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No. 23

GENERAL SPECIFICATIONS FOR APPLICATION OF AUTOMATIC SWITCHING IN TELEPHONE SYSTEMS

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Paris CAHIERS DES CHARGES GENERALES D'EXPLOITATION DES AUTOCOMMUTATEURS TELEPHONIQUES in French 1968-1969 pp 85-149

[Chapters 5 and 6 and three annexes of a document published in French by the Ministry of Posts and Telecommunications]

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CONTENTS (Continued) Page

CHAPTER 5: THE FRENCH NATIONAL FOUR-WIRE SWITCHING TRANSIT CENTER

[Text] This type of center has an automatic switcher system using four-wire connections and switching, junction circuits, local (automatic) circuits, automatic and semi-automatic long-distance circuits, and possibly junctions with an automatic international center.

The four-wire automatic switcher may be used either in a CTR [Regional Transit Center] or in an ordinary CT [Transit Center].

The various links made possible by the four-wire automatic switcher are indicated in the following table.

The lower-case reference letters on this table give special features of routing and have the following meanings:

a. Communications sent to CG [Group Centers] received by an entirely automatic channel, either with a regional or a national numbering system.

b. Only communications sent to CG accessible only from the Group Center are routed via the CT4.

c. Calls that require the intervention of a distant operator are sent by using either of these formulas: PQ 9111, or ABPQ 91-11.

d. Only communications destined for local centers accessible only from the local center are sent via the CT4.

e. The CG called are reached either directly by the CT4, or in transit via the CT2 (French national two-wire transit switching center).

f. The local center calling served by an automatic switcher of the intermediate center type may call directly by the CT2 any CG served by the CT2.

g. Automatic local centers called are reached either directly by the CT4 or in transit by the CT2.

h. Links used when there is a CI [International Center] associated with the CT4 for routing calls destined for international circuits accessible from this CI. Other international calls are routed by national circuits to a CI which is the head of the line via the CT4 associated with this CI.

i. Entirely automated connections and those which do not require the intervention of a foreign operator on the line are open only to subscribers.

j. If there is no associated CI, automatic international calls are routed to a distant CI, using both regional and national automatic long-distance circuits.

k. The local center calling served by an automatic switcher of the intermediate center type may call any urban or suburban center directly by the CT2.

l. Calls destined for B operators of a distant transit center. These calls are made by the operator originating the call using the number AB18.

m. Communications for subscribers of the CT4 group operated manually or in a rural automatic system (calls made by subscribers or by distant operators using the numbers PQ 9111 or AB PQ 9111).

n. These operators are only called by distant operators, who call a 4-digit number in this form: AB 18. This method is used to route communications for manual or rural subscribers of the CTR area. Communications towards e and f may be routed on the same beam upon leaving the CT4.

o. Calls for international operators in a distant international center.

p. Calls for international operators are made by the local operators originating the call using the number AB 17.

q. Communications for CG accessible either only from the CG, or from the CT2, and during overloads of the CT2 are routed by the CT4.

r. Routing used in originating calls from the CG which do not have access to CT4 and by CG which have access to CT2 or to CT4.

ROUTING TABLE

ENTRÉES / SORTIES	Sorties									
	a Ccts départ inter autom. Rx et Nx	*b* Ccts locaux auto (rac. au C.T.4)	*c* Jonctions vers le C.I. associé (pour centres locaux)	*d* Lignes vers centres et suburbaines du C.T.4	*e* Opérations de l'interurbain manuel associé au C.T.2	*f* Opérations B de l'interurbain manuel associé au C.T.2	*g* Opérations internationales dn C.I. associé au C.T.4	*h* Jonctions vers C.I. associé (pour C. G. de la Z.R.)	*i* Jonctions vers C.I. associé (pour C.T.R.)	*j* Jonctions vers C.T.2
1 / 1b	2	3	4	5	6	7	8	9	10	11
A. — Lignes auxiliaires en provenance des centres urbains et suburbaines pour trafic régional et national automatique.	A.a (*a*) (*b*) (*c*)	A.b (*b*)								
B. — Ccts en provenance des centres locaux automatiques du groupement (raccordés au C.T.4).	B.a (*a*) (*c*) (*e*) (*f*) (*j*) (*i*)	B.b (*f*) (*g*)	B.c (*h*) (*i*)	B.d (*k*)						B.j (e) (g)
C. — Ccts arrivée interurbains automatiques en provenance des C. G. de la zone régionale,	C.a (*a*) (*c*) (*e*) (*l*) (*o*) (*p*)	C.*b* (*g*)		C.d	C.e (*m*)	C.f (*n*)	C.g (*p*)	C.h		C.j (e) (g)
D. — Ccts arrivée interurbains automatiques en provenance des C.T.R.	D.a (*a*) (*c*) (*e*) (*h*) (*o*) (p)	D.b (*g*)		D.d	D.e (*m*)	D.f (*n*)	D.g (*p*)		D.i	
E. — Jonctions en provenance du C.T.2 pour acheminement des appels en provenance des centres locaux automatiques du groupement pour trafic régional et national automatique.	E.a (*a*) (*b*) (*c*)	E.b (*d*)								
F. — Jonctions en provenance du C.T.2 pour acheminement appels en provenance des ccts interurbains automatiques et des opérations de l'interurbain manuel (L.A.C., chaîne régionale).	F.a (*a*) (*q*) (*r*) (*c*) (*l*) (*o*) (*p*)	F.b (*d*)								
G. Jonctions en provenance de l'interurbain manuel (L.A.C., chaîne nationale).	C.a (*a*) (*b*) (*c*) (*l*) (*j*) (*o*) (*p*)									
H. Jonctions en provenance du C.I.	H.a (*a*)	H.b (*g*)		H.d						
I. Lignes auxiliaires en provenance centres urbains et suburbaines pour trafic international.	I.a (*i*) (j) (*s*)									
J. — Jonctions en provenance du C.T.2 pour acheminement appels en provenance des centres locaux automatiques du groupement pour trafic international automatique.	J.a (*i*) (j) (*a*)									
K. — Lignes d'appel au clavier des opératrices du centre manuel associé au C.T.4.	K.a	K.b	K.c							K.j

s. If there is an associated CI, calls are routed to this center without going through the CT4.

Key for Routing Table:

1. Incoming
1b. Outgoing
2. International automatic originating communications Rx and Nx
3. Local automatic communications (connected to CT4)
4. Junctions to associated CI (for local centers)
5. Lines to centers and suburban centers of CT4
6. Operations of manual long-distance system associated with CT2
7. B operations of manual long-distance system associated with CT2
8. International operations in CT associated with CT4
9. Junctions to associated CI (for CG of the ZR /Regional Zone/
10. Junctions to associated CI (for CTR)
11. Junctions to CT2

A. Auxiliary lines from urban and suburban centers for regional and national automatic traffic
B. Communications from automatic local group centers (connected to CT4)
C. Incoming long distance automatic communications from CG of the regional zone.
D. Incoming long-distance automatic communications from the CTR
E. Junctions from the CT2 for routing calls from automatic local group centers for regional and national automatic traffic.
F. Junctions from the CT2 for routing calls from long-distance automatic communications and operations of the manual long-distance system (LAC, regional link)
G. Junctions from the manual long-distance system (LAC, national link)
H. Junctions from the CI
I. Auxiliary lines from urban and suburban centers for international traffic
J. Junctions from the CT2 for routing calls from automatic local group centers for international automatic traffic
K. "Keyboard" call lines for operators of manual centers associated with CT4

5.1. Transmission Conditions

5.11. Auxiliary lines. Junctions and Circuits.

All auxiliary lines, junctions, and circuits switched in a four-wire transit center or in an international center have a four-wire arrangement in the switcher.

When a circuit goes through the transmission station, the four conversation wires are extended to the station. To these four wires must be added the signaling wires listed later in the general description of the equipment.

The auxiliary lines, the junctions with the two-wire transit center, and generally speaking, all circuits which do not go through the transmission station end in the junctor assigned to them in the switcher (outgoing junctor or incoming junctor). Therefore, they go in two wires (for conversation) to the input dispatcher of this switcher. To these two wires may possibly be added the signaling wires described later in the general equipment description.

5.12. Transmission plan

Figures 1, 2, and 3 show the diagram of a two-wire circuit leading to a two-wire switching center, a four-wire circuit leading to a two-wire switching center, and a four-wire circuit leading to a four-wire switching center.

These circuits are regulated as indicated in figures 4 and 5.

