



# Cap'System 3 in 1

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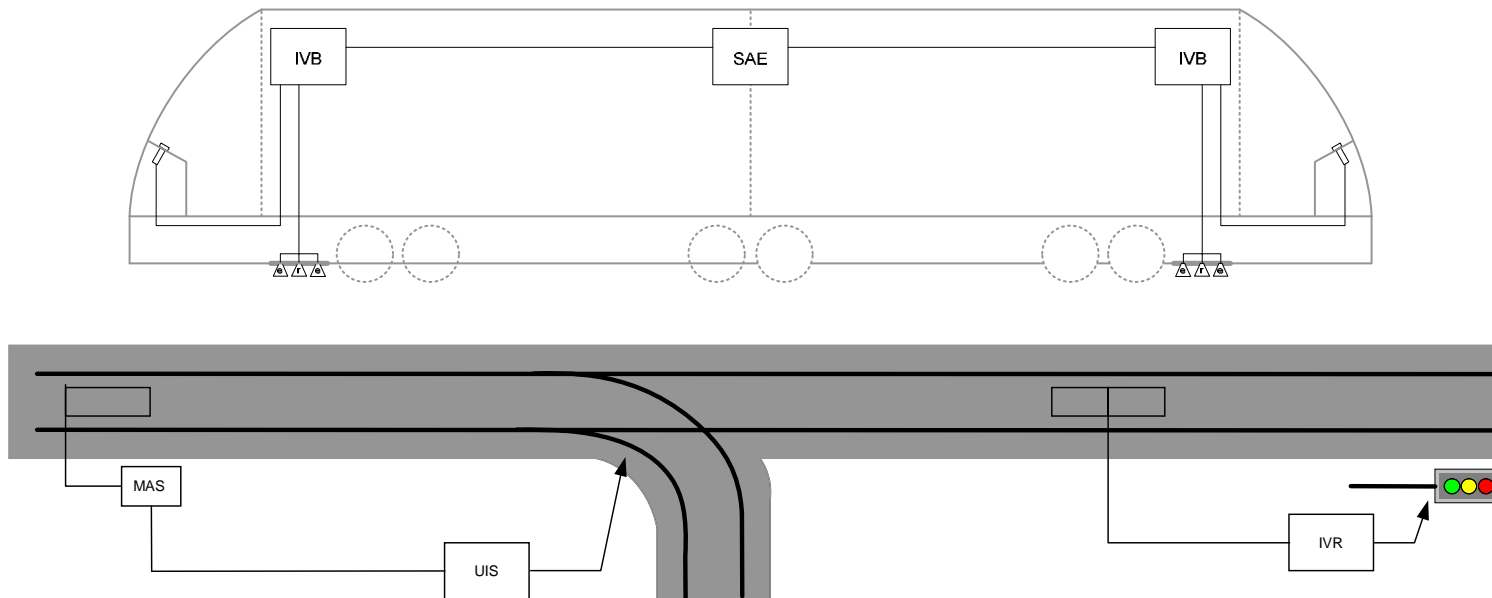
3 functions in 1 only system

1. Track switching command
2. Priority to traffic lights
3. Localization



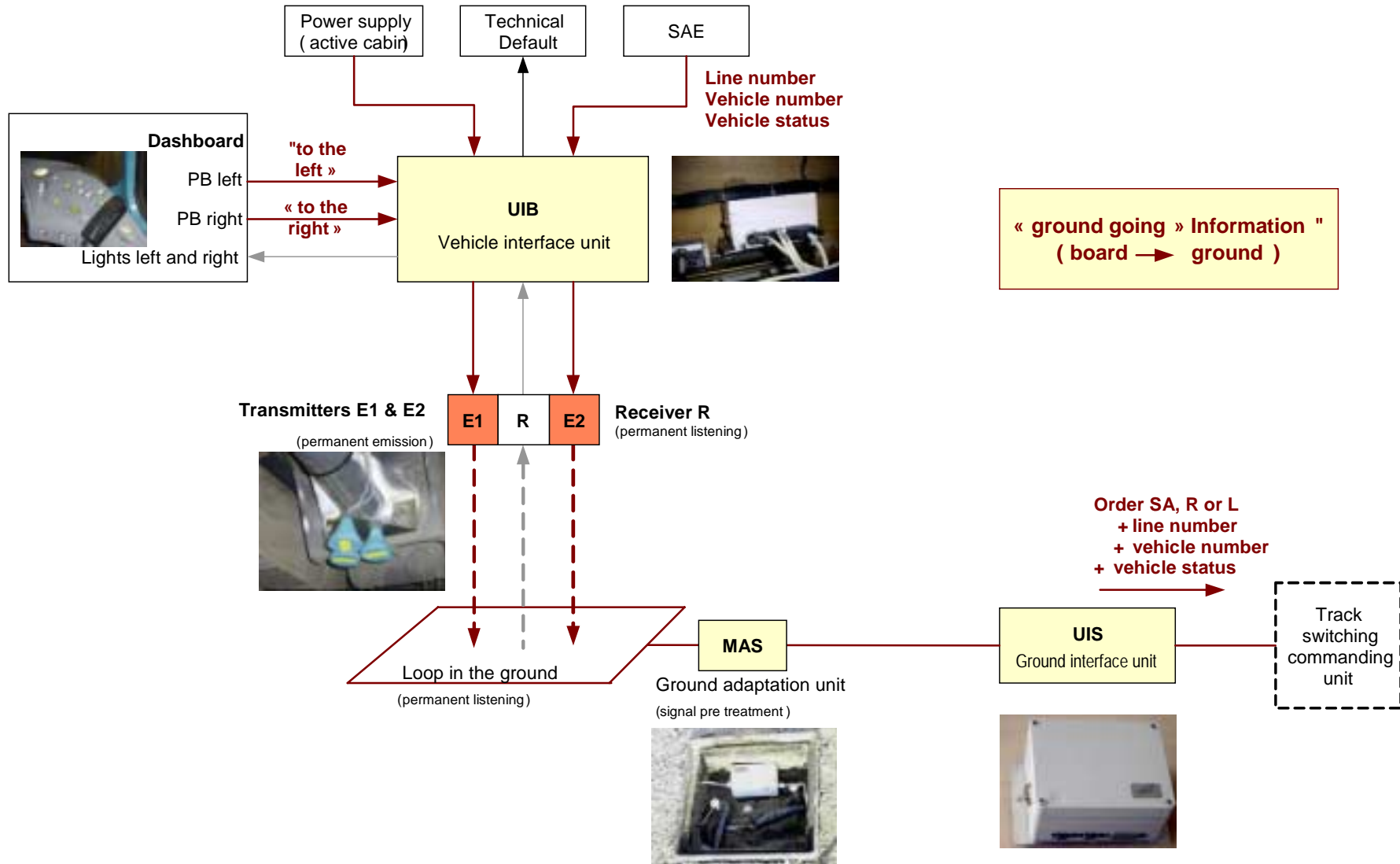
# General principle

- On board emitters/receivers
  - Driven manually and/or automatically
- Ground loop antennas
  - Directly linked to detector for Traffic Light Signaling
  - Linked via a MAS module for Track Switching command



