

The COPP System

DEVICE TO OPEN AND CLOSE THE PLATFORM SCREEN DOORS

Client: RATP

Line: 13

First operational system in service: may 2008

Trains equipped: 73

Platforms: 3

Station : Paris Chatillon line 13

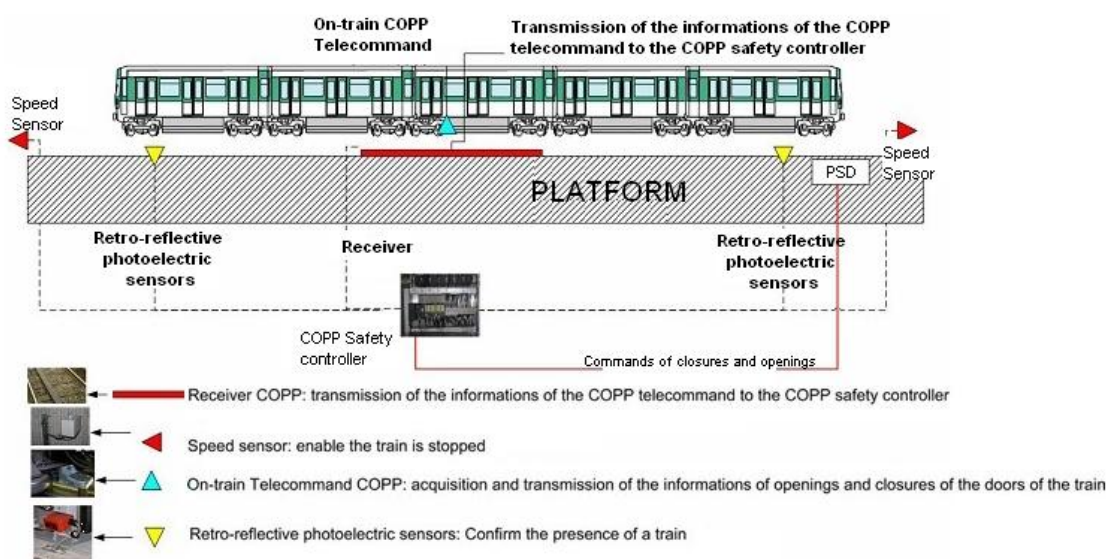
A new version of COPP system, without sensor, is being developed

The COPP system controls the opening and closing of platform doors. This is managed independently from the train's automatic driving mechanisms. COPP, thanks to sensors, observes a portion of the track area and analyzes the behaviour of trains travelling through stations. When appropriate conditions are present, it then orders the platform doors to open or close.

More specifically, the COPP system:

- Detects the absence of the train on the track under observation
- Detects a moving train on the track under observation
- Detects that the train, in the area where it stops at the platform, is moving at a speed lower than 0.5 km/h (which speed is considered null).
- Detects that a train is present at the platform and located in the nominal loading area, i.e. Loading Point +/- 1.10 metres.

A COPP system is dedicated to a single platform and only controls the opening and closing of the platform doors for the relevant platform, in other words, only for the trains travelling on the relevant tracks.



COPP System

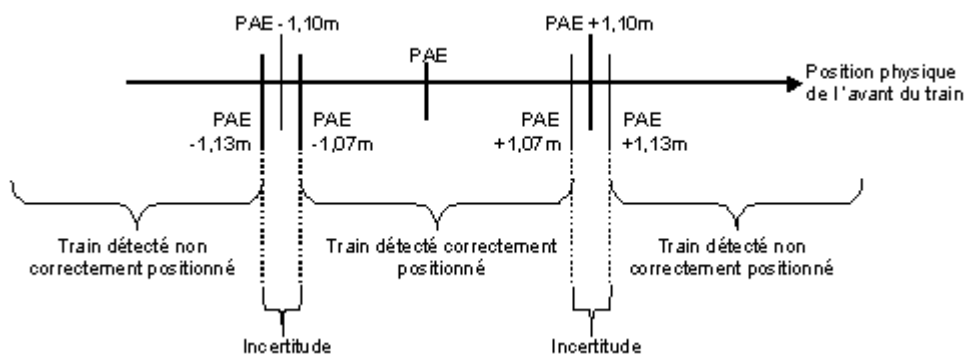
Analytical Function for Train Behaviour

The COPP system processes and analyses the observation data obtained via its sensors. In particular, it conducts the following operations on the track under observation:

- Detects the absence of the train on the track under observation
- Detects a moving train
- Detects that the train has stopped in the loading area and is moving at a speed lower than 0.5 km/h, which speed is considered null.
- Detects the proper positioning of the train at the platform.