The end of a circuit brings about an attenuation of 0.2 N: 0.4 N of the terminator minus 0.2 N from the attenuation line which is erased. The equivalent in terminal service of all amplified circuits connected with a CT4 is therefore 0.45 N.

If one joins end to end n circuits, the equivalent of the link is given by this relation:

$$0.2\ N + 0.05\ N \times n + 0.2\ N.$$

This implies the following switching rules:

a. When an amplified circuit is "ended" at a four-wire transit center, the attenuation lines of 0.2 N are erased in the junctor (figures 6 and 7);

b. When two amplified circuits are placed end to end, the attenuation lines of 0.2 N remain on the link in the junctors of the two circuits (figures 8 and 9).

5.13. Conversation circuit

The situation of the conversation circuit, no matter what the type of link established (in the CT4) is shown in figure 13.

In each junctor, a mid-point coil is placed between the two wires of the same channel. Its natural inductance is greater than 50 H and its resistance is less than 800 Ω.

The appropriate circuits thus formed are used to transmit signaling.

5.14. Link stability before conversation

In the case of a link between an amplified circuit and an auxiliary line or a non-amplified circuit, an attenuation line of 0.4 N will be placed in the two-wire part of the connection each time that there is a terminator in the office when the attenuation of the junction is less than 6 decinepers.

This attenuation line will be erased upon reception of the response signal.

If the attenuation of the junctor is above 6 ds, straps will be used to permanently eliminate the cell; "switching will become ineffective when the subscriber called answers."

5.2. Equipment

5.21. Incoming Junctors

5.211. Categories of incoming junctors

Depending on the conditions in which their communications are to be routed, the incoming junctors are served either by the originating registers or by incoming registers. The role of each of these registers is explained later.

In addition to the routing conditions derived from their service by one or another type of register, each incoming junctor may be assigned a category stating its conditions of operation, which enables the traffic observation equipment, whose role is described later, to analyze the traffic based on its origin.

Category allocation is done on a group of spindles associated with each incoming junctor.

The categories of incoming junctors now used are the following:

Junctors serviced by originating registers.

Eight categories are specified; the following are those now used:

a. Auxiliary signaling line in use in local networks
b. Auxiliary MF SOCOTEL code line with charge retransmission
c. Junction from the connection line of the SRCT automatic switchers to the group with charge retransmission

d. Junction from the CT2 without charge retransmission
e. Auxiliary MF SOCOTEL code line with automatic recording of communications
f. Switchboard call line of the manual long-distance system associated with a CT2; national line call

Junctors served by incoming registers

Nine categories are listed; the ones now in use are the following:

a. Automatic long-distance circuit using the pulse and decimal code system described in ANNEX IV, coming from a CG of the regional transit zone of the CT4
b. Automatic long-distance circuit using the pulse and decimal code system described in ANNEX IV coming from a group center outside the regional transit zone
c. Group circuit using the pulse and decimal code system described in Annex IV
d. Group circuit using the MF SOCOTEL multifrequency system described in Annex III
e. Automatic long-distance circuit, MF SOCOTEL code coming from a CG of the regional transit zone of the CT4
f. Automatic long-distance circuit, MF SOCOTEL code, coming from a CG outside the regional transit zone
g. Switchboard call line for operators of the manual center associated with the CT4 (urban, regional, national communications)
h. Inputs of the associated international center.

5.212. Incoming junctors served by originating registers

5.2121. Incoming junctors of urban and suburban signaling automatic switchers in use in the local network (line A of table).

Communications sent on these junctors are charged by the CT4. The register transmits the charge rate to the junctor. The junctor can receive nine different indications of charge rates (seven rate levels sent by periodic pulse, charge 1 not repeated, no charge). It counts the time and sends charge pulses to the junction. These pulses are relayed in the originating junctor of the automatic switcher.

Junctions between the urban or suburban automatic switcher and the CT4 are three-wire junctions. The third wire is used for

retransmission of charge pulses. The maximum resistance of each wire between dispatchers must not exceed 500 Ω.

5.2122. Incoming junctors of urban and suburban automatic switchers using MF SOCOTEL signalling with retransmission of charges (line A of table).

Communications sent on these junctors are charged by the CT4. The register transmits the charge rate to the junctor. The junctor can receive nine different indications of charge rates (seven of IP rates, 1 charge not repeated, no charge). It counts the time and sends charge pulses to the junction. These pulses are relayed in the originating junctor of the urban automatic switcher.

The junctions between the urban or suburban automatic switcher and the CT4 are three-wire junctions. The third wire is used for retransmission of charge pulses. The maximum resistance of each wire between dispatchers must not exceed 500 Ω.

When the automatic recording of communications system is in service, these junctors -- which may supply data needed for such recording -- will be used to establish communications requested by the subscriber with a meter at home. At the same time communications will be automatically recorded and charges will be retransmitted.

5.2123. Incoming junctors of urban and suburban automatic switchers, using MF SOCOTEL code without long-distance charges (line A of table).

Note: These junctors will only be used when the automatic recording of communications feature is in service.

5.2124. Incoming junctors of automatic local group centers connected to CT4 (line B of table).

These junctors will have the same operating properties as their counterparts used in two-wire automatic switchers.

5.2125. Incoming junctors of the line connecting automatic switchers of the CT2 group (line E of table).

The junctors used in junctions from this line are identical to the incoming junctors used in urban and suburban automatic switchers in use in the local network.

5.2126. Incoming junctors of CT2-CT4 links (line F of table).

Links between CT2 and CT4 are three-wire links. The third wire is used for retransmission of supervision.

The maximum resistance of each wire between dispatchers must not exceed 500 Ω.

5.2127. Incoming junctors for switchboard call line, national line, of the manual long-distance system associated with CT2, national positions (line G of table).

These are three-wire links. The third wire is used for retransmission of supervision.

The maximum resistance of each wire between dispatchers must not exceed 500 Ω.

5.213. Incoming junctors served by incoming registers.

5.2131. Incomiing junctors of automatic long-distance circuits (lines C and D of table).

All these circuits come from the amplification center. Each link has six wires:

a. two wires for sending
b. two wires for return
c. two signaling wires (RON and TRON)

The junctors may be used to equip the circuits operated either in decimal numbered code or in MF SOCOTEL code.

The maximum resistance of each wire between the dispatcher of the amplification center and the dispatcher of the CT4 must not exceed 300 Ω.

"In all cases in which a communication is established, the acceptable intensity on the RON wire (reception) must be less than 50 mA, no matter what the receiving equipment used. All reasonable precautions must be taken to protect the control contact of the amplification center (varistor or spark arrester in a parallel arrangement on the receiving relay)."

5.2132. Junctors for switchboard call lines for operators of the manual center associated with CT4 (line K of table).

5.2133. Incoming junctors of the associated international center. (8/5 intermediate junctor) (line H of table).

The role of these junctors is to provide a link between the switching line of the international center which is an eight-wire line and the CT4, which is a five-wire line.

5.22. Conversation Line.

The conversation line of the CT4 is a 5-wire line. Four wires are used for the two conversation channels, and by appropriation, for transmission of supervision. The fifth wire is the test wire used for maintenance of selectors and for identification.

5.23. Registers.

Two types of registers are or may be used in the CT4:

a. Originating register
b. Incoming and transit register

5.231. Outgoing (or originating) register

5.2311. General remarks

This register handles the communications shown on lines A, E, F, and G of the table.

These communications are then routed to regional or national long-distance circuits, or to local circuits (lines a and b of table).

The incoming junctions may be operated either in a decimal code or in the MF SOCOTEL code.

For routing all communications, the originating register operates in tandem, no matter what the nature of the incoming junction (decimal or MF SOCOTEL code). This arrangement enables all routing information to be centralized at the CT4. The urban or suburban center handles unauthorized routings requested by limited service subscribers.

This register may control charging on some junctions.

If the need should arise, it may control overload traffic.

5.2312. Categories of Incoming Junctors

The originating register can discriminate nine categories of incoming junctors (cf. 211). These categories also indicate to the originating register if the automatic recording feature should be used.

5.2313. Digit reception

Decimal code

For regional communications, the register receives the six digits of the regional number from the urban center.

For national communications, the register receives from the urban center the indicator 16 or a series of 12 pulses. It sends the second tone to the subscriber and registers the eight figures of the national number.

For a communication to be sent to special services, it can register a number with two digits (1Q) or four digits (1 QMC or AB1 Q). In the latter case (AB1 Q), the number is preceded by the prefix 16 or by a series of 12 pulses.

MF SOCOTEL code

For a regional communication, the register receives from the urban center the six digits of the regional number preceded by the access code.