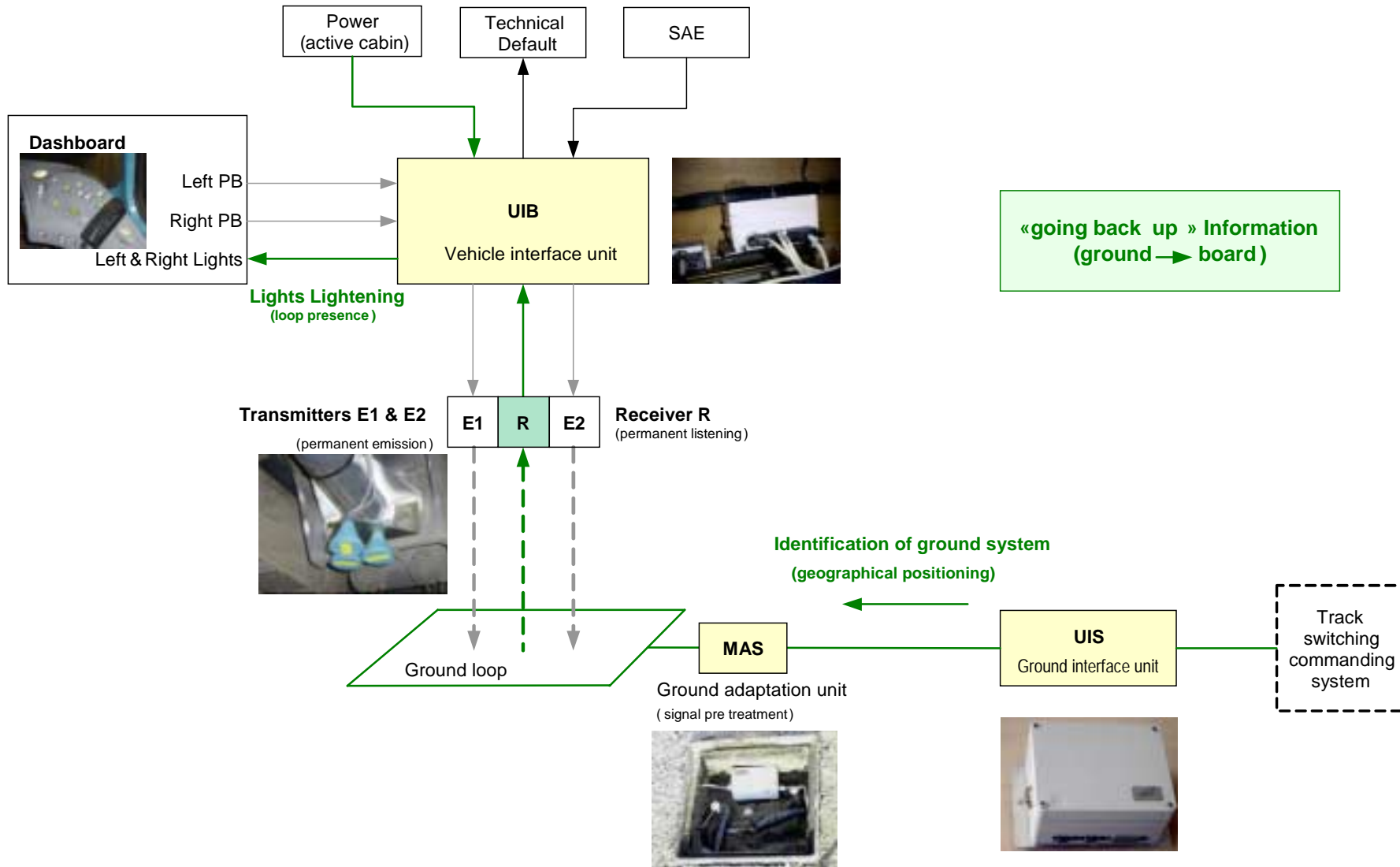
# Cap'System 3 in 1

## Track Switching command



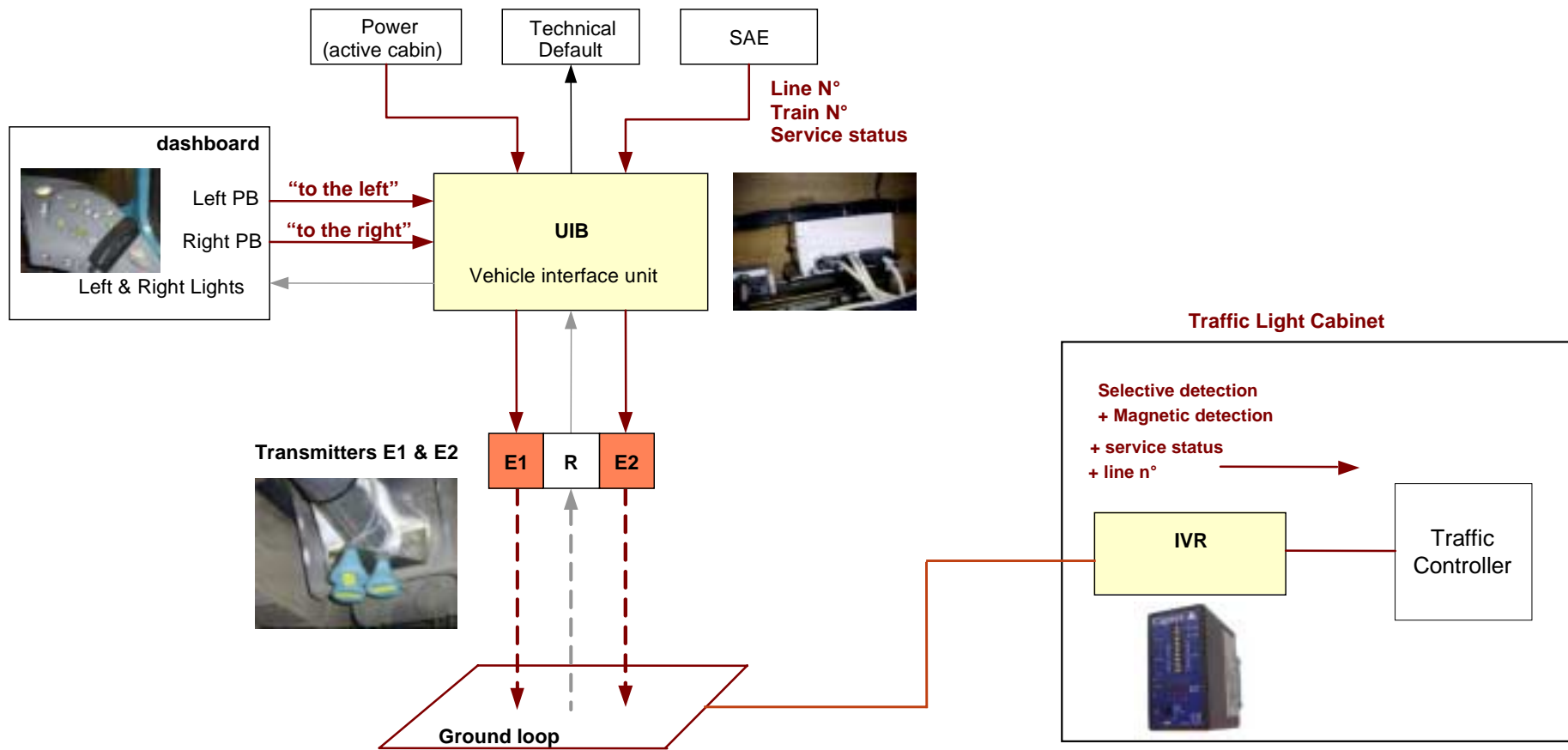
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## Localization



# Cap'System 3 in 1

Priority to traffic lights





# Cap'System 3 in 1

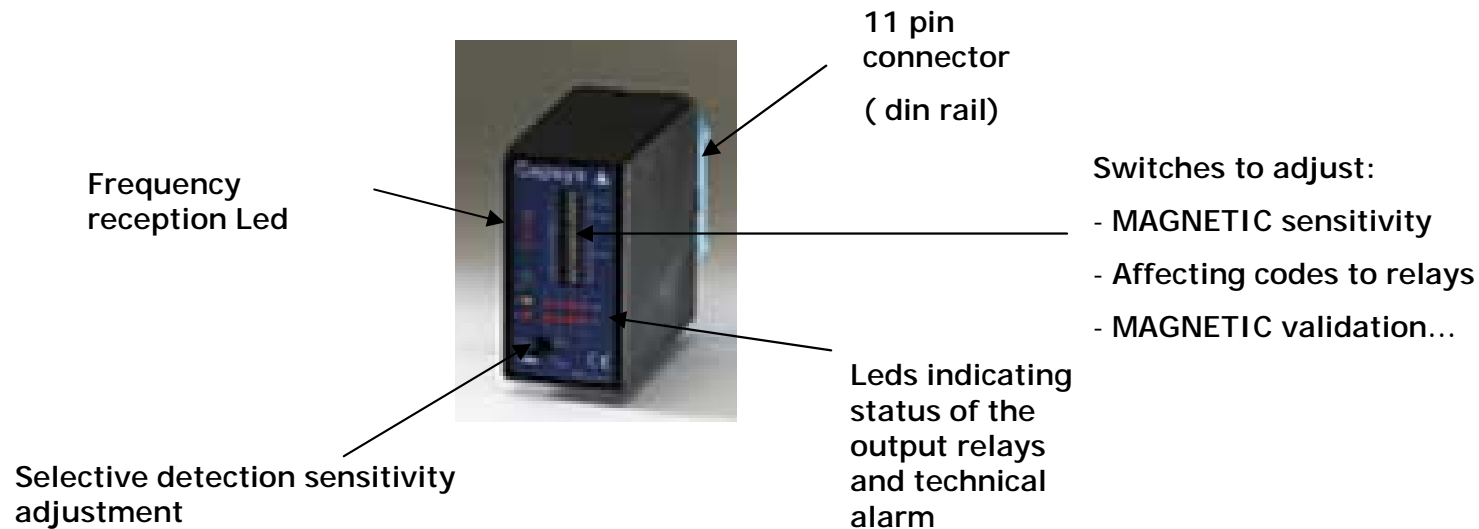
## Ground System



# Cap'System 3 in 1

Priority at traffic light: IVR Ground detector

- IVR detector



Dimensions : 80 X 42 X 102 mm





# Cap'System 3 in 1

Priority at traffic light: IVR Ground detector

- This chapter of presentation is an overview of principles for crossroads signalling
- It has to be noted that Capsys equipment can provide several functionalities ;
- The current chapter address tramway traffic lights command

For additional information, documents, references please contact us;





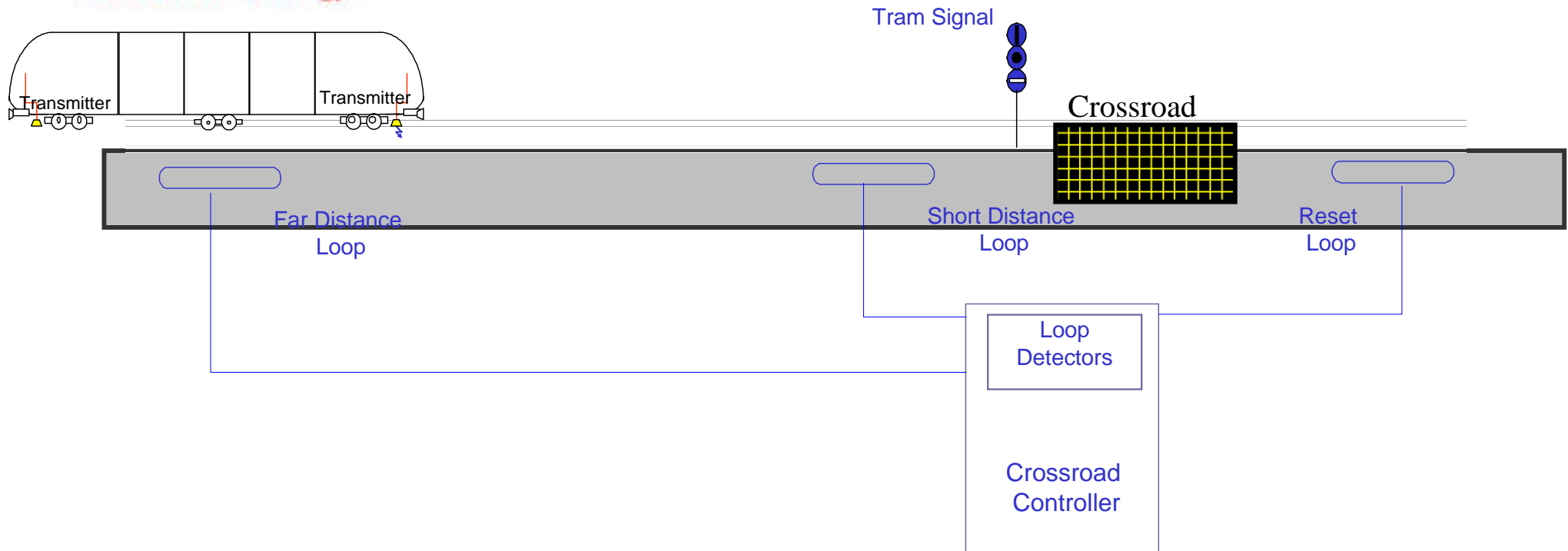
- For tramway traffic lights command equipment shall be installed :
  - On-board the tramway
  - At ground (between the rails)
- The on-board system consists mainly of :
  - **Capsys** transceiver,
  - Vehicle interface module and a set of cables
- The ground system consists of :
  - Inductive loop antenna (possibly a differential loop if magnetic detection also used) with 5-10m feed cable for reception of the information from the vehicle (can be proposed as option),
  - A link cable between the loop feed cable and the Capsys IVR sensor (not included),
  - A Capsys IVR sensor



