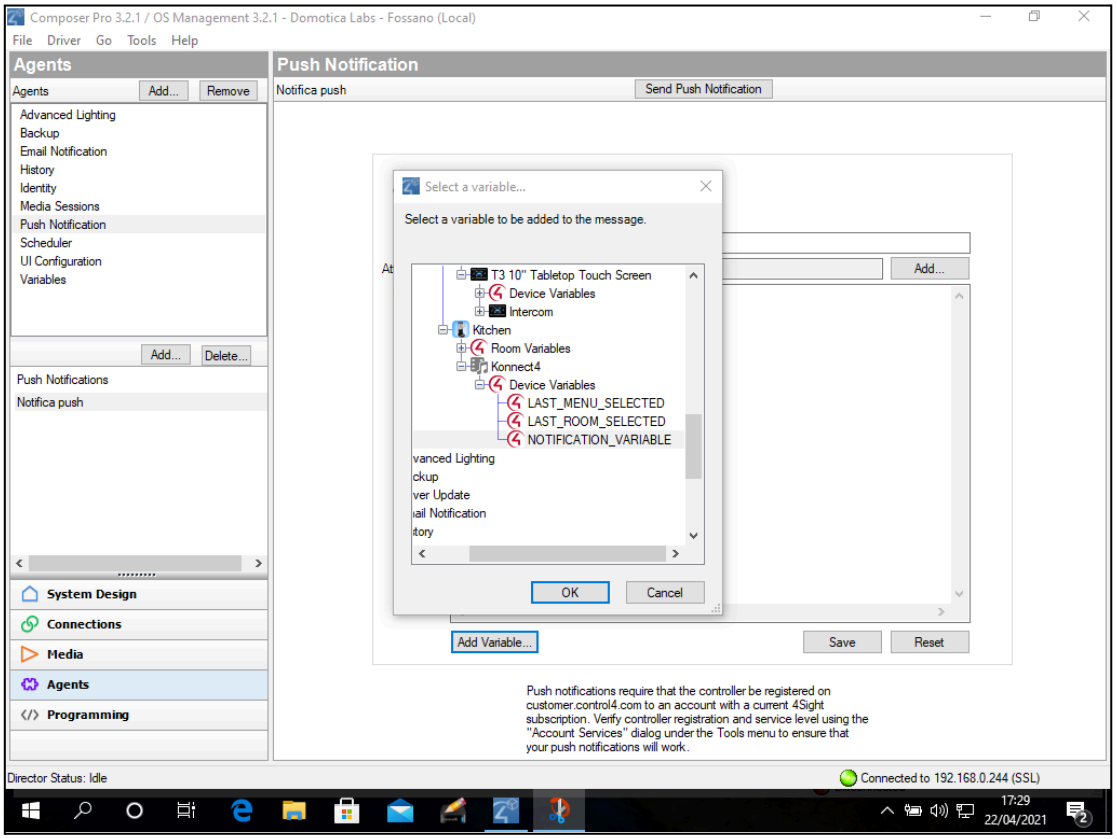
Additionally, when a new notification is found, a TRIGGER is raised, that can be handled in the PROGRAMMING section of COMPOSER PRO.

As an example, the following screenshots describe how to send push notifications with COMPOSER PRO by using the text messages coming from C4 TOOLBOX: the corresponding AGENT must be selected…