For a national communication, the register sends to the urban center the signal A1 (send the access signal and the first two or four digits). In return it receives the A5 signal (two-digit call), followed by the indicator 16 (1 + 6). It sends the A3 signal (passage to code B) followed by the B1 signal (number called free with charge) in order to permit the release of the urban register. The originating register sends the second tone. Pulses are received in decimal code.

5.2314. Call to translator

The register is equipped to transmit to the translator:

a. 2, 3, 4, or 5 digits. The first connection may take place after reception of the first two digits. If the first two digits are not enough to identify the routing conditions of the call (attraction of path relays), the translator asks the

register to make a new connection after reception of the third, the fourth, or the fifth digit. If the number of digits is still inadequate, the translator indicates to the register that a third connection must be made after the fourth or fifth digit.

The translator may then be contacted again as the need arises during routing the call, in the following conditions:

b. Six categories concerning the origin of the call (circuit of the auxiliary line or group, circuit outside the group, incorrect call, operator, incomplete number, available);

c. Two indications concerning the routing of the call (routing on a normal channel, routing on overload channel);

d. Two indications concerning the number received (regional number, national number);

e. Possibly indications concerning selection phases.

5.2315. Internal selections

a. Normal procedure

The translator transmits the code marking the address called and, to the register, information on the possibility of using an overload for the register.

The process may begin again for a second selection. It leads to a second contact of translator to receive the marking code for the second selection.

Then the register receives the category indication of the outgoing junctor:

link with local network
no later selection
interautomatic SOCOTEL multifrequency code
SOCOTEL urban multifrequency code
interautomatic decimal code
decimal selection last three digits (CDU)
three possibilities

b. Overload

Overload by marker

The selection is first made in a first beam. If it does not get through within a period of time determined by the operation

of a relay, it is moved to a second beam. The first beam may be formed of individual junctions and the second beam of common junctions.

In case of overload by marker, no modification is made in the program communicated by the translator to the register.

Overload by register

This overload occasions a new consultation of the translator. The program of the register may be modified: for example, it is possible to pass from sending back six digits to sending back eight digits and to order the sending of the access code "channel diverted."

c. Outgoing Selections

Depending on the category of the outgoing junctor, the register uses either an auxiliary decimal code or an auxiliary MF SOCOTEL code.

Auxiliary Decimal Code

At the first consultation of the translator (upon reception of a sufficient number of digits), the register is informed:

Of the possible sending of a translated prefix. In this case, all or part of the digits of the number received are sent back, which may or may not be preceded by a series of more than 10 pulses;

Of the possible sending of the series of over 10 pulses which immediately precedes the sending of the digits of the number (entirely or partially);

Of digits of the number to be sent. Upon receipt of a national number, the following may be sent back:

ABPQMCDU
or BPQMCDU
or PQMCDU
or MCDU
or DU
or U

Upon reception of a regional number, the following may be sent back:

PQMCDU
or QMCDU
or MCDU
or DU
or U

After the last internal selection, the register takes the auxiliary and communicates to it:

Possibly the indication of the series of 10 pulses to be sent;

The number of digits of the number received to be sent.

When the auxiliary is taken, and if there are translated digits to be sent back, the register uses the translator. The translator communicates to the auxiliary in a unit the translated digits to be sent; there may be 1, 2, or 3 digits. This arrangement makes it possible to send back a national number upon reception of a regional number.

The digits of the number received which are to be sent may be transmitted one by one by the register to the auxiliary; the transmission of one digit is done during transmission of the preceding digit.

Auxiliary Multifrequency Code

The operations take place according to the procedure established by the SOCOTEL multifrequency code.

d. End of selection

The end of selection signal (decimal code) or the status of number called (multifrequency code) is received by the auxiliary (decimal or MF) and is retransmitted immediately to the register.

IF the subscriber called is busy, the register is disconnected after releasing the originating line.

If the subscriber called is free, the register notifies the originating junctor to enable it to receive the response signal, then it disconnects.

In case of reception of a busy signal (MF SOCOTEL code) it is possible, using a variable connection, to resort to one of the following two procedures:

Sending back of busy signal;
Attempt to use overload channel (but in this case, the same call will be indicated twice as "routed" by the traffic obsservation device.

e. Transmission of Charge indication

After reception of the end of selection signal, the register uses the translator to give the incoming junction the rate to be charged for the communication.

The translator may indicate ten different rates, including charge 1 without time limitation.

The reception of the end of selection signal (number called without charge) does not entail the "transmission of charge indication" operation.

f. Incidents

Non-reception of request to transmit signal
Automatic Long-Distance Operation

If the request to transmit signal is not received within a period of time set by a time delay device (10 s cam of the decimal auxiliary, delayed relay about 5 s of the multifrequency auxiliary), the register so informs the originating junctor, which passes into "half-fault." It may use the observation device (order to call or not by special locator button) and makes a new attempt at selection, for which all the operations are repeated from their start.

If the same phenomenon occurs during the second attempt, the originating junctor receives the signal of passage into "half-fault" and the register sends back the busy signal without observation.

Incorrect call -- incomplete number

If the number does not get through after connection of the register within a period of time set by a 10 s timing device, the register uses the translator to route the call, using the instructions given (call back busy, call back on film or call operator).

Level not used

The call may either be sent back busy, or sent back to a special junctor.

Non-completion of internal selection

In the case of non-completion because of internal occupation, the register, after a period of approximately 5 seconds, uses the recording device, then makes a new attempt at selection, for which all the selection operations are repeated from the start.

If the same thing occurs again, the call is sent back busy without using the recording device.

Non-reception of end of selection signal

If the end of selection signal is not received within a period of 2 to 4 minutes (set by cams) after transmission of the last digit, the decimal auxiliary gives the "busy" signal to the register; the MF SOCOTEL auxiliary gives the "congestion" signal.

/Tr Note: Most of page 95 illegible/

5.2325. Internal selection

Cf. Originating register

5.2326. Outgoing selections

Cf. Originating register

5.2327. End of selection

The originating circuit is operated in decimal code.

Whatever the code used on the incoming circuit, the end of selection signal is received by the decimal auxiliary and the communication is routed on an automatic long-distance circuit or by the originating junctor if the communication is routed on an auxiliary line or junction to the CT2. It is retransmitted to the originating register by the originating junctor or by the auxiliary.

If the incoming circuit is operated in decimal code, the end of selection signal relayed by the incoming junctor is retransmitted by the register to the incoming circuit, after which the register and the auxiliary are disconnected.

At the present time, if the incoming circuit is operated in multifrequency code, this signal is retransmitted to the multifrequency receiver which transmits the status of the number called, "subscriber called free with charge" or "subscriber called busy" to the incoming circuit. After this, The register, the auxiliary, and the receiver are disconnected. Later the end of selection siganl "subscriber free with charge" may be sent systematically on the incoming circuit (MF SOCOTEL) as soon as the last digit is received. The busy signal may then be given by sending a tone.

The originating circuit is operated in multifrequency code.

If the incoming circuit is operated in decimal code, the status of the number called code (multifrequency code) is received by the multifrequency auxiliary which retransmits it to the register. The end of selection signal "subscriber free" or "subscriber busy," relayed by the incoming junctor is retransmitted by the register in the incoming circuit; after this the register and the auxiliary are disconnected.

If the incoming circuit is operated in multifrequency code, the register and the multifrequency register are disconnected after the last internal selection. Before this, the receiver sends the multifrequency "transit" signal or possibly "congestion" on the incoming circuit.

5.2328. Incidents

Non-reception of request to transmit signal

Automatic long-distance operation

If the request to transmit signal is not received within a period of time fixed by the timing device (10 s cams on the decimal auxiliary; delayed relay of about 5 s on the multifrequency auxiliary), the register so informs the originating junctor, which passes to a "half-fault" status, may possibly use the observation device (order to call or not by special locator button) and makes a new attempt at selection, for which all the operations are repeated from the start.

If the same phenomenon occurs on the second attempt, the originating junctor receives the "half-fault" signal and the register sends back the call as busy without observation.

Operation of Auxiliary Lines

Functioning is similar to that described above, but there is no passage to "half-fault."

Incorrect call. Number incomplete.

If the number dialed does not get through after connection of the register within a period set by the 10 s timing device, the register is disconnected without sending any signal back.

Level not used

Cf. Originating register.

Non-completion of internal selection

Cf. Originating register.

