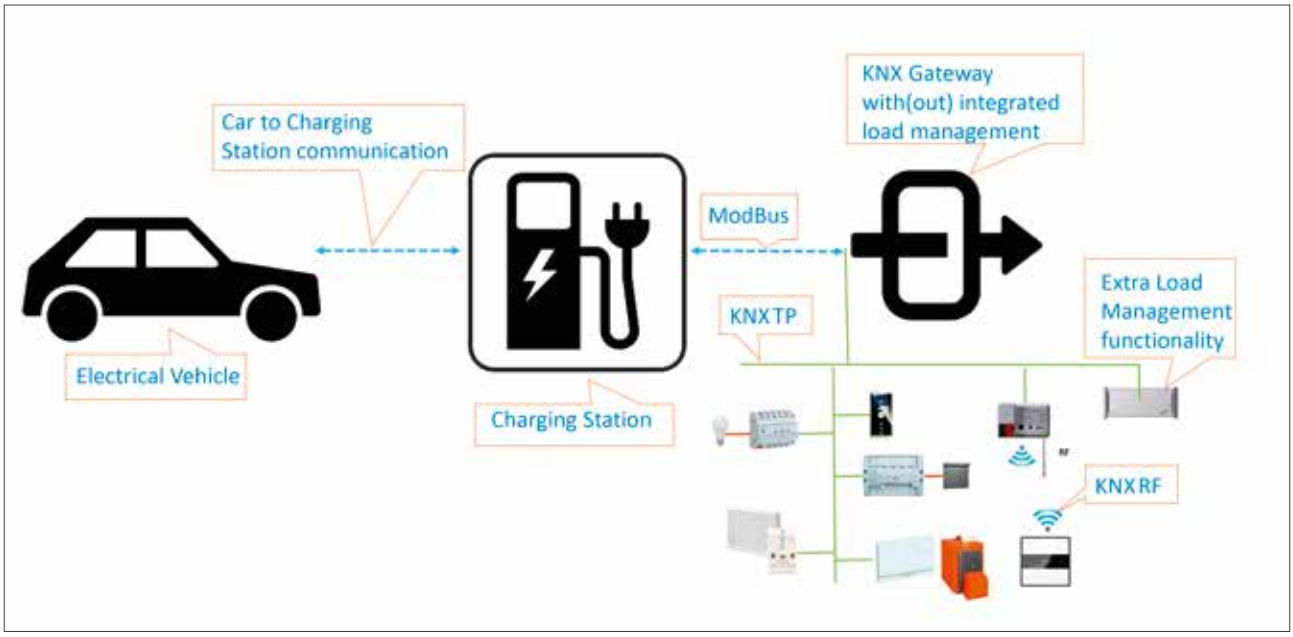
Electrical Vehicle charging and Energy Management

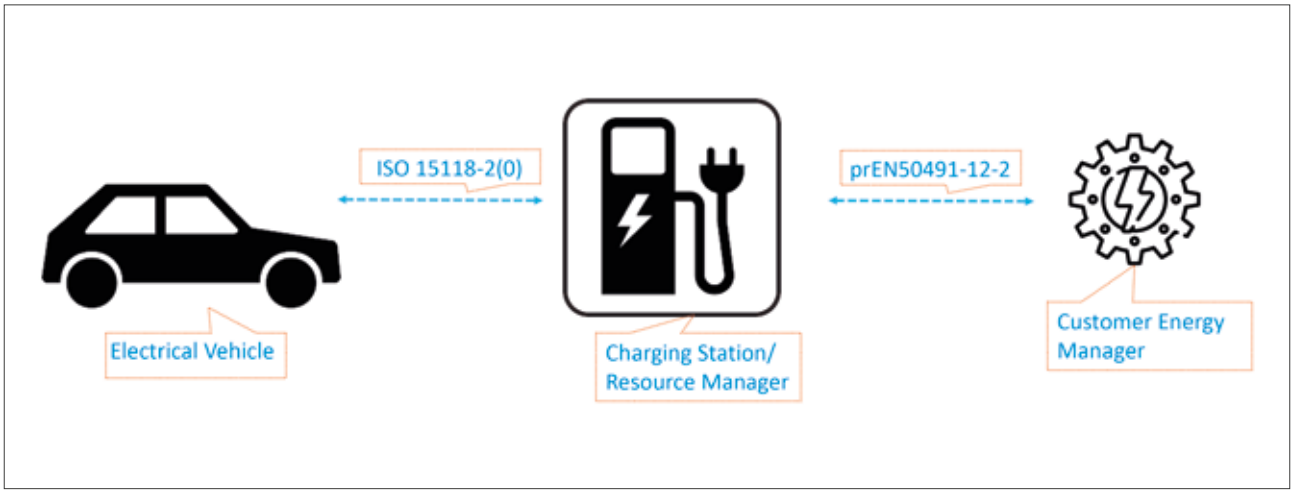
Integrating an eCar in a KNX installation: already a reality today



