

## Car-to-Car-Communication



In order to increase the passengers' safety and to prevent vandalism, the public transport systems use increasingly strategies for monitoring the cars' passenger sections with closed-circuit video systems. Apart from recording the information received from the closed circuit video system with digital display storage facilities, solutions are required that can

- call video sequences selectively from the train concerned in response to an emergency signal released and transmit them to the control center, and/or
- display the situation in the car concerned on a screen in the driver's cab at his request or automatically after the emergency signal has been triggered off.

This would usually require additional transmission channels between the cars coupled to each other. The easiest way to establish such a connection is by cable when the train is permanently coupled together. However, the use of coupling contacts for transmitting signals is often prevented by the fact that no more free coupling contacts are available.

### Wire-bound video and data transmission with the help of ELA cables

The TRAM BVG Berlin realizes the video and data transmission via the coupling contacts between two (or more) streetcars coupled to each other with the existing ELA cables **without affecting** the functioning of the ELA system as such.

The video and data signals are transmitted within a frequency range which is completely outside the frequency used by the ELA system and outside the interference ranges typical of railcar traffic. Besides, the transmission procedure does not need to be compensated as it operates largely independently of the cable length. Another positive feature is that it can be operated potential-free.

Each car will be re-equipped with **one** transmission/receiver module which contains the following functional assemblies:

- a video signal transmitter
- a video signal receiver
- a data signal transmitter
- a data signal receiver
- an interface with the 100-V ELA system

However, only one transmitting and one receiving components each must be active in every transmission/receiver module. The correct function of the transmitting and receiving components in the first (tractive) and in the second car will then be activated/deactivated by a control signal, such as "driver's cabin activated".

In order to ensure the reliable video and data transmission, the **environment will have to be suitably adjusted**. This applies particularly to laying out the cable which is used for the transmission.

The ELA components are usually connected with the bus line via a spur line. There are open tails and (used or unused) emergency call stations in a configuration like that between the connecting points of the spur line for the ELA components and the two couplings at both ends of the train unit. If the video and data transmission was operated within such kind of line configuration, the transmission would be considerably disturbed without any additional measures being applied, which is due the reflections of the HF carrier frequencies at the open tails.

The problem can be solved relatively easily by selectively splitting the ELA bus line as shown in Fig. 1.

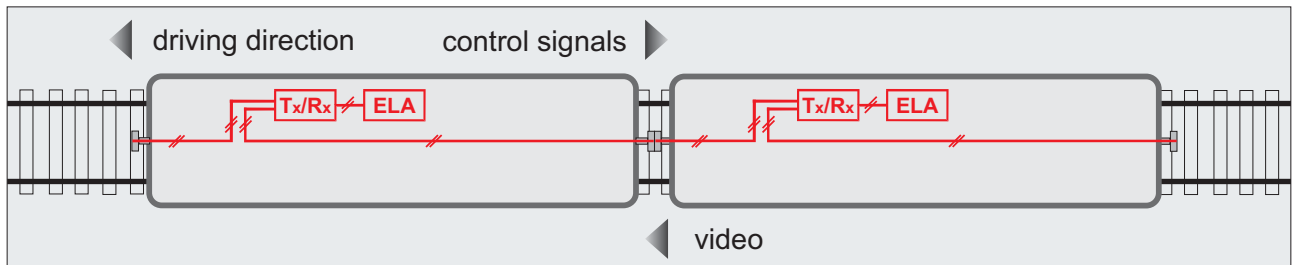


Fig. 1 • How the ELA cable must be laid out

In addition to that, all tail lines connected to this bus line will be blocked for HF signals with a channel filter, while the (ELA) NF signal transmission is ensured without any interference. This configuration ensures that modifications to the coupling situation of the cars can also be made **during operations** without problems. Vehicles operated in two directions with the two driver's cabs A - B used during train operations will allow the following combinations: A - B / A - B; A - B / B - A; B - A / A - B or B - A / B - A.

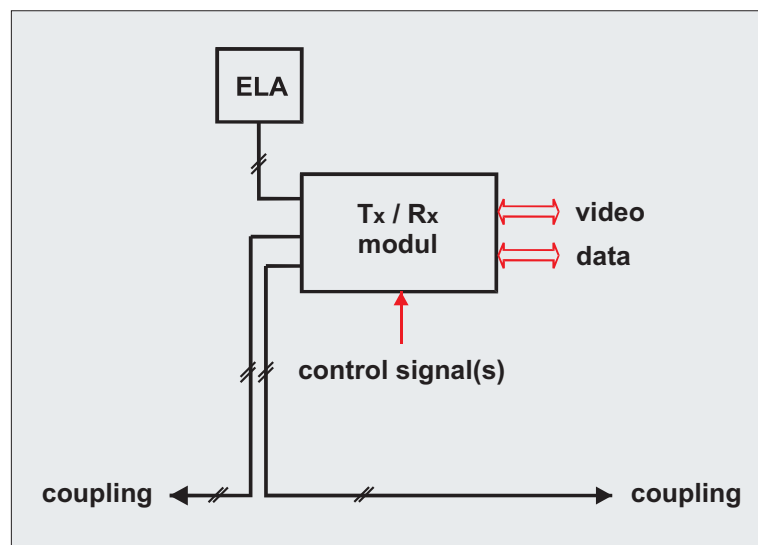


Fig. 2 • Block diagram of the combined ELA-video/data transmission

The S/E module (transmission/receiver module) and the ELA are connected via a (passive) interface with the transmission line. The interface is located in the S/E module which transmits and receives signals in/from both directions at the same time.