Reception of overload signal in multifrequency code

Cf. Originating register

Non-reception of end of selection signal

If, after sending the last digit, the end of selection signal is not received within a period of time set by the timing device (2 min cams) the decimal auxiliary gives the "busy" signal to the register; the MF SOCOTEL auxiliary gives the "overload" signal.

Forced Disconnection

In all cases in which the incoming and transit register sends an end of selection signal other than "number called free," it must receive the disconnect signal. A timing device (10 s cam) is used to force a disconnection without sending a signal back in case this signal might not be received.

5.233. Translator

There is planned a single type of translator usable by CT4 switching lines. However, because of different routing conditions, the originating register and the incoming register have separate access to translators used either for origination, or for incoming and transit traffic.

The general conditions of operation of the translator were given in section 23.

The equipment of a translator must include a minimum of 300 paths. A path is determined by routing and charging. Moreover, each diversion, characterized by routing and charging, requires the use of one path.

Each translator must have ten keys which can, without any change in wiring, modify the path to which each key is assigned. This modification may be made, if desired, based on the category of the incoming junctor. The operation of each key is signaled by the lighting of a lamp.

5.24. Originating Junctors

Originating junctors using decimal code signaling to automatic urban and suburban switchers (column d of table).

The auxiliary lines associated with these junctors are two-wire lines.

The maximum resistance per wire between dispatchers must not exceed 500 ohms per wire.

Originating junctors to urban and suburban automatic switchers using an MF SOCOTEL code (column d of table).

The auxiliary lines associated with these junctors are two-wire lines.

The maximum resistance per wire between dispatchers must not exceed 1,100 Ω.

Originating junctors to local group centers attached to CT4 (column b of table).

Originating junctors of automatic long-distance circuits (column a of table).

The same junctor can be used on circuits operated in both automatic long-distance code with decimal numbering and in MF SOCOTEL code. Straps are used to adapt the junctor to the code being used.

Links between the CT4 and the transmission station require seven wires:

two wires for sending
two wires for return
two signaling wires (TRON and RON)
one blocking wire

The maximum resistance per wire between the dispatcher of the station and the CT4 dispatcher must not exceed 300 ohms.

Originating junctors to CT2 (column j of table).

The auxiliary lines associated with these junctors are two-wire lines.

The maximum resistance per wire between dispatchers must not exceed 500 ohms per wire.

Originating junctor to associated international center.

These junctors are used to adapt internal signaling of the four-wire transit center (done with five wires) with the signaling used by the international center (eight wires).

Category of Originating Junctors

These categories are indicated in 5.2315 (internal selection). They are used to set the program for later operations. In a given beam, some circuits may be operated in decimal code, others in multifrequency code.

5.25. Monitoring of the Automatic System

5.251. Lamps indicating occupation of common mechanisms.

Two lamps indicating occupation are provided for the following common mechanisms, one on the supervision band, the other on the automatic system monitoring panel.

markers
marking channels (one occupation lamp per channel)
translator
register (the lamp flickers at the 500/500 rate before receiving the first digit, and burns steadily afterwards)
receiver
sender

The ignition of the occupation lamps of the monitoring panel is controled by one ignition button per group of 20 lamps.

5.252. Lamps associated with junctors

Automatic long-distance incoming junctors

One individual lamp is on the rack-monitoring band. This lamp signals that the disconnect signal did not arrive when the incoming register is disconnected, either because the lines of the beam called were busy, or because the release cams caused the register to disconnect.

One delayed alarm lamp is also provided (ignition delayed from 2 to 4 min) per frame or rack of incoming junctors, installed on the circuit monitoring panel. This lamp signals that a junctor of the frame or rack did not receive the disconnect signal when the subscriber called hung up.

It also ignites when one of the incoming junctors is occupied manually. It lights in the case when, the incoming junctor being operated in a decimal code and the communication then using a circuit operated in MF code, the junctor has received the signal "subscriber free without charge"; the person called hangs up and the disconnect signal does not get through.

Originating automatic long-distance junctor

One lamp is provided per junctor on the circuit monitoring panel; ignition occurs in the following situations:

Lamp out: junctor available

Steady burn: circuit occupied normally

250/250 flickering: junctor taken by test unit

150 (ignition)/350 flickering: junctor occupied by transmission center

500/500 flickering: junctor in half-fault position

Four buttons can be used to show each of the above ignitions for all of the circuits. These ignitions may be controled independently of each other. Moreover, light signals are on lever-operated wedges.

A button is installed above each light signal which is used to show the junctor is unavailable. If the junctor is in half-fault, depressing this button makes this situation disappear.

With each beam of circuits there is associated a pilot lamp whose delayed ignition (2 to 4 minutes) signals the non-reception of the request to transmit signal on one of the beam's circuits.

Urban originating circuits to the CT2

Each junctor is represented by a cut-off jack and a lamp on the cut-off panel. The ignition of this lamp shows the occupation of the junctor. One button per beam controls the ignition of these lamps.

Total occupation of beams

One lamp per beam signals that there remains at most 3, 2, 1, or 0 circuits available in the beam. The alert limit may be operated separately for each of the beams at one of these four values.

5.26. Counters

5.261. Traffic counters per beam

A set of counters (or several sets for large beams) is associated with each beam of circuits.

This set of counters, controled by the junctor, adds up all actual communications. Each set consists of two counters:

one totaling counter
one partial counter

Operation and shutdown of all the partial counters is controled by a single device for all the counters. In addition, operation and shutdown of each partial counter may be ordered, under the control of this device, by a device for each counter. Partial counters may be set back to zero.

5.262. Traffic counters on switching mechanisms

A portable model equipped with 40 counters with return to zero connected by flexible cord and closing relay to the mechanism connection groups makes it possible to count the number of connections on each of the following mechanisms:

registers
translators
receivers
senders
marking channels

5.263. Congestion counters

A counter is associated with each beam. It is used when the call placed can not be routed because of total occupation of the beam.

5.27. Traffic Observation

Two traffic observation devices may be used. The first employs conventional equipment; the second uses electronic equipment.

5.271. Traffic observation by conventional equipment

5.2711. Counters

See paragraph 5.26.

5.2712. Traffic analyzer.

This device may be branched either on incoming junctors (of any type) or on outgoing junctors (of any type).

Ten junctors may simultaneously be connected to the device, but only one communication may be observed at one time. When the device is free, it is connected with the first junctor on which a call appears.

The link between the ten observation lines of the device and the junctor observed is made by a jumping wire to the intermediate dispatchers.

Observations on incoming junctors

For each call the analyzer registers:

A. The time that elapses between sending of the request to transmit signal by the register and the disconnecting of the register. The time represents "dialing + selection."

B. If the end of selection "subscriber called free" signal is received, the time elapsing between the release of the register and the response of the person called. This time is the "response time."

C. When the subscriber answers, the time elapsing between reception of the response signal and hanging up by one of the two parties (disconnect signal or hangup signal of the subscriber called). This time is the "length of conversation."

In the case of call back (communication established by an operator) the conversation time after the new response is added to the preceding time and only one call is counted.

Times A, B, and C are recorded on time totalizers.

Moreover, the analysis also totals separately:

D. The number of "actual calls" (calls resulting in a charged conversation).

E. The number of "no answers" disconnected within a time less than 15 s after the end of selection.

F. The number of "no answers" disconnected within a period of time above 15 s after the end of selection.

G. The number of calls for which the end of selection signal is not received 15 s after reception of the last digit.

H. The number of calls leading to disconnection within a time under 15 s (after reception of the last digit).

I. The number of calls with disconnection during dialing phase.

J. The number of calls that can not be sent because of occupation of the circuits of the subscribers called or because of disconnection by the register (sent back in fault).

Calls in categories D through J are totaled on counting relays. When one of these counters arrives in position 10, the analyzer transmits all the data it contains (A to J) to the recording device.

Observations on Originating Junctors

The information obtained by observation of the originating junctors is identical to that obtained by observation of the incoming junctors, except for the duration of "dialing+ selection" which is then limited to the time elapsing between connection of the originating junctor and reception of the end of selection signal.

Selection of Calls

Whatever the type of junctor observed (originating or incoming junctor) and the signaling code (decimal code or MF code), the analyzer has a system for registering numbers which can be used to observe, if desired, onlythose calls destined for certain addresses characterized by the first two or four digits (AB, PQ, or ABPQ).

The series of prefixes observed are made up by mobile links made in a dispatcher.

It is possible either to observe only calls thus selected, to eliminate these calls and to keep all the others, or to make no

discrimination. The number of prefixes (AB, PQ, and ABPQ) that can thus be constructed is a minimum of 20 combinations (80 gates).