In the recent years, many countries worldwide have announced plans to phase out the use of fossil fuels for mobility and want to actually impose the use of electrical vehicles. Although these are very challenging targets, many countries are very serious about this. By 2030:

- ***the Biden Administration is expected to deploy more than half a million new public charging stations in the US;***
- ***the UK want to ban fossil fuel cars altogether;***
- ***and with its Green Deal, the EU commission wishes to lower its emission by at least 55 % compared to 1990.***

This clearly shows that the eCar may still be a very scarce phenomenon on the road today but this is about to change dramatically. If every household has an eCar in ten years from now, a (very) energy hungry element will be added to every single home and if taking the car to work, several of these hungry elements will want to be fully charged again by the time the working hours end.
It will therefore be paramount that we make the best use of our available energy, preferably green energy rather than just tapping energy that is converted fossil fuels.
The most ideal would be that what we consume can be produced entirely at the site where the charging happens and there is still sufficient energy to also run all the rest of the applications we have in the building (lighting, heating/cooling, appliances, ...). Just as ideal would be that we can also use the storage capacity of our eCars – in addition to a stationary battery storage – to save energy when energy is abundant and to tap energy when production in the grid is low.
It is clear from the above that an intelligence will be needed in homes or buildings to manage this. Compare this to a director of an orchestra, who will make sure the strings are not overwhelmed by the brass section. Translated into technical terms: there is the need for a customer energy manager instructing the different energy consuming/producing elements in a home or building and keeping an eye on whether there is enough energy to go around.
In traditional KNX, there are already solutions on the market that allow to solve this exercise of performing load management in a home that also has a charging station.
One of the KNX members is providing an interface that allows to integrate several charging stations in a KNX system. The product has an integrated Modbus RTU interface and in this way allows communication to many types of charging stations, also providing a ModBus RTU inteface.



It provides amongst others the possibility to:
- view the last charge and overall energy consumption;
- the momentary loading current
- the charging start and end time
- and is also able to perform the required load management.

When wanting to realize more sophisticated energy management algorithms, the product can then also be combined with an extra KNX server or visualization software.

A further product is currently under development at another KNX member that will make the connection between a smart meter and a possible charging station. However, also in international standardization, currently there are activities that wish to solve this exercise in a technological neutral way. The prEN50491-12-2, which KNX helps to shape, abstracts all energy consumers and producers in a home or building as elements called “resource managers”(RMs). Such RMs can be a single product (e.g. a charging station), but may just as well “hide” an entire application domain (e.g. lighting control) or even an entire system (e.g. a complete KNX installation). All RMs are directed by a central intelligence, the customer energy manager (CEM). The interaction between the CEM and the RMs is defined by a number of different control strategies, which are referred to as “control types”.

As for eCar charging, such a resource manager would be the charging station, as the communication between the charging station and the car is laid down in another standard, the ISO 15118-2 and upcoming part 20. This standard defines two charging strategies, the dynamic and scheduled mode, the basic difference being that:
- in the case of scheduled mode, the eCar keeps the complete control over the charging process
- in dynamic mode, the charging station acts as charging controller, once the energy demand, the departure time and other charging parameters have been exchanged between the car and the charging station.

The control types from the prEN50491-12-2 that is most ideal for the eCar charging use case in dynamic mode is without any doubt the fill rate based control type, as the eCar is in this regarded as a storage/buffer and the departure time can be modelled as the fill level target. For the scheduled mode, the power enveloped based control defined in prEN50491-12-2 seems the best option to keep the EVs power consumption over time between certain limits. Although the above concepts could for sure be realized also by means of KNX classic methods like Group Communication, it seems evident that this would better be realized in forthcoming KNX IoT devices using the KNX IoT Point API with IPv6, which allows to communicate larger data sets.