- The principle of traffic lights command by the tramway consists of the following typical steps
- The tramway runs over a “far distance” loop (upstream the crossroad) and the loop receives carrier and transmitted by Capsys antenna under the tram.
- The IVR connected to the loop detects the tram and sends information to traffic controller
- The traffic controller initiates the sequence to deliver “green” to the tram
- A “short distance” loop is located few meters before the crossroad; this is used for degraded cases (e.g. when detection over “far distance” loop fails) and for confirmation of the tram arrival
- While tram is approaching the crossroad the signal aspect for tram is changing; for example when trams is about 6 seconds before crossroad a dedicated indication is flashing to notify the driver the coming “green”
- When tram is about 3 seconds before the crossroad “green” aspect is displayed to tram.
- When tram clears the crossroad it runs over a “reset loop” ; the event is notified to crossroad controller
- The traffic controller will change the aspect of tram signal and finally set it to “red”
- Note : “green” and “red” are displayed to trams as respectively a vertical and horizontal white bar.



# Cap'System 3 in 1 Crossroads Traffic lights command – tram detection loops

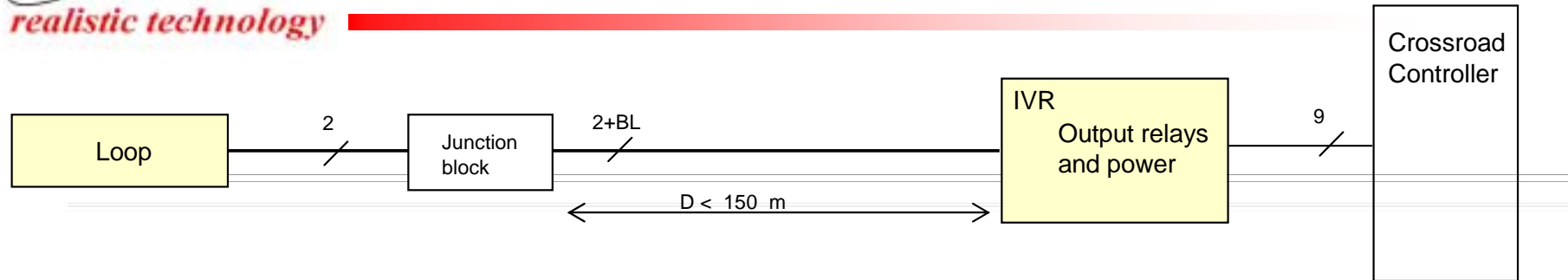


The diagram illustrates the principle of loops disposal for tram detection

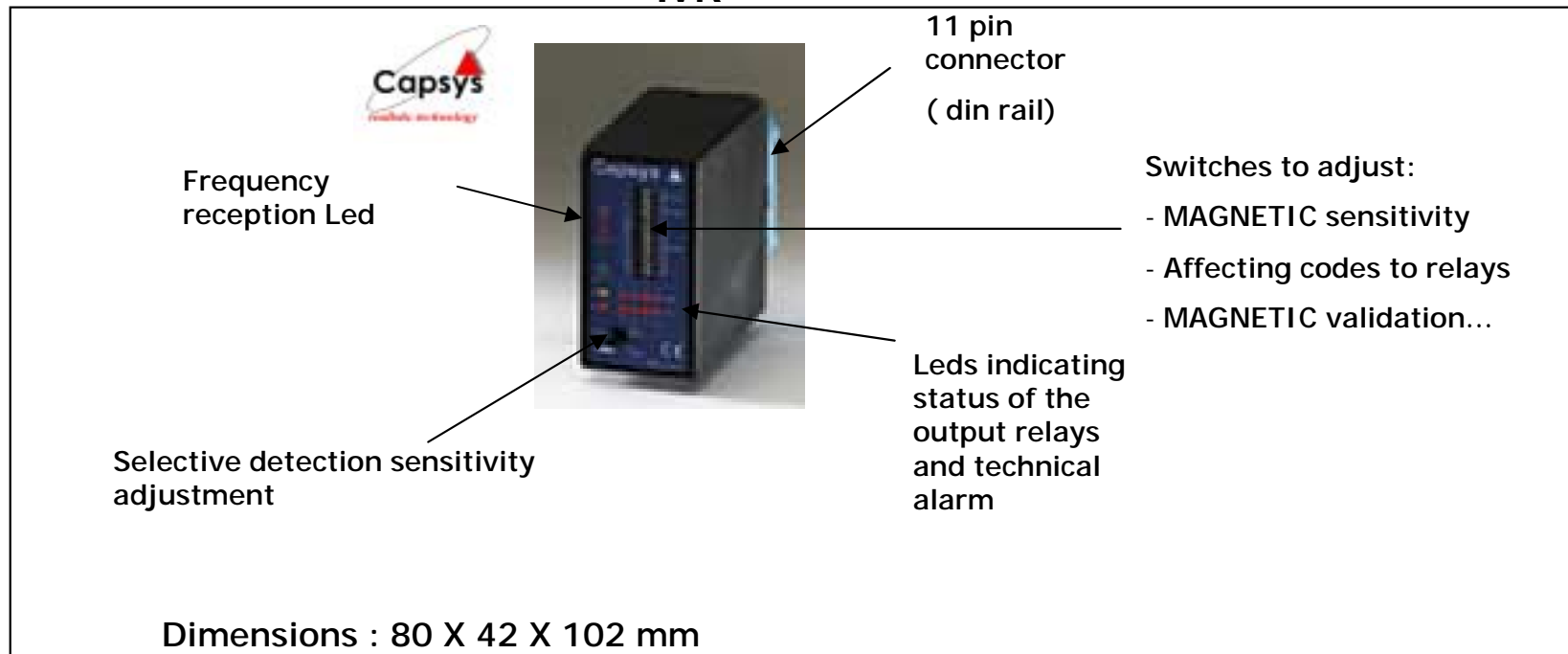


# Cap'System 3 in 1

## Crossroads Traffic lights command – Ground equipment



### IVR



Frequency reception Led

Selective detection sensitivity adjustment

11 pin connector (din rail)

Leds indicating status of the output relays and technical alarm

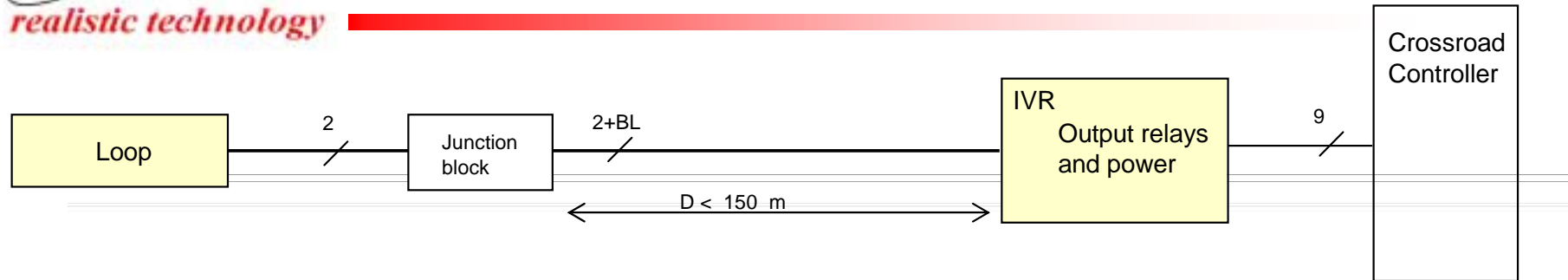
Switches to adjust:

- MAGNETIC sensitivity
- Affecting codes to relays
- MAGNETIC validation...