One single control signal (to define the active driver's cab) is sufficient to configure these S/E modules for the operations in the tractive unit or in the second car and thus to activate/deactivate the transmission/receiving activities of the video and data components concerned.

The interfaces realized are the standard (F) BAS signal  $1 V_{ss}$  with 75 Ohm and the RS 485 - level point-to-point connection (simplex) for the data signals, optionally also: V24 / RS 232.

There is also an alternative for the signal transmission via coupling contacts already used: Although this alternative requires a much higher hardware input, it is easier to install it, not to say child's play. This applies in particular to the ambient conditions to ensure a reliable video and data transmission:

## Infrared video and data transmission between two cars

The wide-angle STIVIS 2.5 infrared transmission (with a range of 2.5 m) is based on the technical STIVIS solutions for the transmission of camera signals from the platform to the driver's cab, as in-stalled at the Berlin city train system ("S-Bahn") and the Wuppertal suspension tramway, as well as solutions for bi-directional IR video/data and Ethernet systems.

The bi-directional STIVIS 2.5 infrared transmission system is a modularly designed infrared transmission system that can be used for the transmission of video and control signals.

A disadvantage of railcars operated in both directions is that the number of transmission modules must be doubled, as one transmission module will have to be installed at each end of the car. This is more than outweighed by the considerable advantages gained over the wire-bound and radio transmission:

- Only a visual connection between the transmission and receiving modules is required to ensure a reliable video and data transmission.
- No malfunctioning due to electromagnetic interference fields.
- No disturbing influence on the ambient areas.
- Low installation input, no wear and tear and a long service life.
- Passing trains are not mutually affected by interference/disturbances

The transmitters and receivers have identical transmission angles, i.e.  $40^\circ$  horizontal and  $10^\circ$  vertical depending on the application, so that they can be used for track radii of up to a minimum of 25 m.

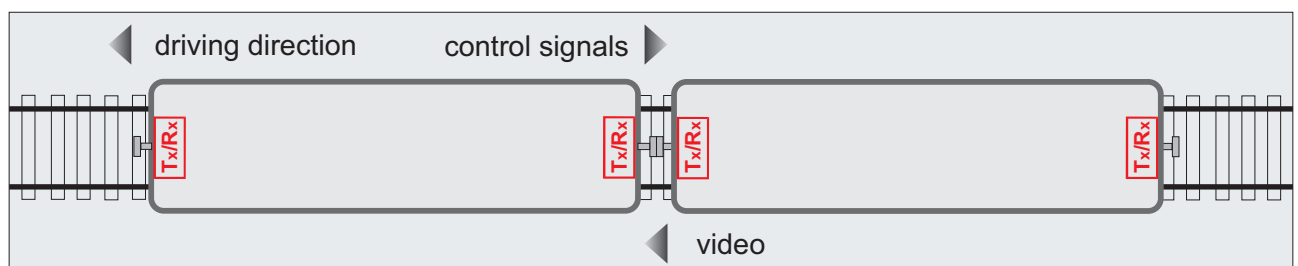


Fig. 3 • Schematic diagram of the IR video/data transmission

Each driver's cab or the end of each car will be re-equipped with a transmission/receiver module which includes the following functional assemblies:

- a video signal transmitter
- a video signal receiver
- a data signal transmitter
- a data signal receiver

The volume of the casing is about < 1 liter. The dimensions of the casing and its design can be adapted to the installation conditions and to the requirements of the customer.

It is recommended to locate the transmission and receiver modules behind the windscreen/rear screen or in the casing of the destination display.

Of the altogether four transmission channels, only two must be active at any one time, i.e. the video transmission in one direction and the data transmission in the other. The active channels are activated by two static signals each, depending on the operating conditions.

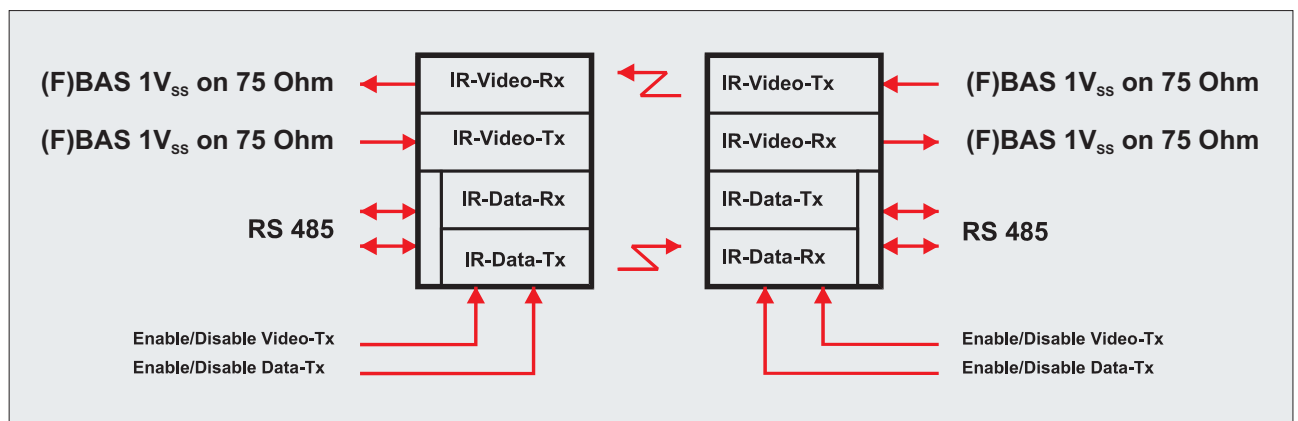


Fig. 4 • Block diagram of the infrared video- and data transmission between two railcars



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