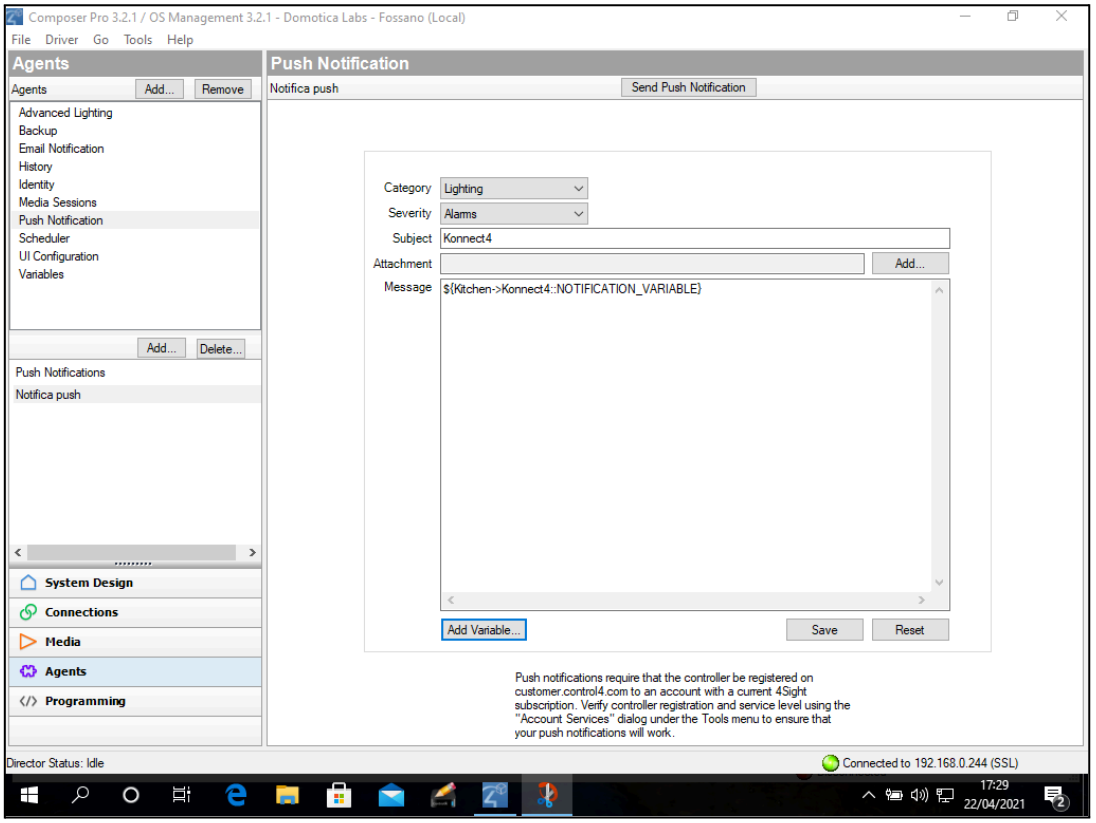




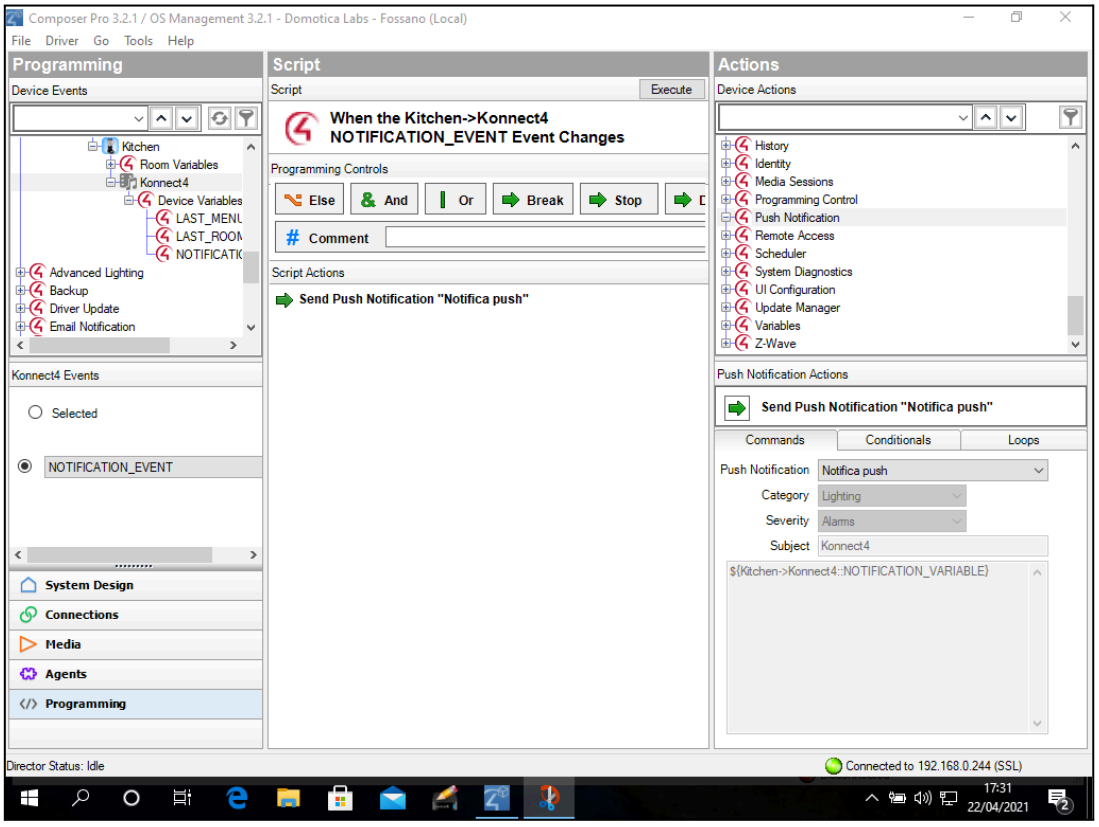
… and associated to the variable offered by C4 TOOLBOX driver:



The variable itself can be used as text message…



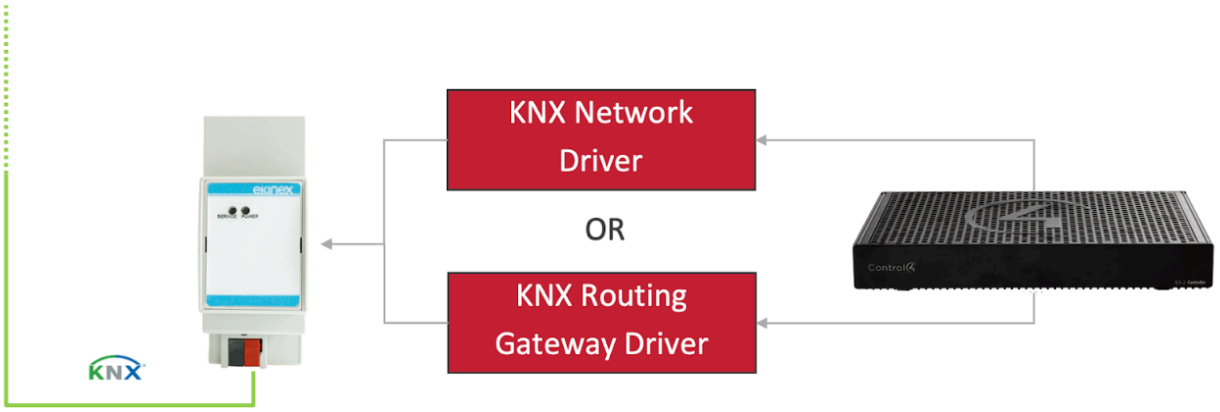
… and finally saved as a programming rule, as shown in the following picture:



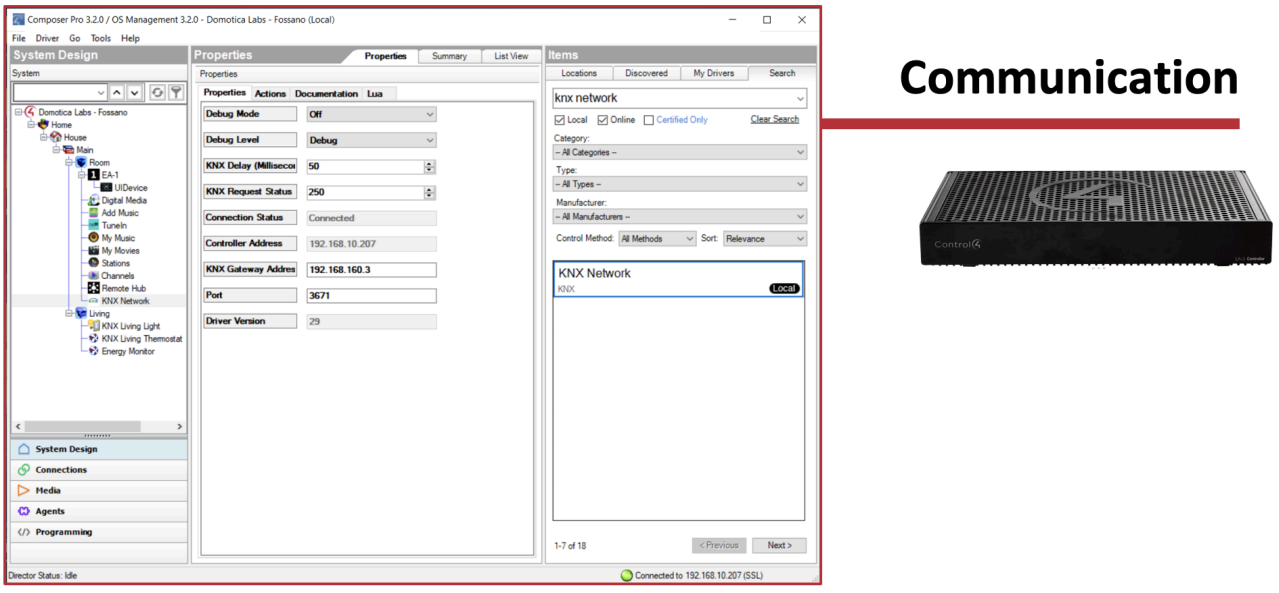
KNX communication

C4 TOOLBOX acts as IP interface and/or IP router in the LAN, by offering an access to the KNX bus over the standard communication protocol known as KNXNET/IP.

CONTROL4 offers two different communication protocols for the connection with a KNXNET/IP interface; C4 TOOLBOX supports both of them:



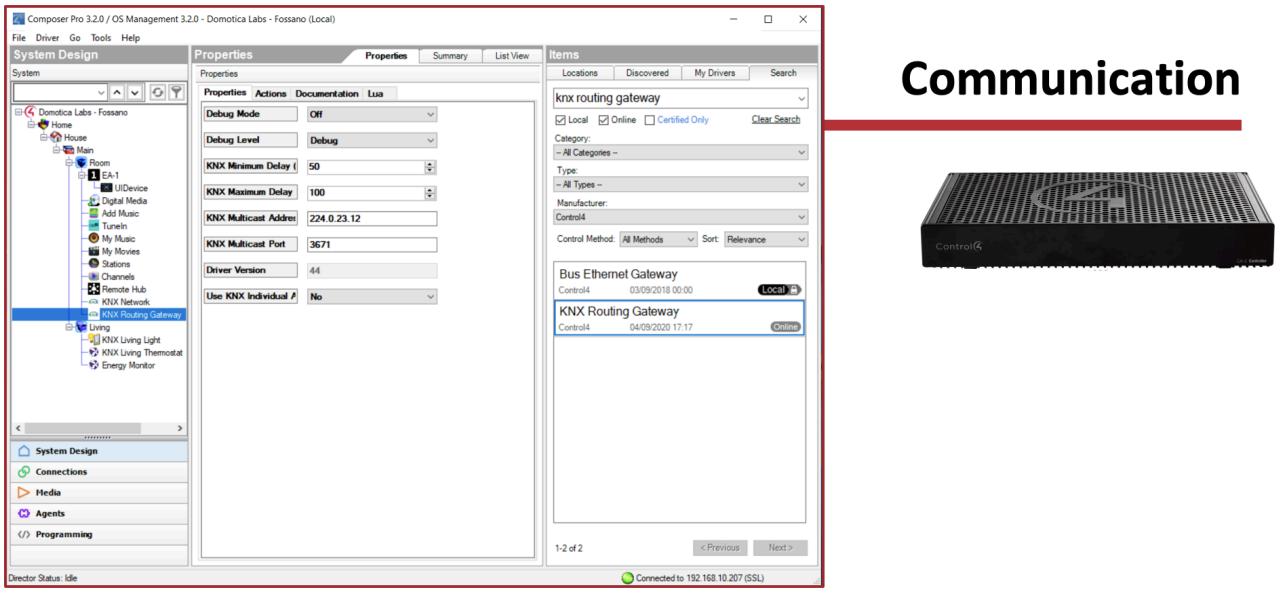
The first driver that can be used is called KNX NETWORK and can be found in the online DRIVER SEARCH (manufacturer: CONTROL4). Once dragged in the project, it offers the following list of attributes to be set:



The IP address of C4 TOOLBOX must be entered in the KNX GATEWAY ADDRESS field; once entered, the driver attempts a connection and, if successful, updates the CONNECTION STATUS to CONNECTED.