Dimensions : 80 X 42 X 102 mm



Cap'System 3 in 1  
Crossroads Traffic lights command –  
Ground equipment : products part numbers



Product	Capsys Part Number
IVR detector	IVR-N0M -XXX
6 m differential loop	WAB-0-130
4 m differential loop	WAB-0-129
Junction box	WAB-000-118



- The loops are connected to an IVR sensor that has to be located in a technical cabinet,
- The IVR should be at a maximum distance of 150m of the loop.
- The IVR sensor implements the communication interface with the traffic lights controller via dry contact relay outputs. As option a RS485 serial link can be implemented to interface with a supervisory system
- Technical characteristics of IVR :

Power supply	24VAC - 230VAC $\pm$ 15%
Consumption	< 1,8VA
Digital relay outputs	10mA/12Vdc to 1A/24Vdc on resistive load. I <sub>max</sub> : 1A - U <sub>max</sub> : 40VDC - P <sub>max</sub> : 24VA
Weight	220g
Dimensions with connector	80 mm X 42 mm X 102 mm

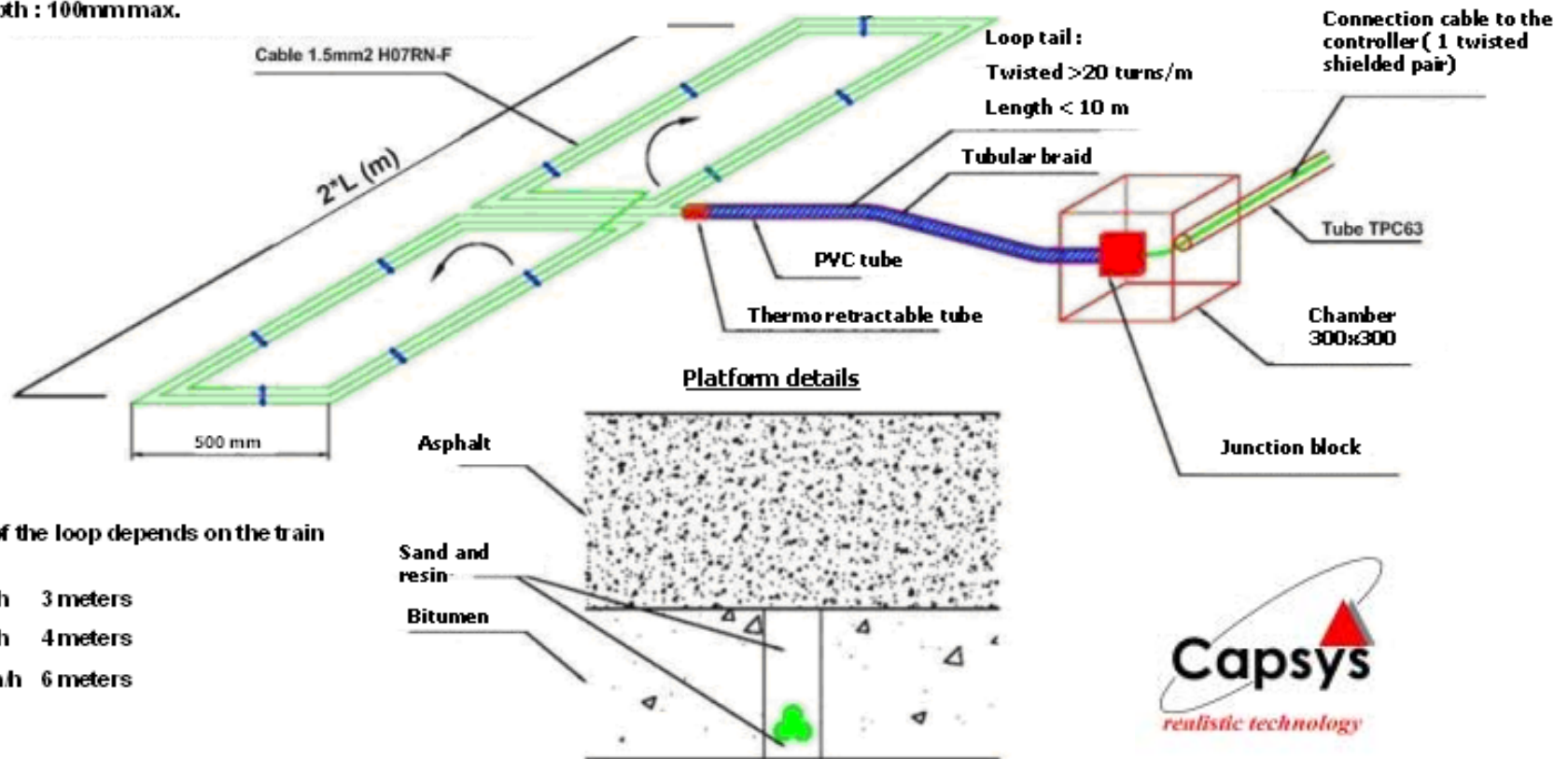


# Cap'System 3 in 1 Crossroads Traffic lights command – Loops installation

**Nota:** Capsys provides pre fabricated ready to install differential loops.

See leaflet on Capsys loop. The current in the drain below the loop should go in the same way and no equipotential link between rail and drain at less than 5 m from loop zone.

Priority loops depth : 100mm max.



The size of the loop depends on the train speed:

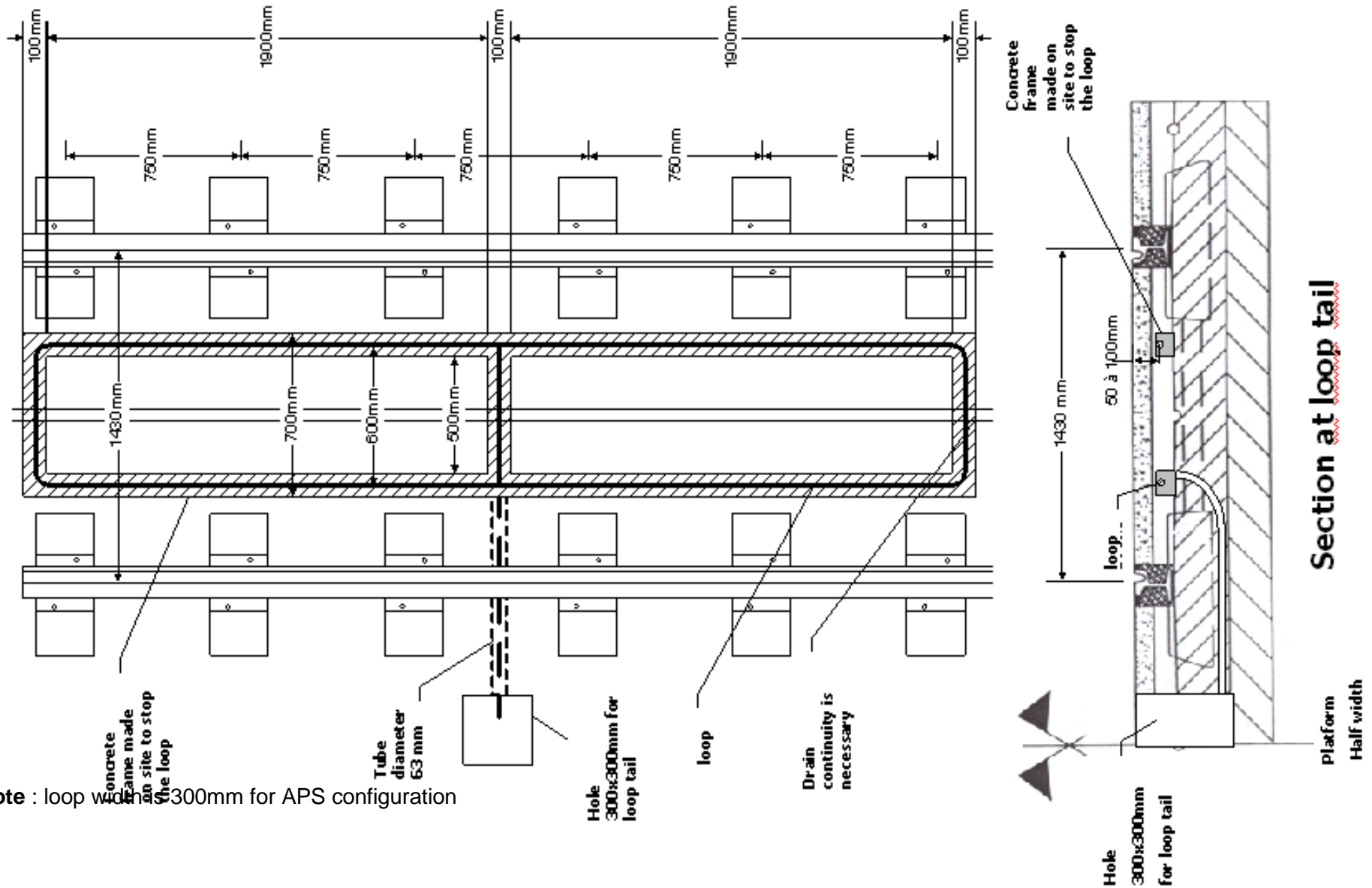
- 0 - 40 km/h 3 meters
- 0 - 50 km/h 4 meters
- 0 - 100 km/h 6 meters

**Note :** loop width is 300mm for APS configuration



# Cap'System 3 in 1

## Crossroads Traffic lights – Loops installation





- Documents used as reference :
  - CAP'SYSTEM DETAILED DESCRIPTION ref IV62013C
  - 3 in 1 CAPSYSTEM PRESENTATION UK 01.02.10

# Cap'System 3 in 1

Priority at traffic light: Ground detector IVR

- **Advantages of IVR Capsystem 3 in1 for an efficient prioritization of tramway:**
  1. **LRT Passing selective detection**
  2. **LRT PRESENCE selective detection (maintained by MAGNETIC detection)**
  3. **Magnetic detection for**
    - service vehicles, Police/ Ambulance, mixed traffic parts
    - degraded mode of operation (transmitter out of order, LRT without equipment, etc..)
  4. **Indication of status of each relay output and technical alarm** 👍 message through LED
  5. **Technical Alarm** 👍
  6. **Management of departure from station close to traffic light line** 👍 with magnetic signature
  7. **High reliability of detection** ++ with magnetic confirmation
  8. **Resistance to railways and roads harsh environments** ( electronic boxes in cabinet)  
Good integration in urban environment
  9. **Maintenance : ++ Easy and Quick :**  
Disconnectable box, display of errors in front panel
  10. **Compliance with the latest railway norms**
  11. **Evolutivity** 👍 Detection of direction of LRT (front , rear)  
Manual or Automatic immediate departure command (with door contacts), or absolute priority by Push Button on dashboard...