The results indicated (time and number of calls) are only calls of which a complete observation was done. However, the recording does indicate the total number of calls from which those that had a complete observation done were taken.

Manual Observation

When the analyzer is connected to incoming junctors, it is possible to make a manual observation of calls. In this case, the call observed will not be counted by the observation device. This device will only analyze the number called, possibly to reject observation of this call and to move on to the following call.

A lamp is associated with each of the ten lines observed; it ignites upon connection of the observation line and goes out upon disconnection of this line by the observation device (only one of the ten lamps giving the number of the observation line which is working with the device is lit).

The operator can use a key to maintain a discreet monitoring on a loudspeaker. There are three possible cases:

First case: intervention on a call during observation.

The call is handled by the device as in the case of recording. Nonetheless, the operator may follow the operations on a light signal for the number called and on a loudspeaker for the conversation.

The calls which follow will be observed by the operator while the manual observation key is down and will not be recorded on time totalizers or on the other call counters. There will be no recording per ten calls occurring in the operator's presence.

Second case: intervention at the start of a call.

The call will be followed by the operator and the observation device is involved only in authorizing or rejecting observation.

Third case: the operator withdraws during observation of a call.

a. If the operator intervenes when observation has already started, the device continues its automatic observation.

b. The operator was present at the start of observation. The device which has worked to analyze the number called, will not handle this call to memorize the information which could be recorded and will only do a complete observation of a call coming in after the withdrawal of the operator.

The number dialed is displayed on an eight-character light panel.

The type of number called is displayed on lamps (national, regional, or special services numbers).

If a charger is associated with the incoming junctor, the number of charge pulses for the communication observed is also displayed on a counter with return to zero.

5.272. Electronic traffic observation

This issue is discussed in paragraph 3.2.

5.273. Maintenance

5.2731. Incidents during selection

When an operation is not accomplished within the scheduled period of time, a recording device is used which indicates the various mechanisms involved in the communication and the position of their major relays.

The use of the recording device is ordered by the mechanism which observes the non-completion within the prescribed time period. This mechanism is called the "active mechanism."

The active mechanism calling is sought by the locator. When the search is completed, the active mechanism places all the common mechanisms (passive mechanisms) with which it is associated in a position connected with the recording device.

The data on the identity of the mechanisms (active and passive), their status, and the conditions requiring fault recording are recorded in a memory, then transmitted to the recording device.

The same mechanism may, if the occasion requires, either be an active or a passive mechanism.

5.2732. Test of decimal senders and registers

This device consists of incoming lines connected with the first stage of selection and one outgoing line connected with the last selection stage.

The number (six or eight digits) may be composed as desired within the limitations indicated below, by using eight manual switchers with 11 positions.

The tests are designed to check that the reception of the number (in decimal code), the exchange of internal signaling, and the transmission of selection series by decimal senders (outgoing selection) are correct.

The device is permanently linked to a vertical position for each of the selection elements.

To avoid immobilizing a regional series, a number from the series assigned to the hypsometer will be used: 771 CDU or 991 CDU; CDU may be selected at will.

The device is also permanently linked to each group of register searchers. A light indicator shows at each moment the number of the frame with which the device is working.

Calls may be sent in succession to different groups of register searchers or, on the contrary, they may be sent repeatedly to the same group.

A counter indicates the number of tests done.

5.2733. Automatic test of junctors-chargers

This automatic test device permits:

Either general testing of all junctors-chargers;
Or individual testing of a given junctor-charger.

The test affects only the "charging" function. For this, the appropriate rates for each charging level are checked (11 test cycles).

When an incident occurs during a test, it is possible to use the recording device to register the anomaly found.

At the end of recording, the test device moves to the following junctor.

5.2734. Automatic decimal call sender

This device has 10 junctors which may be linked, via the intermediate dispatcher, to 10 vertical units of selection elements, and to 10 horizontal outputs of originating register searchers.

On each line this sender may compose a number with a varying number of digits, but never over 10. On one line, the number is made up by buttons and on each of the nine others, it is done by strapps.

Calls may be sent to automatic response junctors of the center or of a distant center.

When the calls are sent to the automatic response junctors of the center, on one line which the operator selects by pushing buttons, a simulated conversation test is made, checking in turn the reception of the 450 Hertz current emitted successively on the two channels by the response channel. On the nine other lines, the test consists of checking the correct exchange of signaling up to and including the hanging up signal.

When the calls are for automatic response junctors of a distant center, the test is limited to a signaling exchange.

5.2735. Automatic response junctors

Ten automatic response junctors are assigned to local calls and two junctors per test rack are assigned to incoming calls.

The automatic response junctors assigned to local calls consist of a single beam with a three-digit number: 772 or 992, depending on the number series of the hypsometer (77 or 99).

The automatic response junctors assigned to incoming calls have six-digit numbers or eight-digit numbers in the series reserved for the hypsometer (773 CDU or 993 CDU). CDU may be selected as desired. The indicator AB, which may be added, indicates the department where the switcher is installed.

The response junctors for local calls and for incoming calls give the response signal, in conversation position emit a permanent tone at 450 Hertz for 20 to 40 seconds, and give the hangup signal of the person called.

5.2736. Test and maintenance of automatic long-distance circuits from the test unit

Rapid and systematic transmission tests.

These tests are only for originating junctors. Their purpose is to check:

That the exchange of line signals is correct;
That the circuit's transmission qualities are acceptable for conversation and, in the multifrequency signaling system, for the exchange of code and numbering signals.

A light indicator placed on the test unit shows at each moment the number of the junctor to which the unit is connected.

On circuits operated in decimal code, the hypsometer has a three-digit number (777 or 999). On circuits operated in MF code, the hypsometer has a four-digit number (7799 or 9989), preceded by the regional access code, A1.

Manual tests of originating junctors

These tests are to enable the originating switching center to locate the incidents signaled by the rapid and systematic transmission test device.

Manual tests of incoming junctors

These tests are to check the length of the line signals, transmission levels, and to locate incidents signaled by the originating center.

Start of service and maintenance of originating circuits

These operations are done from the originating office on signaling circuits by RON and TRON wires (outside signaler). They are used for adjustment and control of the circuit signalers.

Distortion tests (decimal numbering only)

These tests are to check the behavior of the retransmission mechanisms from the point of view of the restoration of the numbering signal.

These tests may be done:

Either on the originating or incoming junctor;
Or at any point of the circuit with calibrated transmission at origination: signaler of an intermediate station, incoming junctor of a distant center (case of a complete link).

Additional tests

In addition to the measurements indicated above, the test unit can also perform dc measurements normally done from a test table.

5.2737. Test using AAMT /Automatic Transmission Measurement Equipment/

This test is done between two terminal transmission stations, via the two switching centers.

In origination, access to the junctor is provided by the mechanism seeker.

When the mechanism seeker is engaged, it is shown as busy for the test unit. All the junctors to which it provides access, therefore, can not be returned to this unit.

After sending each junctor to the AAMT, the test unit has priority for connection and return of a junctor. The junctor is returned by a relay, which releases the mechanism seeker of the AAMT.

Upon arrival, the access to the AAMT is provided by a junctor behind the selection of the incoming group.

The incoming AAMT is called by the originating AAMT using a four-digit number (no matter what the code used on the circuit (9988 or 7798).

In multifrequency signaling, the number is preceded by the regional access code, A1.

For a more detailed description of maintenance on long-distance circuits, refer to the SOCOTEL specification: "Specifications concerning Maintenance of Long-distance Automatic Circuits of the French Telephone Network."