The KNX NETWORK operates in point-to-point mode; a single connection is supported in this mode by C4 TOOLBOX webserver.

A more flexible solution is offered by the KNX ROUTING GATEWAY, operating in multicast on the LAN; this driver offers a more reliable connection, not being connection-based and influenced by other connections opened with the C4 TOOLBOX by other devices (e.g. in case of multiple CONTROL4 controllers in the same installation). The configuration in COMPOSER PRO of this driver is even simpler, being not necessary to insert any information at all:



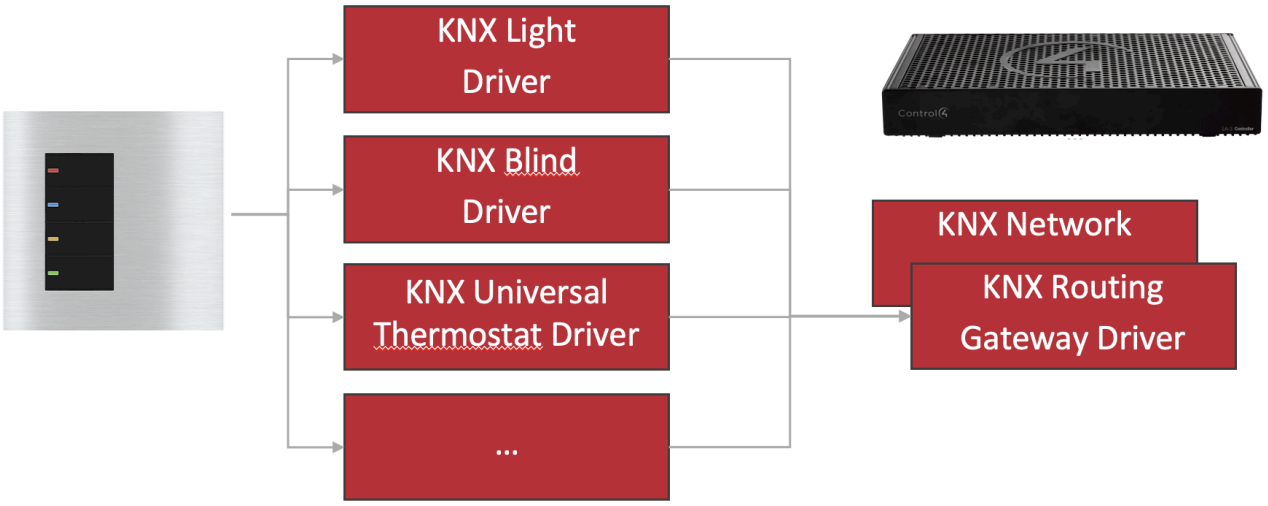
The KNX MULTICAST ADDRESS parameter, in fact, is the default multicast address used for communication, and must not be changed.

In order the KNX ROUTING GATEWAY driver to work, the “ENABLE INTEGRATED KNXNET/IP ROUTER” parameter must be enabled in C4 TOOLBOX, as previously described in the KNX section of this manual

It is highly recommended to add the KNX NETWORK or KNX ROUTING GATEWAY drivers to the project BEFORE any other KNX driver. Otherwise, the automatic binding with those drivers does not happen.

Once the communication is established between C4 TOOLBOX and the KNX bus, other KNX

functional drivers can be added to the project:



Those driver can be generic (published by CONTROL4 in the online driver catalogue) or specific for EKINEX devices (offered by EKINEX to its customers); in any case, those drivers offer a way to handle the smart home devices in the CONTROL4 supervision, and make use of the integrated KNX port of C4 TOOLBOX to exchange bidirectional information with the KNX installation.