# Cap'System 3 in 1

Track switching :  
Ground Interface Unit (UIS)



Serial link  
(option)

To  
MAS

Power supply and  
outputs





# Cap'System 3 in 1

Track switching : Ground adaptation module (MAS)



**Size: 126 x 86 x 55 mm**

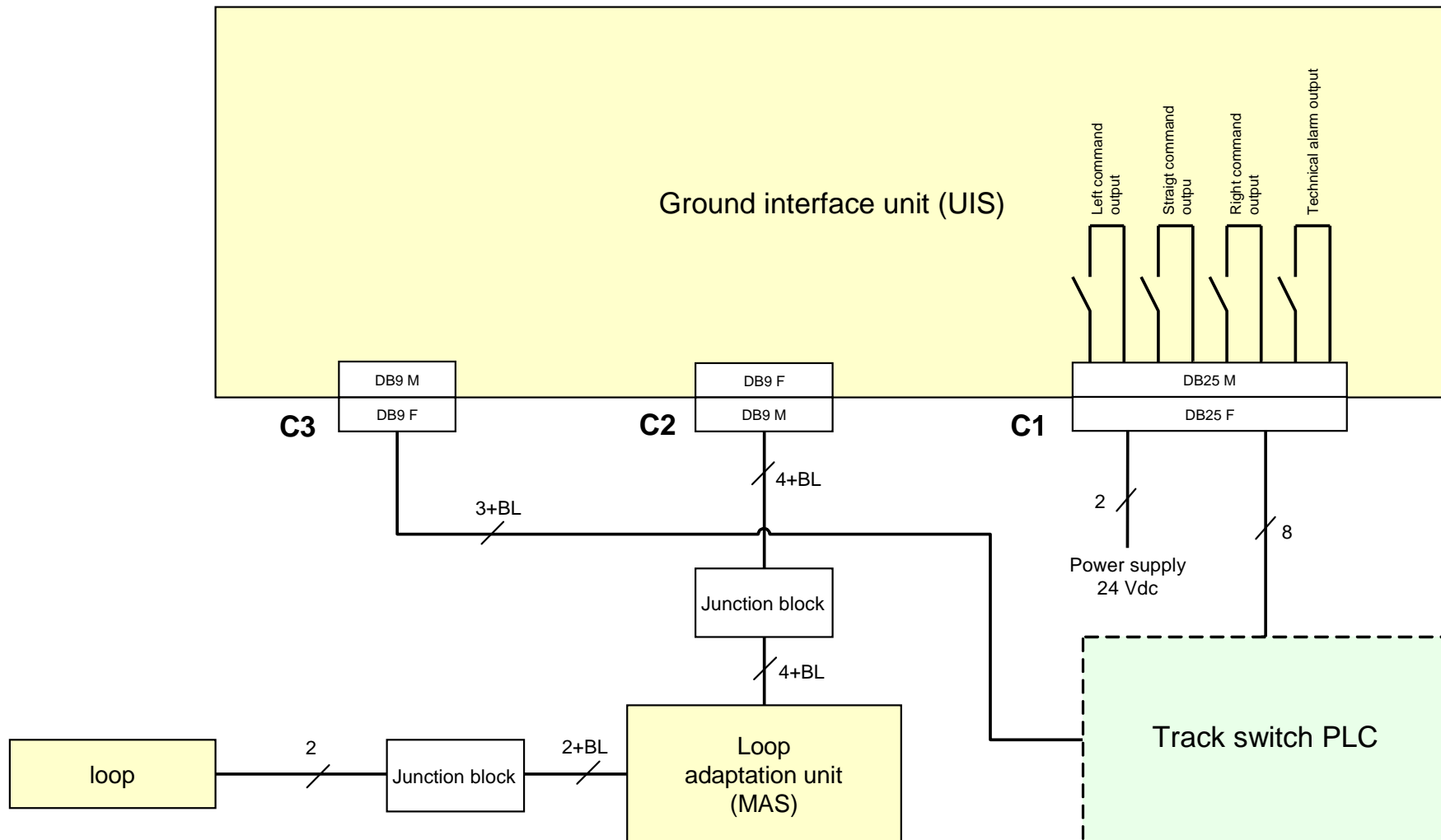
**IP67 water resistant**

**Resin encapsulated electronic**



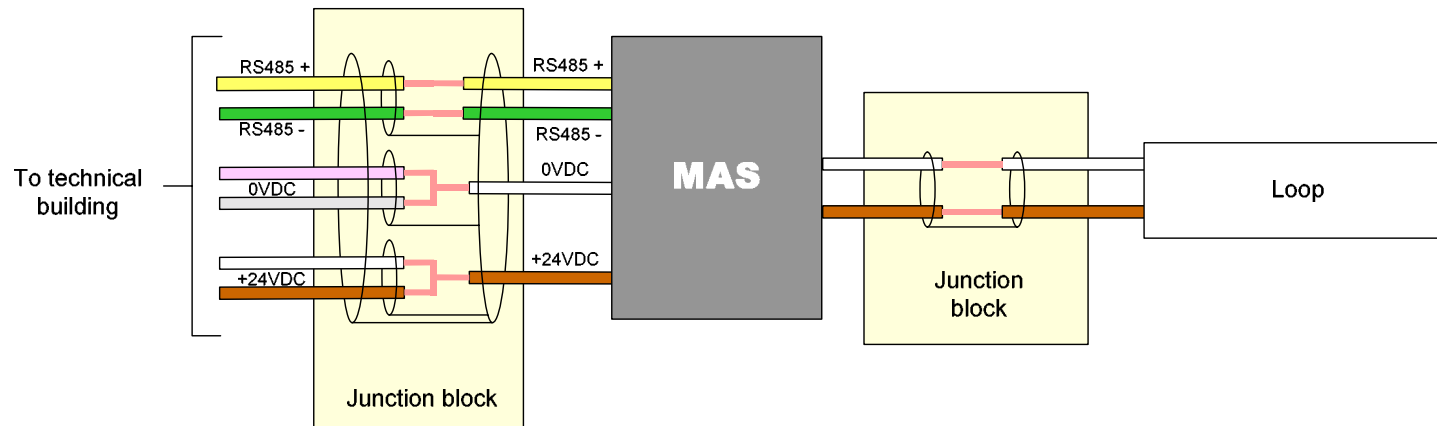
# Cap'System 3 in 1

## Connecting Diagram



# Cap'System 3 in 1

## Cabling principle (MAS)



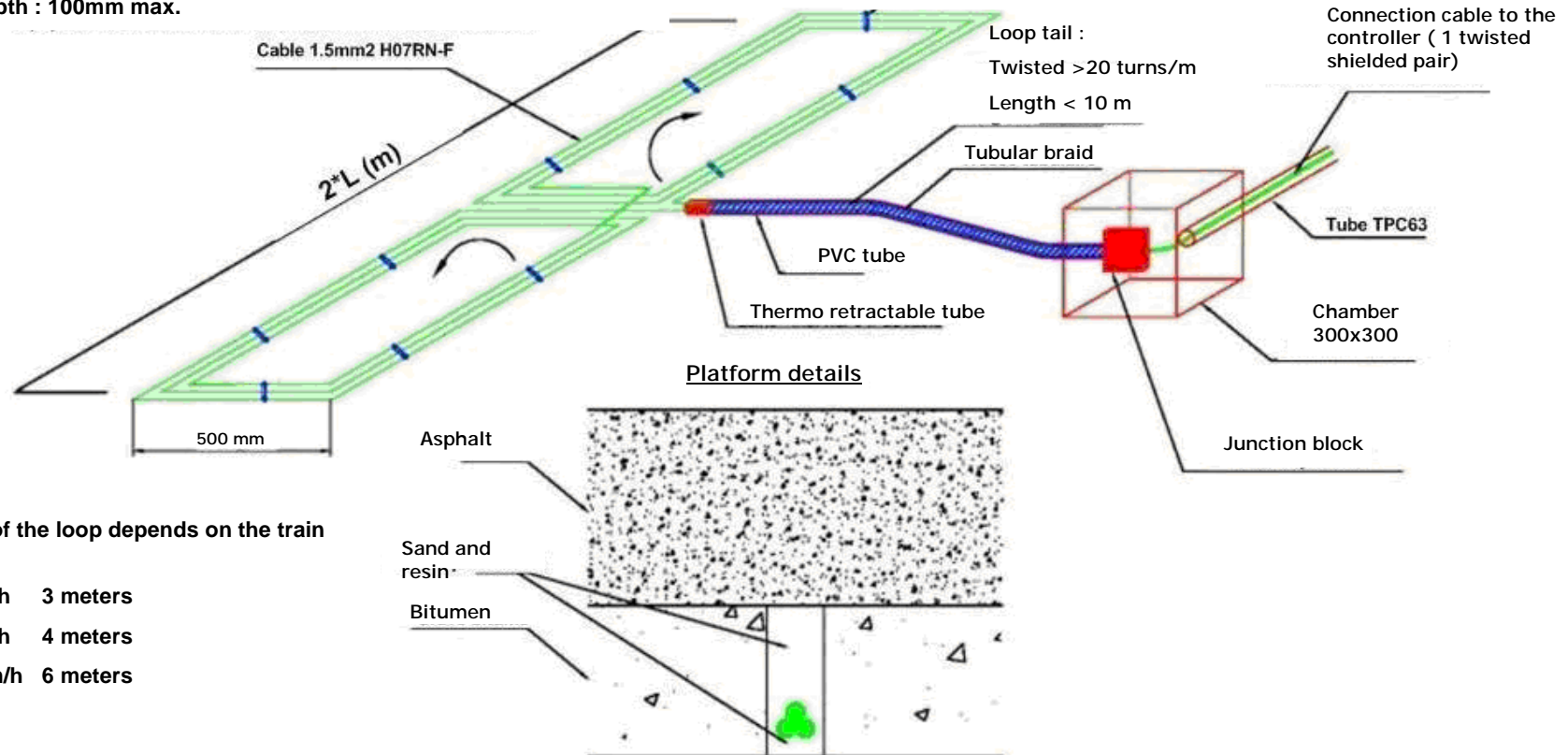
# Cap'System 3 in 1

## Loops for Priority

Nota: Capsys provides pre fabricated ready to install differential loops.