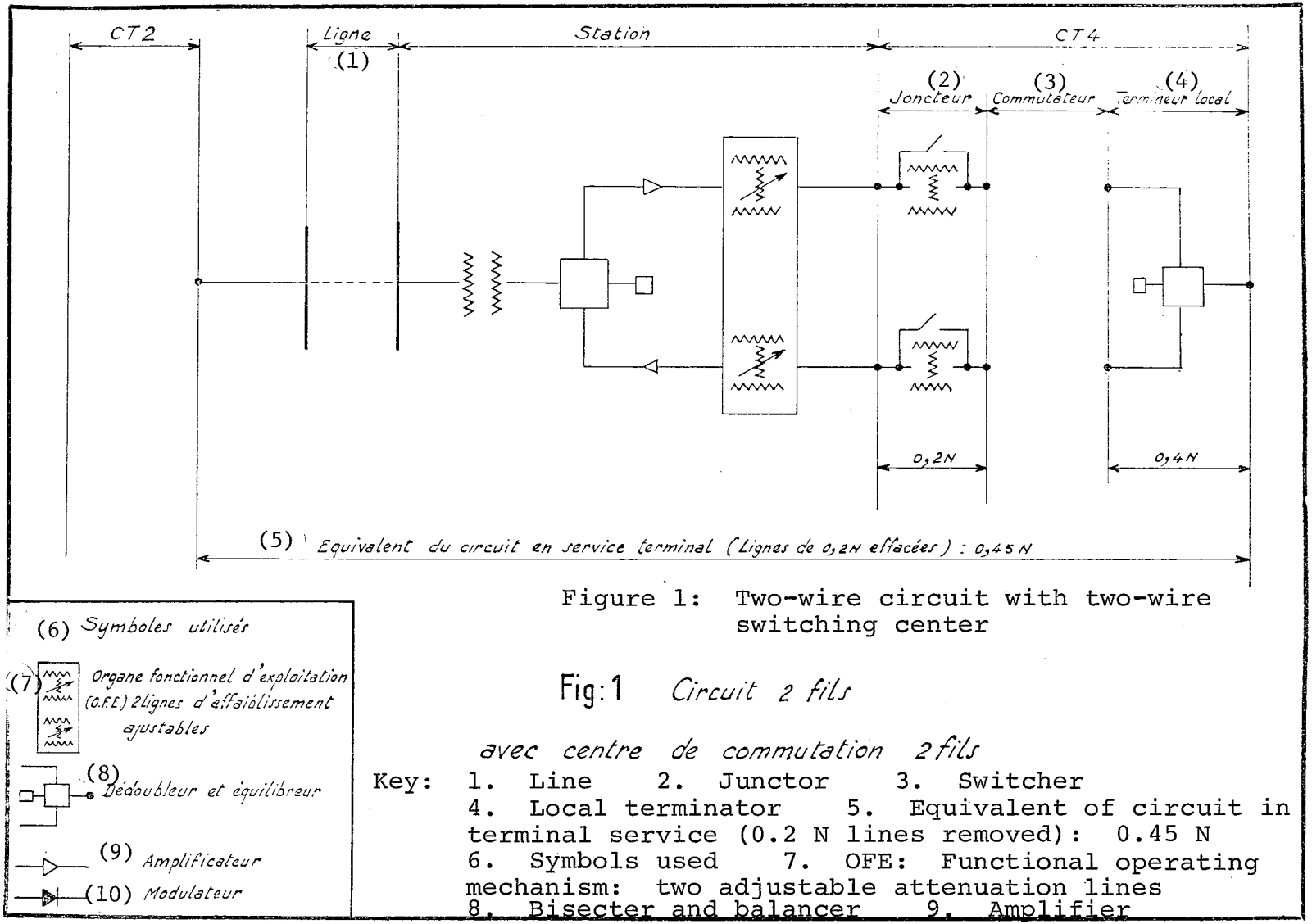


Figure 1: Two-wire circuit with two-wire switching center

Fig:1 *Circuit 2 fils*

avec centre de commutation 2 fils

Key: 1. Line 2. Junctor 3. Switcher
4. Local terminator 5. Equivalent of circuit in terminal service (0.2 N lines removed): 0.45 N
6. Symbols used 7. OFE: Functional operating mechanism: two adjustable attenuation lines
8. Bisecter and balancer 9. Amplifier
10. Modulator

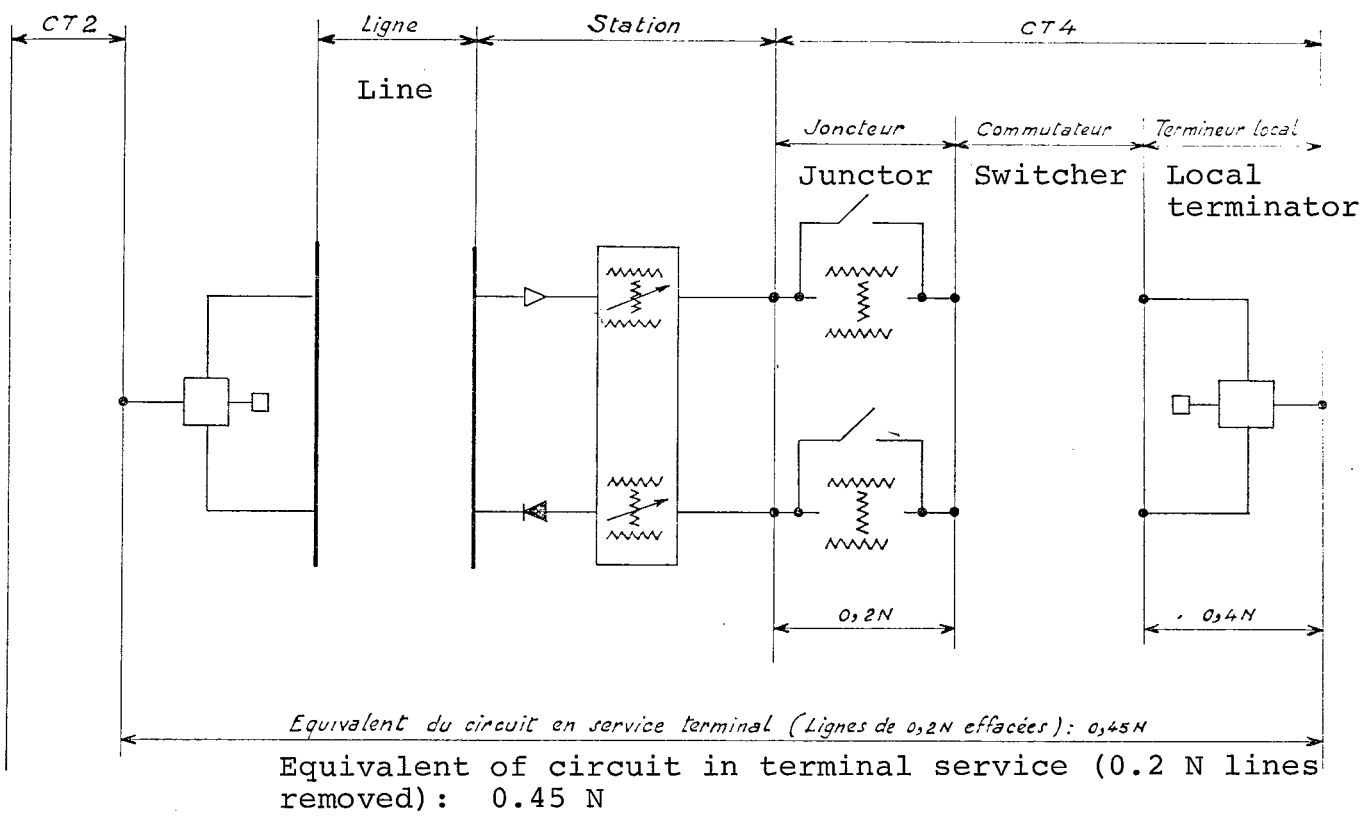
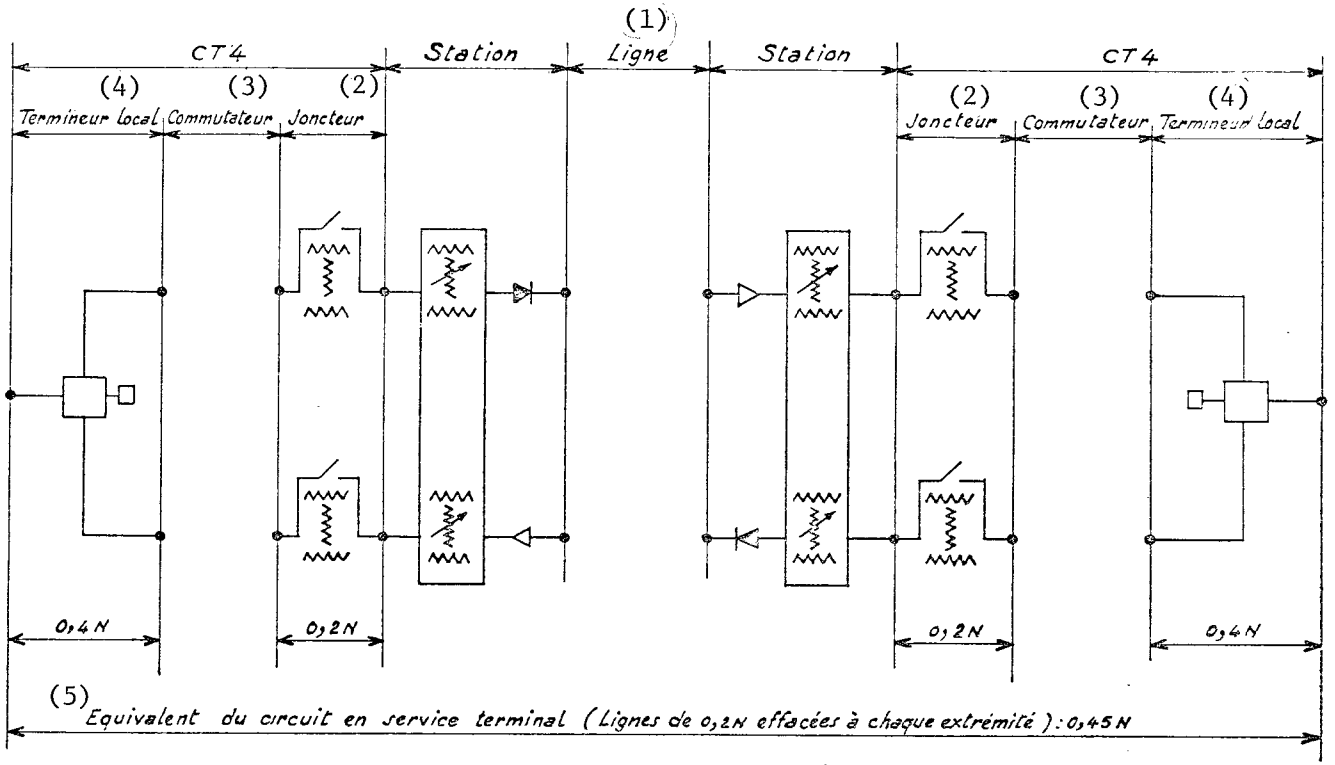