The COPP system detects that a train is present at the platform and located in the nominal loading area, i.e. Loading Point +/- 1.10 metres. It tolerates an uncertain measurement in the range of +/- 3 cm. The management of this uncertainty is described in the diagram below. If the train is located in the uncertainty zone, the COPP system may either consider that the train is properly positioned or not properly positioned.

- Detects the proper positioning of the train at the platform.



- Acquire and provide information supplied by the train on the opening and closing of the doors, provide this information to the train by the ground and process this information.
- Not acquire information from the train stopped on the adjacent track.

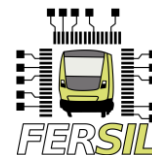
Command Functions for the Platform Doors

Automatically control the opening of the platform doors

The COPP system orders the opening of the platform doors once the functions described above have allowed for the following events to be observed, successively and in this order.

- A moving train enters the station,
- The train decelerates to reach a speed that is lower than 0.5 km/h,
- The train stops and is positioned correctly in its nominal loading zone.

The train doors open.



The command to open the platform doors is maintained for a period to be defined and that can be configured. By default, this period ranges between 2.5 and 6 seconds. If the COPP system receives information that the platform doors are completely opened, it stops the command if the command time exceeds 2.5 seconds.

Automatically order the closing of the platform doors

The COPP system controls the closing of the platform doors once the functions described above have allowed for the following events to be observed, successively and in this order.

- The train has stopped,
- The train doors have started to close.

The command to close the platform doors is maintained for a period that must be defined by the system user and that can be configured. By default, this period is 15 seconds. During this phase, the COPP system maintains its analytical functions for train events. If the system has detected that the doors have opened during these 15 seconds, the function to re-open the doors occurs although the 15 second period has not ended.

Automatically order the platform doors to close without detecting the closure of the train doors.

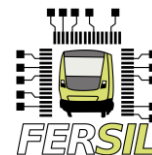
The system orders the closing of the platform doors once the functions described above have allowed for the following events to be observed, successively and in this order.

- When the last system command is to open the doors,
- After the 40 second time period triggered at the end of the command to open,
- The laser range-finder measures the distances that correspond to the absence of a train.

Automatically order the re-opening of the platform doors

The COPP system must also order the opening of the platform doors after the following events and behaviours have been observed, successively and in this order:

- An open/close cycle for the platform doors has ended,
- The train stops and is positioned correctly in its nominal loading zone.
- The train doors have been completely closed,
- The train doors have started opening again.



COPP System Safety Level

The COPP system is being developed for the RATP (autonomous Parisian transport system). The development of the COPP system complies with standards EN50129, IEC61508, EN50126, EN50128 and uses the Formal B method.

The development process involves a ClearSy safety team that is separate from the development team. The RATP has had the system verified by an independent body (EOQA). The system has been qualified as Level SIL3, but is not certified. The levels achieved are as follows:

- The opening command is Level SIL3.
- The sign flashing command is Level SIL 0.
- The authorization to open the platform doors is Level SIL3.

Communication between the train and the ground is not SIL3. The safety guarantee relates to the presence and correct positioning of the train in a stopped position at the platform.

The safety level for each component is determined so that the entire system achieves Level SIL3, taking the following items into consideration.

- The automaton is SIL3
- The automaton program is at least Level SIL 3.

Information from a single sensor is never used to command the safety exits.

The safety guarantee depends on the location of the antennas and mats on the tracks and the platform/ground height.

References

See the websites of the projects:

- http://www.copp.fr/index_en.php
- http://www.dof1.eu/index_en.php
- <http://www.coppilot.fr/>

Documentation:

- <http://www.fersil-railway.com/>