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*Translation*

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## **Omnibus telephone circuits - Regulations for construction and equipment**

*Circuits téléphoniques omnibus - Règles de construction et d'équipement*

*Gesellschafts- (Omnibus-) Fernsprechverbindungen - Regeln für Aufbau und Ausrüstung*



UNION INTERNATIONALE DES CHEMINS DE FER  
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*The person responsible for this leaflet is named in the UIC Code*

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## Summary

This leaflet concerns the technical aspects of railway telephony, dealing with omnibus circuits as defined in *UIC Leaflet 750, Chapter II, B*.

The principles defined in this leaflet are old in conception, but have in most cases remained valid to this day.

The systems have benefited from technological advances and their performance has improved.

Fibre optics and new transmission equipment ensure better-quality service on omnibus circuits.

Point 2 is dedicated to transmission channels (overhead lines, copper cables and fibre optics), frequency band widths, attenuation and connections.

Point 3 is devoted to call systems; those most generally used being centralised call lines (many railways having replaced their decentralised call systems with an automatic telephone network).

This point also deals with the various call modes, the nature of call pulses and different call current sources (generators, receivers and repeaters).

Point 4 covers the classification of telephones according to the method of use and defines the technical and operating conditions.

Points 5 and 6 contain recommendations for the construction of new omnibus circuits and their maintenance.

This leaflet does not consider the possible future replacement of omnibus circuits by radio services furnished by GSM-R.

# 1 - Foreword

## 1.1 - General

Although the principles set out in the present leaflet are on the whole based on superseded concepts, they have in most cases retained their general usefulness to the present day.

However, it should be noted that whilst retaining their functionality, the systems have benefited from recent technological advances, resulting in enhanced performance.

Future transmission links becoming available with the introduction of GSM-R can be expected to change some systems significantly, particularly on high-speed lines.

This leaflet deals only with the telephonic aspects of the omnibus circuits described in *UIC Leaflet 750, Chapter II, B* used for various purposes.

The circuits listed below are referred to as "omnibus circuits".

## 1.2 - Definition

An omnibus circuit is understood to be a telephone circuit to which a number of points are shunt-connected to meet the service requirements, bearing in mind the characteristics of the call system of the telephone and the need to avoid overloading the circuit.

## 1.3 - Classification of omnibus circuits

The omnibus circuits referred to in *UIC Leaflet 750, Chapter II, B* can be classified in four separate categories.

### 1.3.1 - Omnibus circuits reserved for operating links

These are used to supervise and regulate the running of trains (*UIC Leaflet 750, B 5*). On many railways they are referred to as control circuits. Signalling circuits also come within this category (*UIC Leaflet 750, B 2*), together with circuits for train advice (*UIC Leaflet 750, B 6*) and omnibus circuits alongside remotely controlled lines, e.g. signalling circuits with identified call.

### 1.3.2 - Omnibus circuits suitable for connecting to the general network

These are generally used for operating or traffic purposes, and by the administrative departments (*UIC Leaflet 750, B 3*). Semi-direct circuits also come within this category (*UIC Leaflet 750, B 4*).

### 1.3.3 - Omnibus circuits for technical maintenance departments

- Track maintenance circuits (*UIC Leaflet 750, B 8*).
- Signalling maintenance circuits (*UIC Leaflet 750, B 7*).
- Catenary maintenance circuits (*UIC Leaflet 750, B 12*).

It may be advisable to be able to connect these circuits to the general network.

#### 1.3.4 - Omnibus circuits for special purposes

- Warning circuits (*UIC Leaflet 750, B 9*).
- Sub-station control circuits (*UIC Leaflet 750, B 10*).
- Sub-station omnibus circuits (*UIC Leaflet 750, B 11*).

## 2 - Characteristics of telephonic transmission

### 2.1 - Transmission channel

The transmission channel used for omnibus circuits can be either:

- overhead lines, or
- cables (copper, fibre optics).

For economic reasons, it may be advisable to increase the number of links of each elementary circuit in the form of cables or overhead lines. This is known as "multiplexing" and enables several simultaneous communications to be transmitted using phantom circuits and analogue or digital transmission systems.

To avoid interference from electrified lines, it is recommended that cables should be used.