Fig: 2 *Circuit 4 fils avec centre de commutation 2 fils*

Figure 2: Four-wire circuit with two-wire switching center

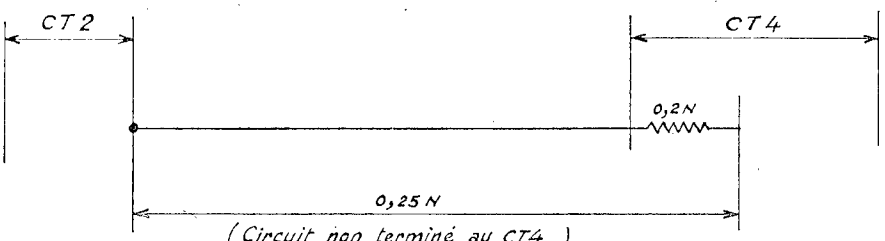


Key:

1. Line
2. Junctor
3. Switcher
4. Local terminator
5. Equivalent of circuit in terminal service (0.2 N lines removed at each end): 0.45 N

Fig. 3 *Circuit 4 fils reliant 2 centres de commutation "4 fils"*

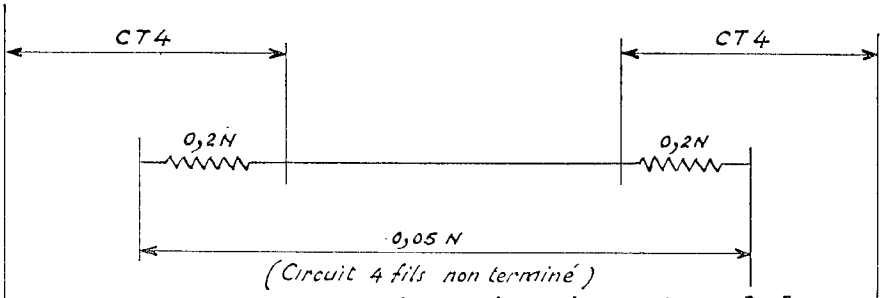
Figure 3: Four-wire circuit linking two four-wire switching centers



Circuit not ended at CT4

Fig:4 *Circuit 2 fils ou 4 fils avec centre de commutation "2 fils"*

Figure 4: Two-wire or four-wire circuit with two-wire switching center



Four-wire circuit not ended

Fig:5 *Circuit 4 fils avec centre de commutation "4 fils"*

Figure 5: Four-wire circuit with four-wire switching center

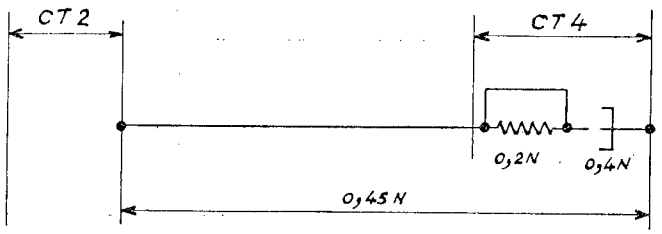


Fig: 6 *Circuit amplifié avec C.T.2 "terminé" au C.T.4*

Figure 6: Amplified circuit with CT2 "ended" at CT4

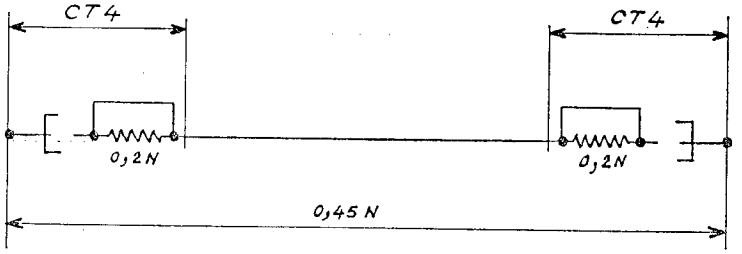


Fig: 7 *Circuit amplifié entre deux C.T.4 "terminé" dans les deux C.T.4*

Figure 7: Amplified circuit between two CT4 "ended" in the two CT4

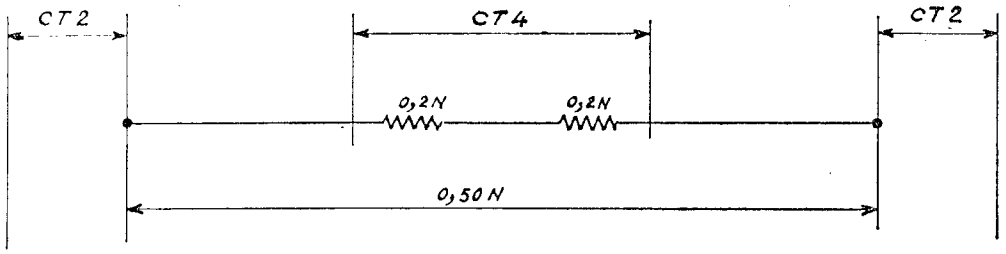


Fig: 8 *Commutation au C.T.4 de deux circuits avec deux C.T.2*

Figure 8: Switching of two circuits with two CT2 at the CT4

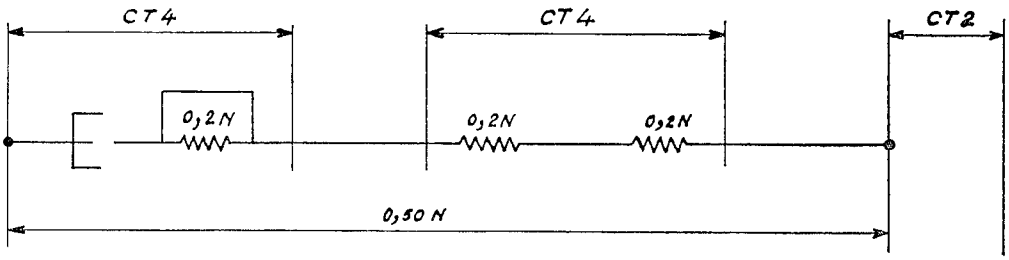


Fig: 9 *Commutation au C.T.4 d'un circuit avec C.T.4 et d'un circuit avec C.T.2*

Figure 9: Switching of one circuit with CT4 and one circuit with CT4 at the CT2

CHAPTER 6: THE INTERNATIONAL CENTER

6.1. Definitions

6.11. International Center.

An international center is a center placed at one end of an international telephone circuit.

International centers must be considered:

a. From the point of view of switching facilities: automatic international center, or manual international center.

b. From the point of view of routing on the French network: general traffic international center, limited traffic international center, vicinity international center.

6.12. CIA /Automatic International Center/

This is an international center with an automatic switcher which provides:

a. For originating traffic: access to international originating circuit which is the head of the line and to a circuit of specialized beams which provides a link with other automatic international centers of the French network.

b. For incoming traffic: routing of all traffic coming from beams of international circuits for which it is the head of the line and from specialized beams coming from other French automatic international centers and local international originating links.