VISUALIZATION

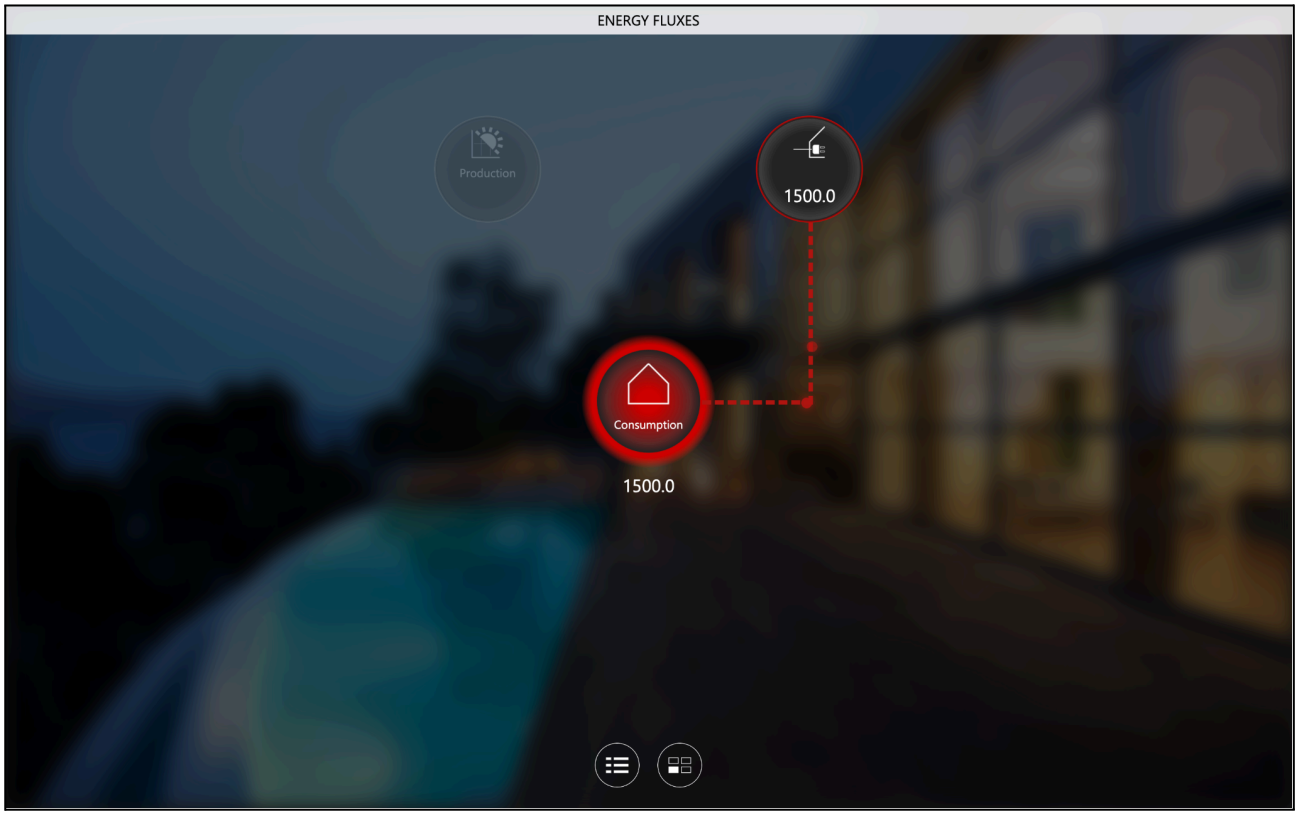
Introduction

C4 TOOLBOX offers a graphic visualization of energy management and load control, based on web technology. It can be accessed:

- Inside CONTROL4 visualization, by means of the dedicated driver (supported only on CONTROL4 touch panels)
- With a standard web browser on computers, tablets and smartphones

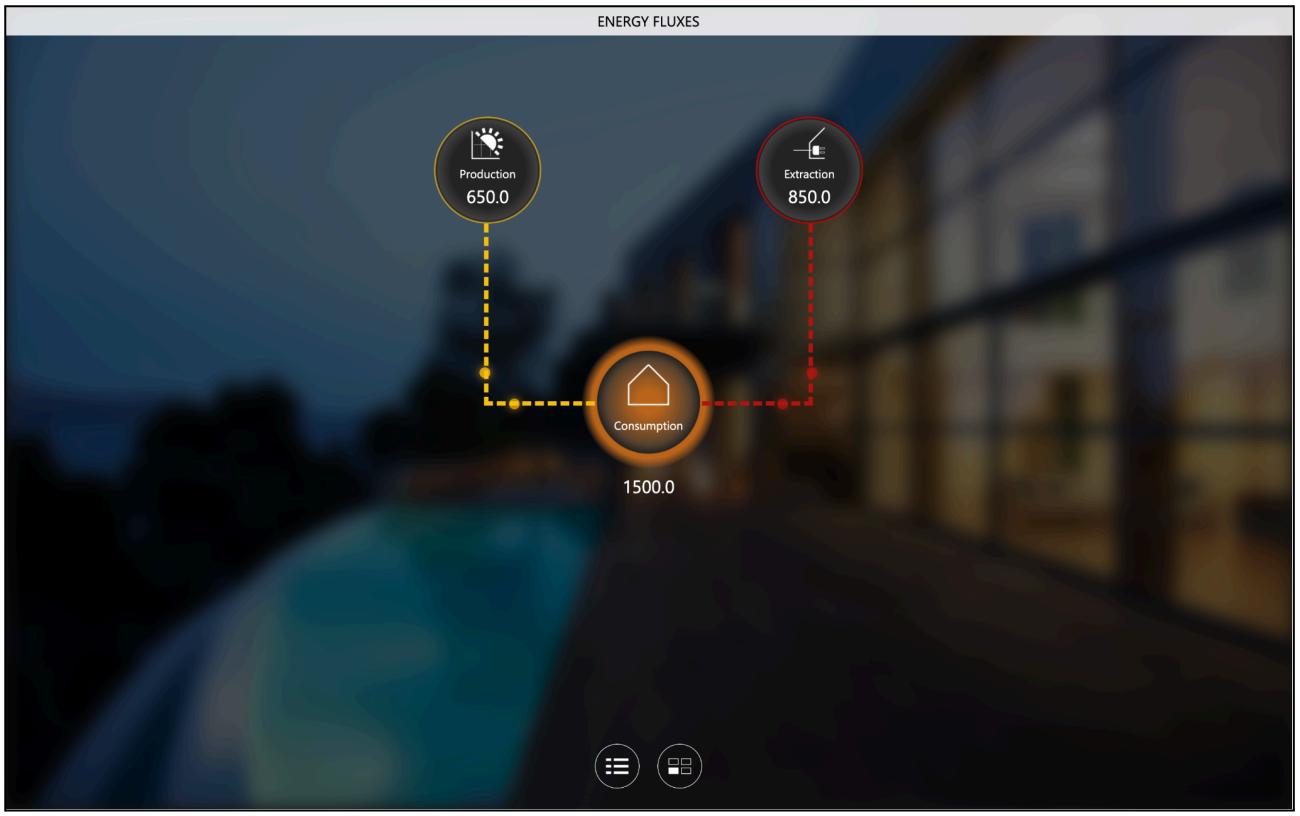
Energy balance overview

By entering C4 TOOLBOX visualization, the following diagram is presented on screen:

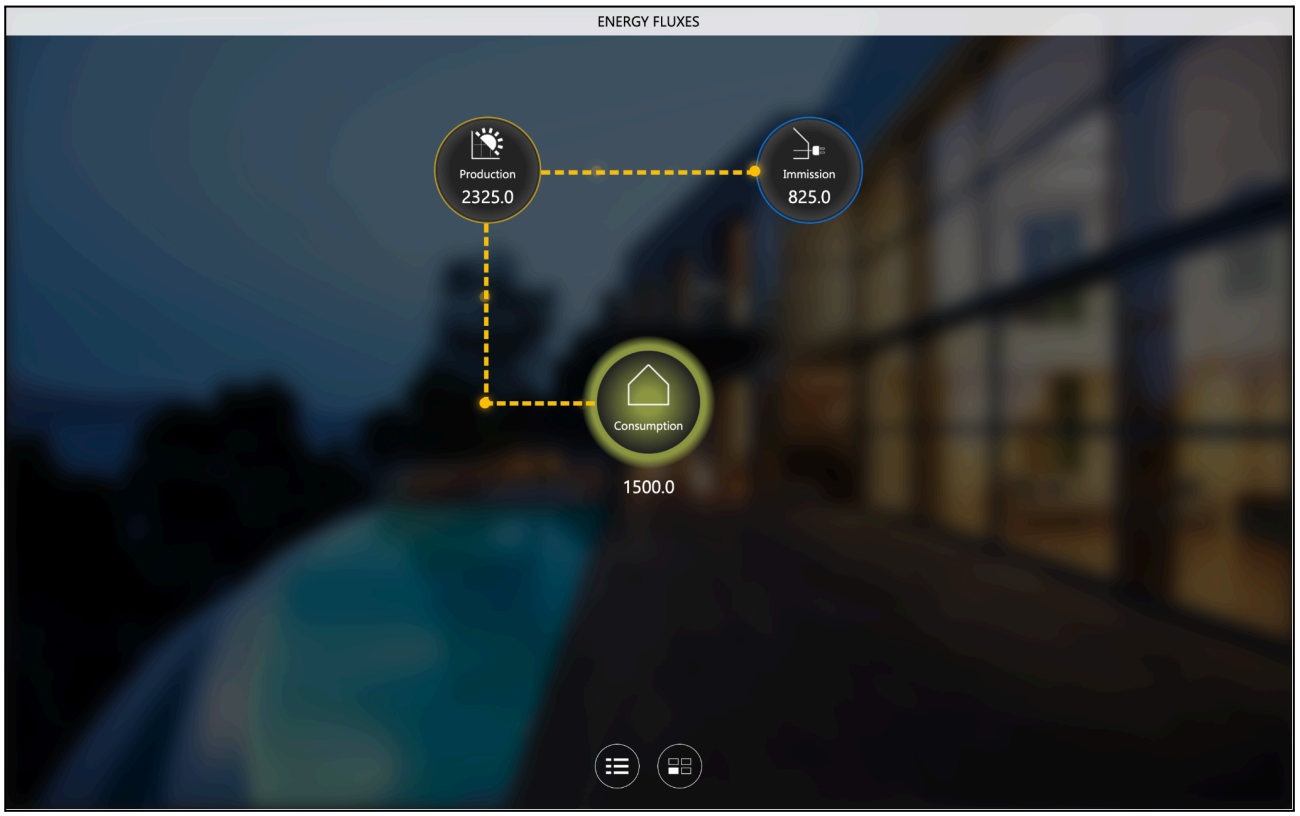


The graphic element in the center represents the real-time energy consumption of the building. If a production system is not available, the entire power demand is provided by the grid; in such a case, the symbol is in red color, meaning that no contribution is given to the power demand.

As opposite, when a production system is available and active, the energy demand is partially covered by the renewable source, and the diagram evolves as follows:



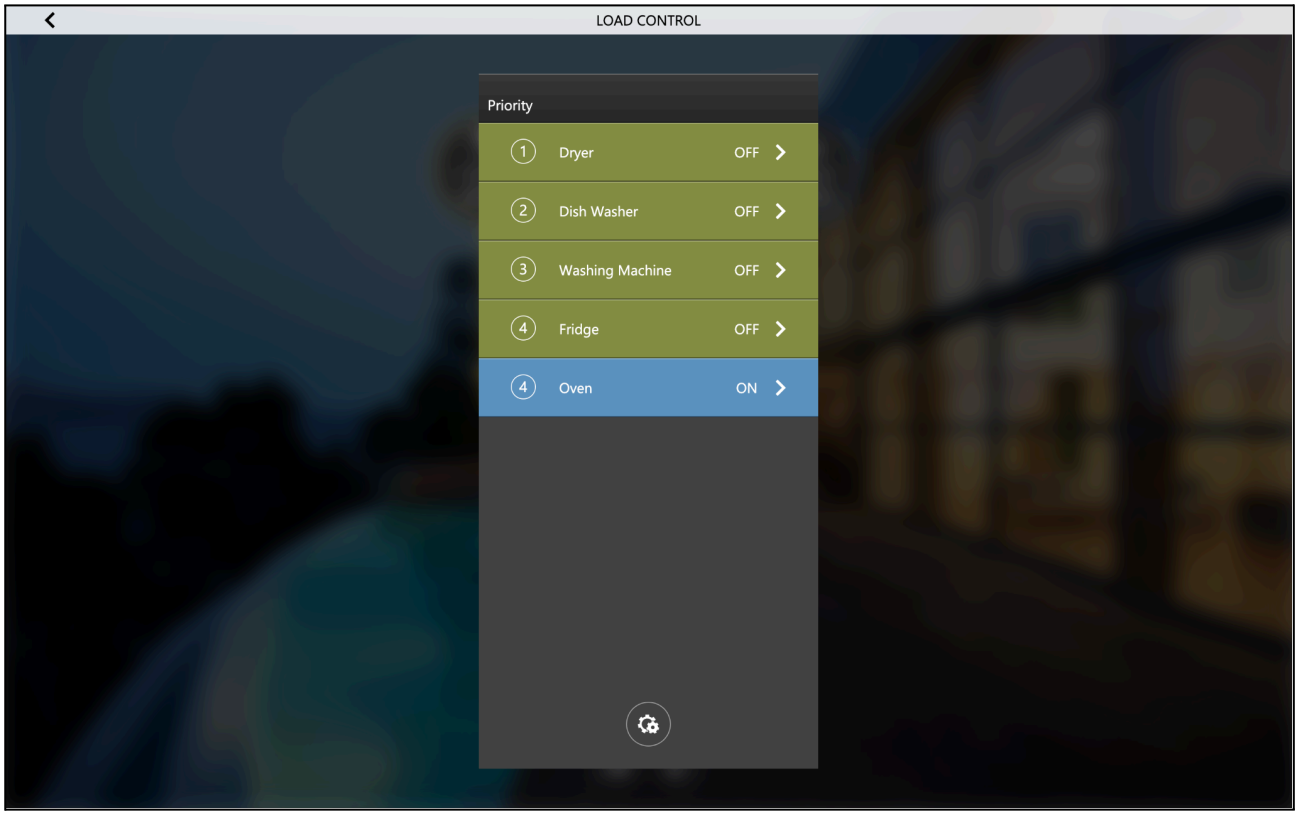
The orange colour highlights that the energy demand is partially “green”; the green colour is reached only in the event of production at least equal, or higher to the energy demand (and the excess energy is sent to the grid, and we talk of “immission”):



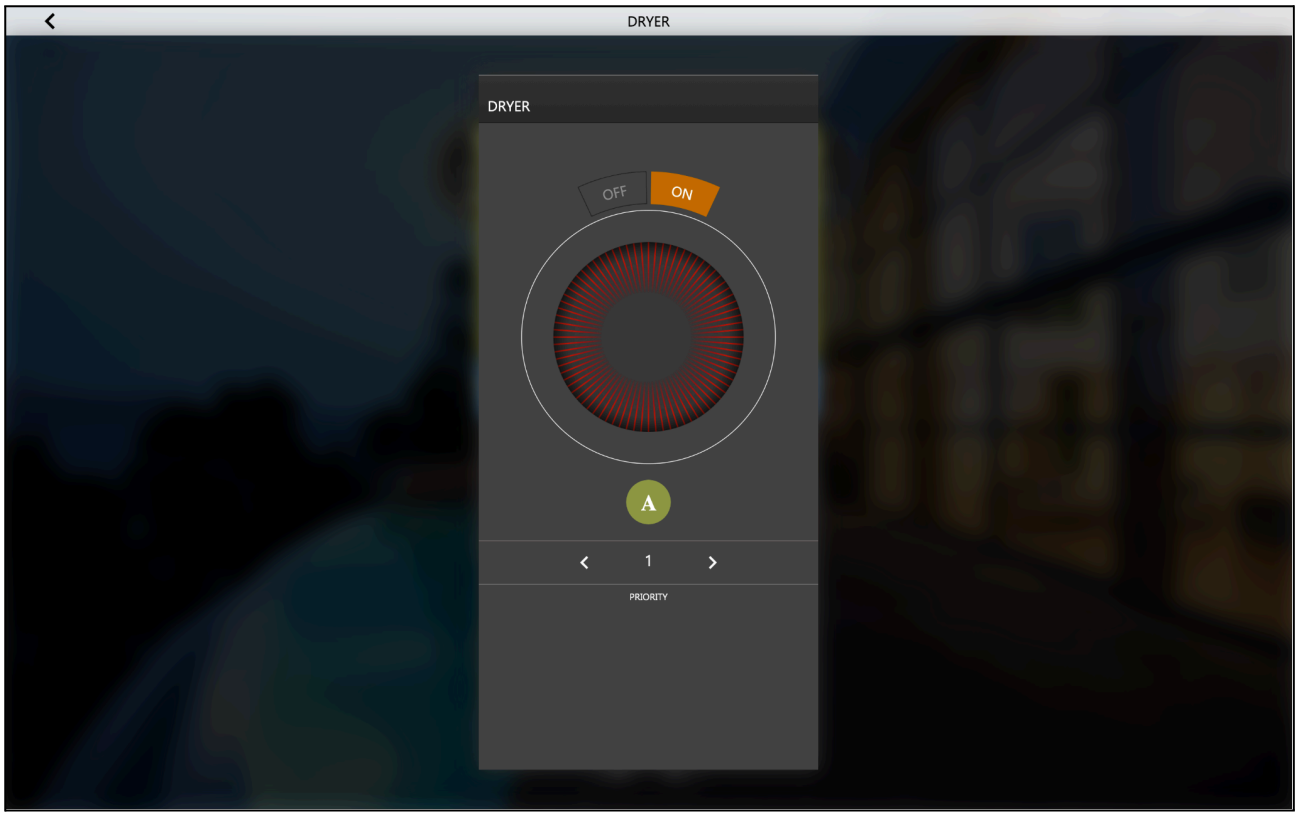
The right button in the bottom of the page opens a popup, containing a diagram of the energy demand along time.The toolbar offers the possibility to change the period of time, the charted data refer to; different colors are used for consumption, production and self-consumption (the portion of the energy demand of the building, covered by renewable source).