See leaflet on Capsys loop. The current in the drain below the loop should go in the same way and no equipotential link between rail and drain at less than 5 m from loop zone.

Priority loops depth : 100mm max.



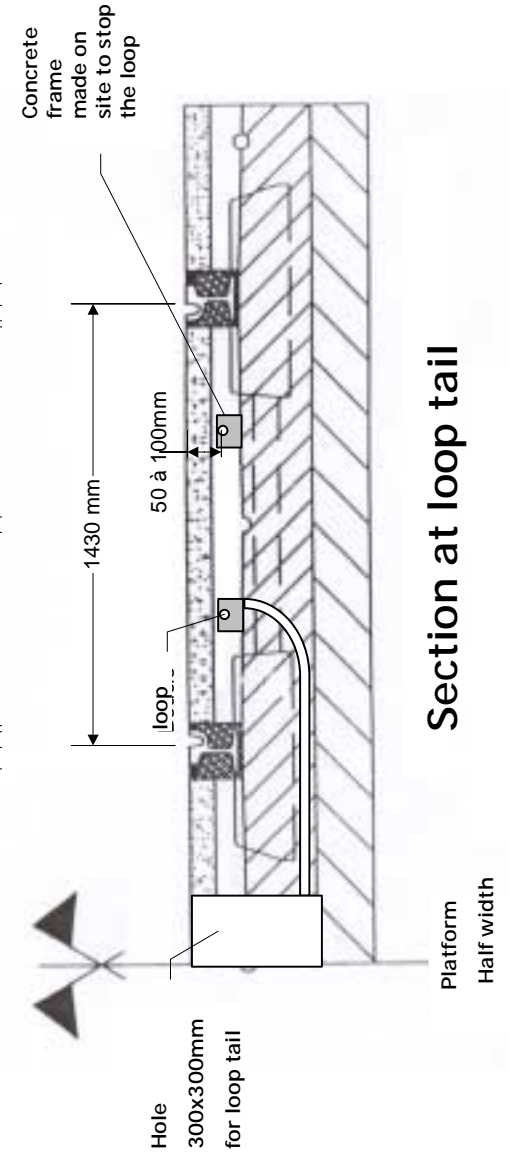
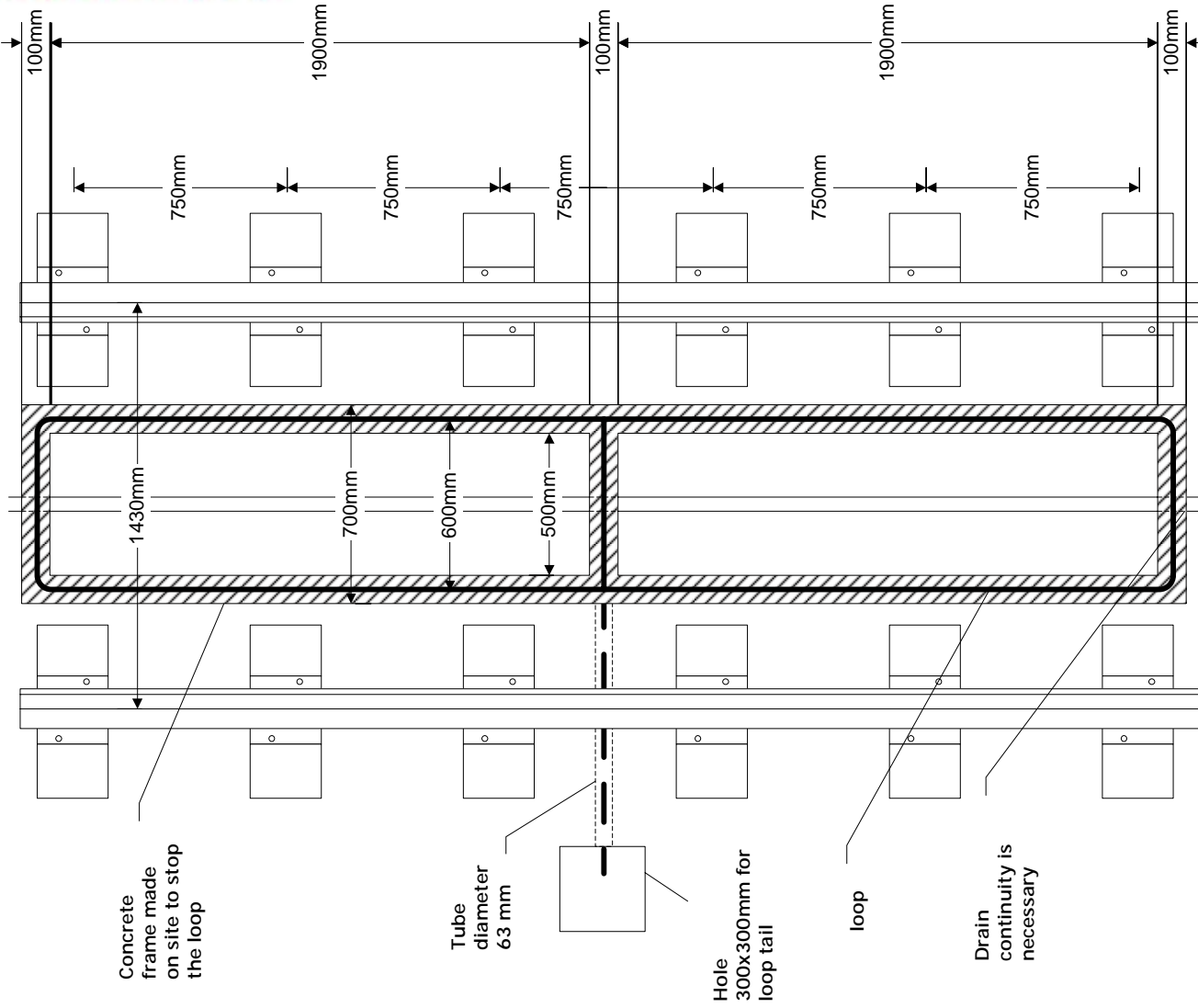
The size of the loop depends on the train speed:

- 0 - 40 km/h 3 meters
- 0 - 50 km/h 4 meters
- 0 - 100 km/h 6 meters



# Cap'System 3 in 1

## Loops for Priority





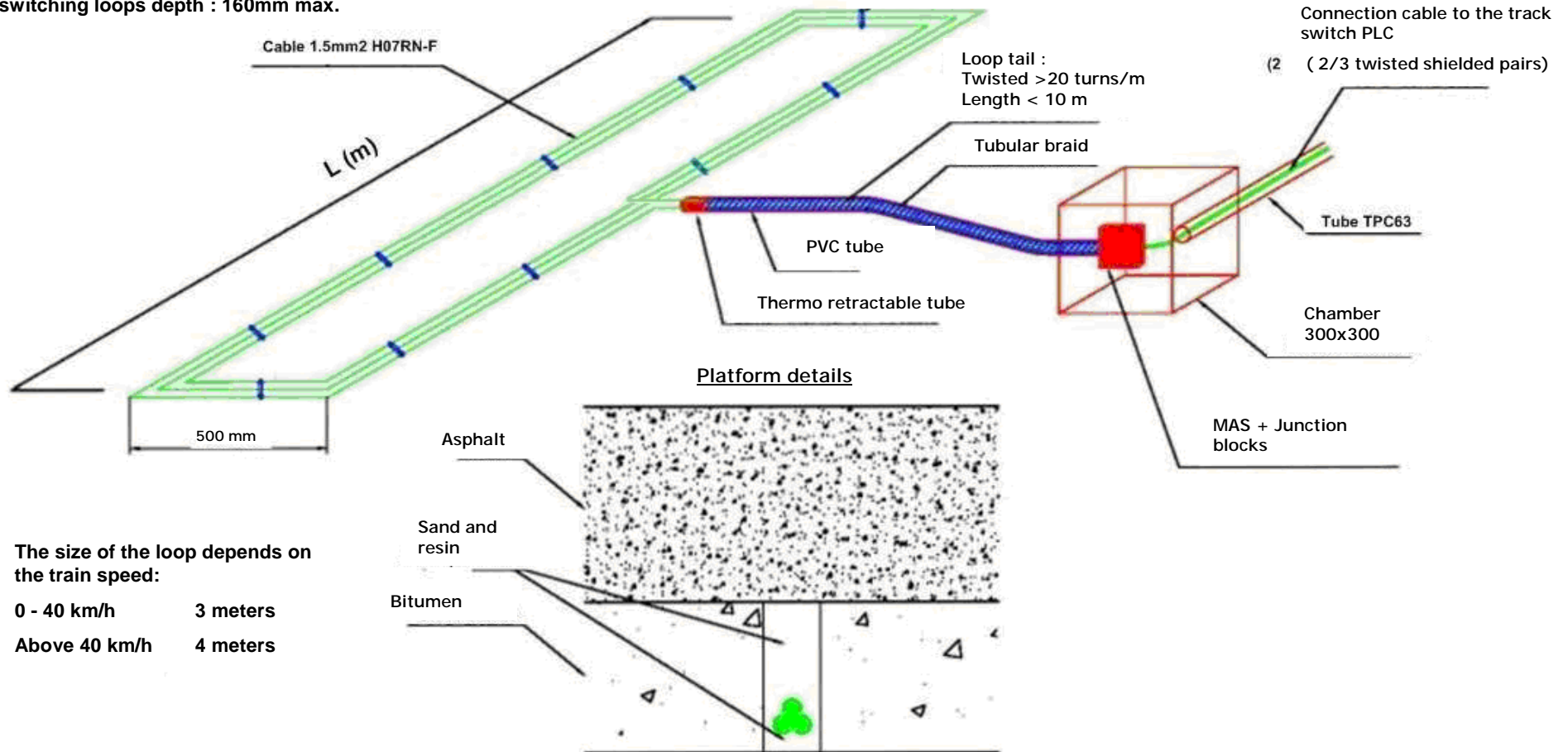
# Cap'System 3 in 1

## Example of Loops for Track switching

Nota: Capsys provides pre fabricated ready to install loops.