**2.1.1** - The maximum length and the average length of omnibus circuits differ on the various Railway Undertakings (RU). They depend on the geographical extension of the RU, on the density of the rail centres situated along a line, on the average density of the traffic, and on the transmission characteristics of the circuit used.

**2.1.2** - The number of points to be connected depends on the nature of the omnibus circuit and the operating requirements.

**2.1.3** - Sometimes, the operating requirements make it necessary to shunt-connect secondary lines with the main circuit. For the purpose of linking points with the main circuit, shunts of any length can be used. When the electrical capacity of the shunt is very great, or when safety measures are necessary because of electrical interference, it is advisable to make the connection with the main circuit by means of retransmitters with a large impedance on the main circuit side.

**2.1.4** - Consideration can be given to linking circuits on a provisional basis for operating purposes. When connecting the circuits, it is necessary to take into account the transmission characteristics and the possibility of all the points shunted being able to call each other (see point 2.3.1 - page 6).

**2.1.5** - The use of short sections of cable in overhead circuits should be avoided.

When it is not possible to avoid the use of input or intermediate cables, the impedance characteristic of the various sections must be adapted.

**2.1.6** - Omnibus circuits may be two, four or six-wire circuits, or equivalent systems (analogue or digital channels).

Generally speaking, in the case of overhead lines two-wire circuits are used; in the case of cable circuits, four or six-wire circuits can also be used.

**2.1.6.1** - The use of a two-wire circuit allows telephonic points to be connected easily; in addition, it is not necessary to provide a connecting device between four or two-wire circuits for conversations with a user of the general telephone network.

For these reasons, those railways which possess omnibus circuits with two and four wires (or even six wires) at the same time use two-wire circuits for circuits suitable for connecting to the general network.

When omnibus circuits are in the form of cables, it is recommended that coil-loaded circuits should be used. In many cases, in view of the reduced attenuation, this enables the use of line amplifiers to be dispensed with.

**2.1.6.2 -** Omnibus circuits with four wires can only be used for a conversation between two connected points on the circuit when a connecting device between the two existing electrical circuits (transmission and reception) is provided.

In order to avoid reaction effects, the connection of the coupling device is done at to the end of the circuit. For this purpose, an acoustic connection between a loudspeaker connected to the micro circuit and a microphone connected to the loudspeaker circuit, will suffice.

This permits simultaneous checking of both directions of conversation on the omnibus circuit at the connecting point. There are few cases where it is worthwhile, from an operating point of view, to allow for conversations to take place between two points connected to the same circuit, even if the equipment would permit this type of interconnection. It may even be advisable to prohibit such conversations and only to allow conversations between the points connected to the circuit on the one hand, and the control point, on the other.

For these reasons, those railways with four-wire omnibus circuits often use this system for electric traction warning circuits and for controlling traction sub-stations, in view of the fact that such circuits must necessarily give access to a responsible person. In the case of four-wire omnibus circuits, calls are made using two wires over the combined circuit of the quad. The system of using alternating current for calling sometimes permits the use of simple transformers and thus allows for total sectioning of the cable (combining circuits and combined circuits) from place to place; this kind of sectioning is essential in the case of high voltage electrification using industrial current, to maintain the induced longitudinal voltages in the cable at an acceptable value.

**2.1.6.3 -** Six-wire circuits can be established in two ways:

1. A two-wire main circuit coil-loaded and amplified by two-wire repeaters runs the whole length of the line and is supplemented by a four-wire auxiliary distribution circuit with larger non-coil-loaded conductors; this circuit serves the points in advance and in rear of each repeater station up to a point half way from the adjacent stations; at the repeater station, both pairs are shunted to the main circuit by the insertion of a four-wire repeater and a four-wire/two-wire isolating transformer. The telephone of the person in charge of the line is connected to the end of the two-wire main circuit.

Calls are made via the combined circuit of the quad of the distribution circuit, as in the case of four-wire circuits.

2. A main four-wire conversation circuit coil-loaded and equipped with four-wire repeaters; this circuit is supplemented by a separate two-wire call circuit which is not coil-loaded. In the case of more recent installations, it has often been found that four-wire circuits are preferable to six-wire circuits, since four-wire circuits of good design give better functioning stability.

### **2.1.7 - Concentration turnouts**

These concentration turnouts are useful when, in the case of light traffic, it is possible to disconnect certain circuits from the desk in question and to connect them to the desk of another controller at the same centre.