Load control

The left button on the bottom part of the screen opens the following popup, containing the list of loads controlled by C4 TOOLBOX:



Each load is identified by a label, the actual priority and the current state (ON or OFF). By pressing the element, the following details are displayed:



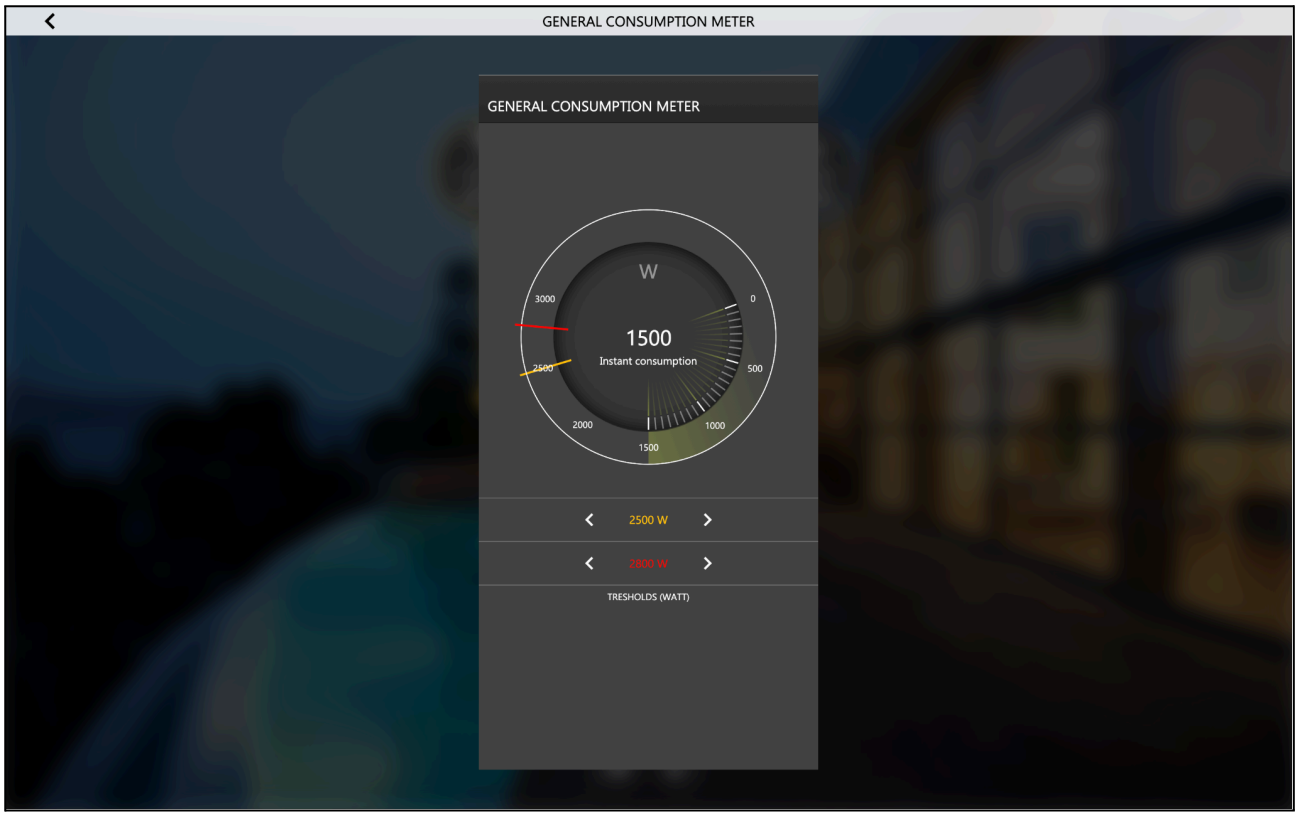
The top buttons offer the possibility to switch the load ON or OFF; in case of loads with integrated energy metering, the corresponding measurement is shown in the center part of the visualization.

The center button below the main widget changes the operating mode of the load:

- AUTO: the load is controlled by C4 TOOLBOX according to its priority
- MANUAL: the load is ignored by C4 TOOLBOX and left to its original ON or OFF state, even if its priority should be controlled by the load control system

The priority (order of detach in case of excessive power demand) can be dynamically changed with the controls in the bottom part of the popup.

At the bottom of the loads list, a button offers the possibility to adjust the limits of overall energy consumption, used by the load control to determine if the loads must be switched off:



As soon as the higher limit is reached (red colour) the load control starts switching off the loads; the restore back to normal functioning of the loads does not happen until the energy demand goes under the lower limit (yellow colour). As long as the power demand keeps between the two limits, the situation continues to be monitored by the system, but no action is taken on the loads.

Control4 visualization

In the moment that the dedicated C4 TOOLBOX driver has been added to the COMPOSER PRO project, and bound at least to a room, the corresponding icon is displayed in the visualization. By doing a tap on it, a webview is opened in fullscreen mode, by showing the visualization graphical environment as detailed in this chapter.

The visualization integrated in CONTROL4 is supported only on CONTROL4 touch panels, due to a limitation of the support for web-based contents in the app for mobile devices.

Web browser visualization

The visualization described in the previous chapters is accessible with a standard browser both for computers or mobile devices.

The following address must be entered in the address bar:

```
http://<ip address>/www/index.php?context=runtime
```

REVISIONS

DATE	REF	NOTES
2021-04-30		First release of this document
2024-01-22		Document updated to refer to new product name (C4 Toolbox)