See leaflet on Capsys loop.

Track switching loops depth : 160mm max.



The size of the loop depends on the train speed:

0 - 40 km/h	3 meters
Above 40 km/h	4 meters





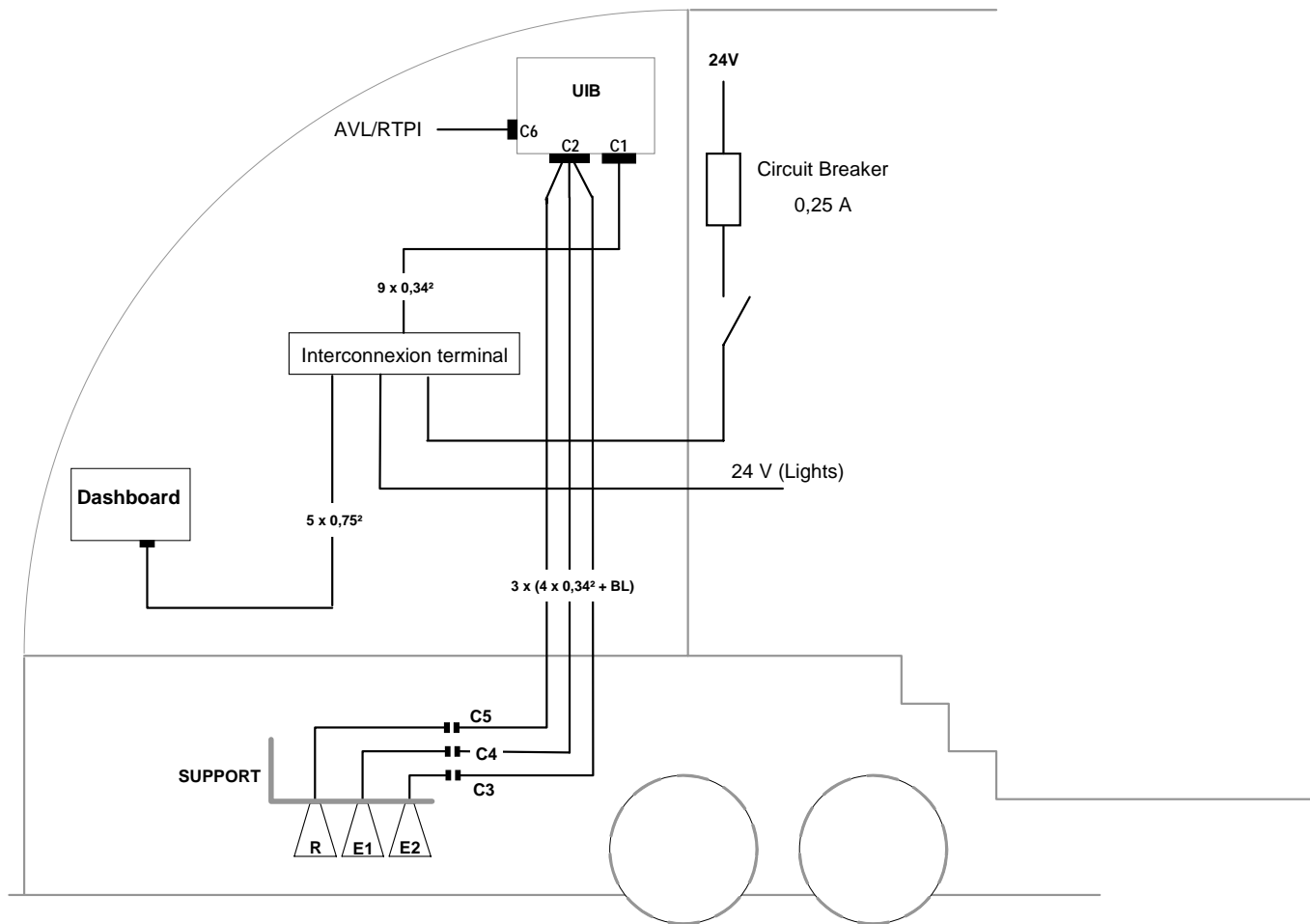
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On board sub-system



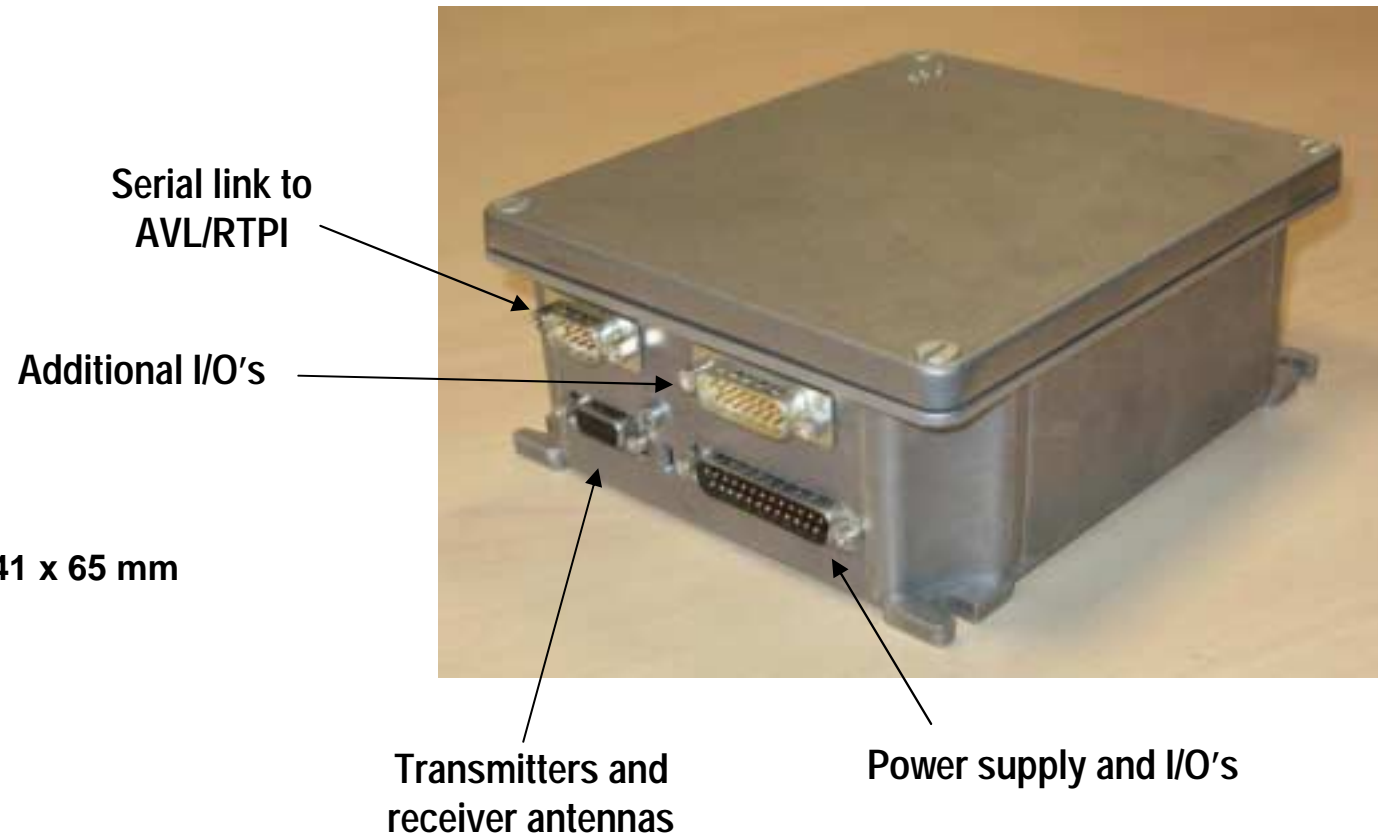
# Cap'System 3 in 1

Cabling principle for the on-board sub-system



# Cap'System 3 in 1

On-board interface unit (UIB)



# Cap'System 3 in 1

The transmitters and receiver antennas

Size: 105 x Ø 88 mm





# Cap'System 3 in 1

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## References



# Cap'System 3 in 1

## References -1



### Functions :

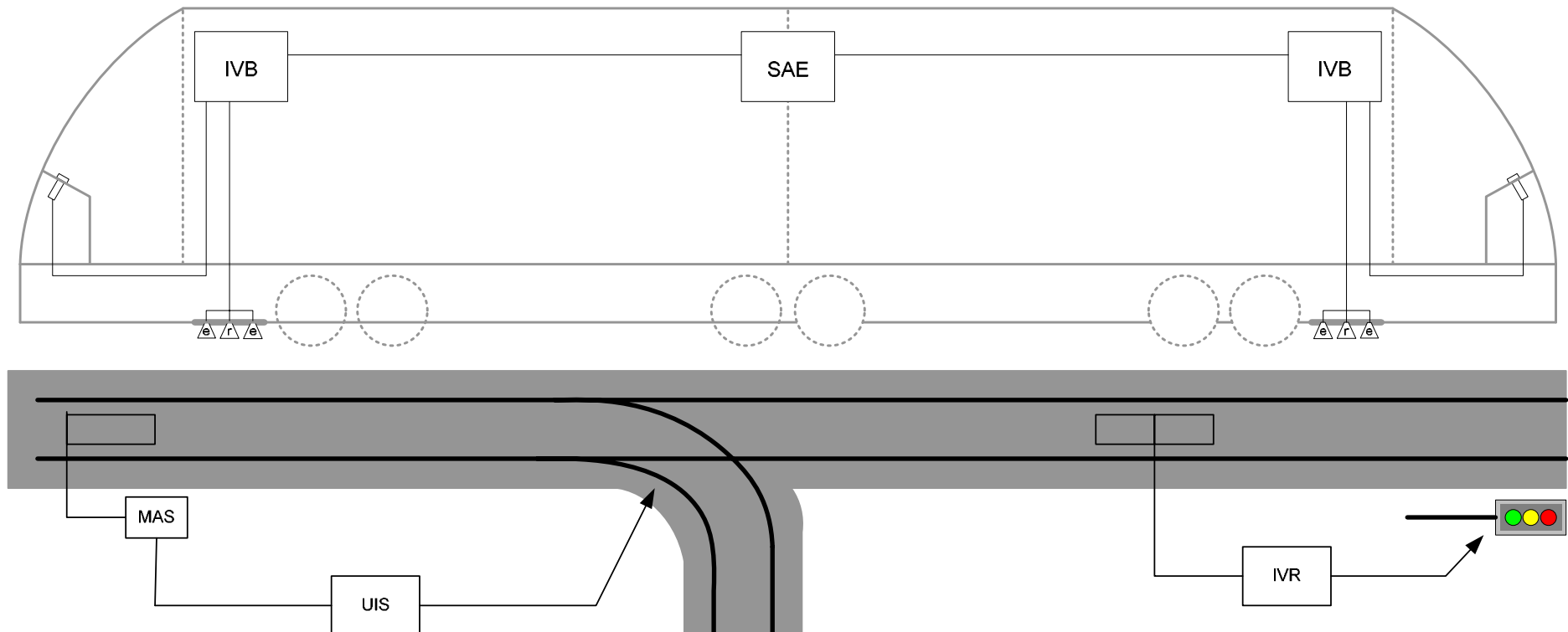
- Priority
- Track switching

### Equipments :

- 38 TFS Tramways
- 35 Citadis Tramways
- 62 ground track switching systems
- 252 ground priority systems

### I/O :

- L, M, R



## References - 2

### Functions :

- Track switching
- Priority
- Track switching
- Priority

### Equipments :

- 26 Citadis Tramways
- 26 ground track switching systems
- 23 Citadis Tramways
- 11 ground track switching systems
- 252 ground priority detectors
- 26 Flexity Tramways
- 140 ground priority detectors

### I/O :

- L, M, R
- L, R
- Door closing contact for priority
- Front 30 m cabin
- Front 40 m cabin
- Rear cabin





## References - 3

### Functions :

- Priority
- Track switching

- Priority
- Track switching

### Equipments :

- 20 Citadis Tramways
- 6 ground track switching systems
- 220 ground priority detectors

- 25 Citadis Tramways
- 10 ground track switching systems
- 285 ground priority detectors

### I/O :

- L, M, R
- Manual Priority

- L, M, R
- Manual Priority
- Auto/manu Track switching commands
- Test



A total of about 200 vehicles equipped  
More than 100 ground track switching systems  
More than 1100 ground priority detectors



Light Rail networks in construction with Cap'System solution:

- Alger (Algeria)
- Reims (France)
- Oran (Algeria)
- Constantine (Algeria)
- Rabat (Morocco)
- Orleans (France)
- Angers (France)
- And more to come ...

Light Rail networks equipped with previous generation Capsys solution:

- Paris (France)
- Reims (France)
- Nantes (France)
- Lyon (France)
- Montpellier (France)
- Caen (France)
- Clermont-Ferrand (France)
- Saint Etienne (France)
- Nancy (France)
- Madrid (Spain)
- Parla ( Spain)
- Jerusalem (Israel)





# Cap'System 3 in 1

Tram-Train version  
approved by SNCF operator





# Cap'System 3 in 1

Tram-Train implementation



## Functions :

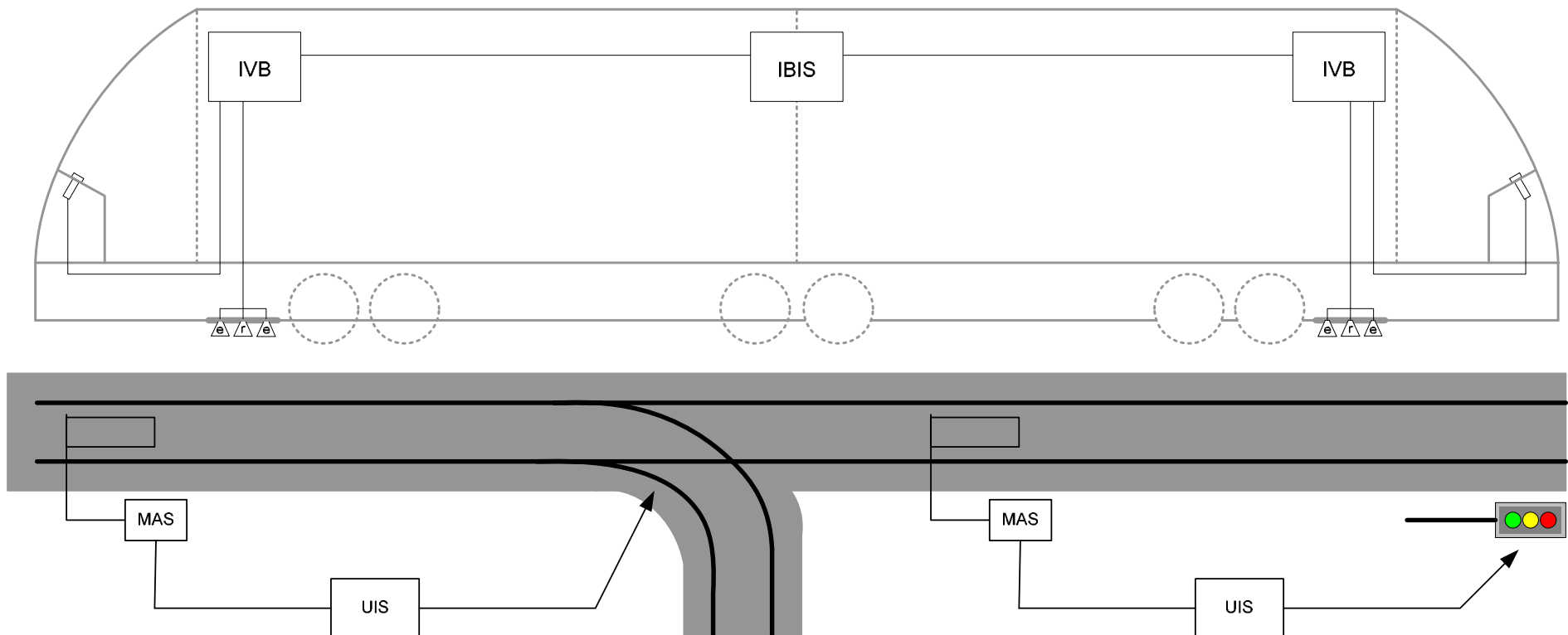
- Priority
- Track switching
- Localization

## Equipments :

- 17 Avanto Tramways
- 122 ground systems

## I/O :

- L, M, R



- approved SIL 2 for critical safety events :
  - « Train recognized as Tram-Train »  
With an error rate below  $1. 10^{-6}$
- approved for 6 non critical safety events:
  - « Tram-Train not recognized as Tram-Train »
  - « track switching system not operating »
  - « track switching system operating not operating or not correctly read»
  - « No priority request at crossroad »
  - « Ground system identification not transmitted to SAEIV »
  - « Ground system identification is false »



# Cap'System version SNCF

- Includes auto checking of alarm output in positive security :
  - For ground equipment:
    - Power supply leakage – UIS fault – MAS fault and MAS connection fault
  - For on board equipment :
    - Power supply leakage – UIB Fault – Emitting antennas and its connection fault – Reception antenna fault
- Boxes for « harsh rail environment » :

Robust boxes



anti-vandalism loop





# Cap'System 3 in 1

Our Cap'System clients

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- SNCF (Aulnay-Bondy)
- SMTC(Grenoble)
- INEO Systrans (Mulhouse)
- Alstom ( Grenoble, Valenciennes, Reims, Madrid, Alger Oran, Constantine,...)
- Vossloh Cogifer (Valenciennes, Le Mans, Rabat)
- Amec Spie (Marseille)
- Forclum Transport (Nice)
- Sagem (Marseille, Valenciennes)
- Fareco (Valenciennes)



# Cap'System 3 in 1

## Standards Compliance

- **NF EN 50 155** Équipements électroniques utilisés sur les véhicules ferroviaires - *EMC*
- **NF EN 50 125-1** Conditions d'environnement pour le matériel.
- **NF EN 50 125-3** Equipement pour la signalisation et les télécommunications.
- **CEI 77** Règles applicables à l'appareillage électrique et de traction.
- **EN 50-121** Applications ferroviaires - EMC.
- **La Directive R&TTE ou Directive 1999/5/CE** du parlement européen et du conseil, du 9 Mars 1999, concernant les équipements hertziens et les équipements terminaux de télécommunications et la reconnaissance mutuelle de leur conformité.
- **La Directive 89/336/CEE** relative à la compatibilité électromagnétique. La Directive CEM (89/336/CEE modifiée par la Directive 92/31/CEE) est transposée dans le régime réglementaire français : décret n°92-587 du 26 juin 1992, modifié par le décret n°95-283 du 13 mars 1995





# Cap'System 3 in 1

The good reasons to choose Cap'Sytem 3 in 1

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- Provide new functions.
- More economical (only one system to install in the vehicle)
- More connectivity (SAE, SIE...).
- Allow to install the loops at a long distance.
- Compliance to railway standards



# Cap'System 3 in 1

The next evolutions

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- Magnetic detection on MAS
- Localization with a standalone MAS
- Multi-loops IVR detector
- Loop size reduction
- ....