6.13. CIM /Manual International Center/

When the intervention of an operator is required (operation of manual circuits, special communications, semi-automatic operation), a manual international center is associated with the automatic center.

For originating traffic, the operator has access to automatic international circuits for which the international center considered is the head of the line, and also to automatic international circuits accessible from a distant international center of the French network which can be reached by a beam of specialized circuits.

For incoming traffic, the operators answer code 11 and code 12 calls and calls for assistance coming in on beams for which the associated CIA is the international head of the line.

Operators of the manual international center also handle manual international circuits for which this center is the international head of the line.

In this document, we will use the term "international operator" to mean an operator who handles an international circuit; "national operator" will refer to all other operators of the French network.

6.14. International center for general traffic

An international center is called a general traffic center for a given direction when the beam of circuits it handles in this direction is a beam of normal circuits (beam of circuits with low loss probability) or, in the case of a beam of transversal circuits, when an overload can only be handled by a foreign international center.

6.15. International center for limited traffic

An international center is called a limited traffic center for a given direction when the beam of circuits it handles in this direction is a beam of transversal circuits (beams of high efficiency circuits with the possibility of overload on another French international center).

6.16. International vicinity center

An international center is called a vicinity center for a given direction when the beam of circuits it handles in this direction routes only traffic for the vicinity.

A single international center may, therefore, depending on the international relation being considered, be a general traffic center, a limited traffic center, or a vicinity center. For example, Lyon is a general traffic international center in its relations with Germany, and a limited traffic international center in its relations with Belgium. Nice is a vicinity international center for the Nice-San Remo link and a limited traffic international center for the Nice-Milan relation.

6.17. CLI /Local International Originating Link/

This is a link which enables the automatic subscriber of a non-CIA transit center -- and even more so, the subscriber of a CTR -- and of local group centers of this center to obtain through an automatic international center an international originating communication according to the methods of operation described in 3.2.

It provides charging for the international automatic communications that it routes and, in some exceptional cases, if circumstances warrant, it directly handles international transversal or vicinity circuits.

This link also handles routing of international communications coming from the international access links that it handles.

6.18. Ch.AI /International Access Link/

This is a link which enables the automatic subscribers of a group center and of local centers of this group to obtain automatic international communications and to call international operators directly.

It does not provide charging, but it retransmits pulses coming from an automatic international center or from a local international link.

6.19. Rear zone

The rear zone of a general traffic international center consists of all the transit zones, which are in principle regional, whose international traffic for the direction considered is sent (in entirety or only overload traffic), both originating and incoming communications, by the international center being considered. The rear zones of general traffic international centers shown in an annex are defined by circular no 16 of 4 October 1963.

The rear zone of a limited traffic international center consists of the regional transit zone (or the transit zone) of the transit center with which it is associated. This definition covers originating and incoming traffic.

Table 6.20. International Center: Routing Table

Incoming \ Outgoing	p Automatic international outgoing circuits accessible directly from the international center	q Circuits of specialized beam leading to a distant international center	r Junctions to CT4	s Originating international operators 1933 xy	t Code 11 operators; code 12 operators; assistance operators
P. Auxiliary lines coming from urban and suburban centers	P.p (a)	P.q (a) (g)		P.s	
Q. Junctions from CT2 or CT4 for routing calls from local automatic group centers	Q.p (a)	Q.q (a) (g)		Q.s	
R. Junctions from CT4 for routing calls from CG of the regional transit zone	R.p (a) (b)	R.q (a) (b) (g)		R.s (b)	
S. Junctions from CT4 for routing calls from other CTR	S.p	S.q (g)			
T. Circuits of specialized beam from a distant international center	T.p (g)				
U. Incoming automatic or semi-automatic international circuits	U.p (e)	U.q (e) (g)	U.r (c)		U.t (f)
V. Operators of manual international center associated with automatic international center	V.p	V.q (g)			

An international center always coexists with a four-wire transit center. It can establish all or part of the connections indicated in the preceding table. The letters on this table show the routing features and have the following meanings:

a. Entirely automatic connections and those which do not require the intervention of a foreign operator on the line are open only to subscribers.

b. Only incoming circuits connected directly with the CT4 have access to the international automatic center.

c. Communications for urban and suburban centers, local group circuits, and regional and national long-distance automatic circuits are routed on this beam.

d. International transit.

e. These operators can only be called by foreign operators.

f. This beam is open when traffic or transmission conditions so warrant. If it does not exist, links are handled by national circuits accessible both from CT4 and from the CI leading to the distant CT4 associated with the CI which is head of the line for the direction being called.

6.2. Transmission conditions

6.21. Presentation of auxiliary lines, junctions, and circuits

Refer to paragraph 5.11.

6.22. Transmission plan

The national part of an international link creates an attenuation of 0.25 N + 0.05 N x n between the four-wire ends of the international circuit and the terminator. n represents the number of national long-distance circuits entering in the link. This attenuation is distributed as shown in figures 10 and 11.

Figure 10: The termination at the international center brings about the clearing of the 0.2 N line. It thus introduces an attenuation of 0.40 + 0.05 - 0.20 = 0.25 N.

Figure 11: The four-wire international circuit-national circuit transit lets the 0.2 N lines remain in the national circuit and introduces a 0.2 N line in the CT4-CI intermediate junctor in addition to the 0.02 N line to compensate for the 0.2 N line of the international circuit which remains cleared. The attenuation of the national part of the international link shown in figure 11 is given by the relation given previously.

In the case of the figure, n = 1 and the attenuation is 0.30 N.

For international transit (figure 12), the two 0.2 N attenuation lines associated with each international junctor are inserted in the link.

Note: In principle (and except for a situation justified by especially heavy vicinity or international traffic), only some CTR will be international centers. The other CTR and large CT and group centers which have to pass vicinity traffic will have local originating international links. The other CT and CG will have international access links.

6.23. International number

This is the set of numbers that a subscriber must dial, after the international prefix (in France, this is 19) to reach a subscriber in another country.

The international number includes, in this order:

a. The international indicator of the country being called;
b. The local number + area code being called.

The total number of digits in the international number can not be greater than 12.

The international indicator may have one, two, or three digits: 11, 12, 13.

The local number + area code (N1...Nn) is the set of numbers needed to make the selection of a subscriber called from a long-distance center in his own country.

It consists of the local number of the subscriber preceded by the long-distance indicator[1]. When the long-distance prefix[2] is published as if it were part of the long-distance indicator, the number called consists of the local number preceded by the long-distance indicator with the long-distance prefix deleted.

6.3. Operating Mode

6.31. Originating communications

6.311. Groups without access to the automatic international network

To obtain an international communication, subscribers call a national operator using the directions given them locally.

The national operator of the originating group center connects the calling subscriber with an international operator of the manual international center which is the head of the international line, or transmits the request herself (depending on instructions given at her center), either manually or by dialing a number in the format AB17 if the group center belongs to the regional transit zone of the international center.

6.312. Groups whose center has access to the automatic international center

Entirely automatic communications

The subscriber dials the international prefix (19) and then, after hearing a second tone, dials the international number of the person he is calling.

Communications requested by an automatic subscriber requiring the intervention of a French international operator.

This is the case with communications established through a manual international circuit, special communications, etc.

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1. In France the local number + area code is the eight-digit number (ABPQMCDU). The long-distance indicator in the provinces consists of the first two digits of this number (AB); in the seven-digit zone of the Paris region, it consists of the digit 1 which precedes these seven digits, and which occupies position A.
2. In France: 16. In most other countries: 0.

The subscriber first dials the international prefix (19) and then, after hearing a second tone, dials a number in the format 33 XY, or possibly 33 XYZ. The digits XY are used to direct the call to the manual international center for general traffic for the relation considered and possibly to sections of special positions within this international center. The digits XY or XYZ are analyzed at the first international center used, or in some exceptional cases, at the local international link, and the call is routed to the manual international center for general traffic for the direction considered.

The following combinations are now assigned:

Netherlands	31
Belgium	32
Spain	34
Italy	39
Switzerland	41
United Kingdom	44
West Germany	49
Luxembourg	352
North Africa	21
all other countries	19

Communications requested by a manual subscriber or by a subscriber from the rural automatic system.

The CG operator uses a call line of the national switchboard and dials a number in the format 16 or AB 17, which enables her to reach an operator of the CIM for general traffic, which is the head of the line for the direction being called.

This obligatory intervention of a CIM operator makes it possible to locate problems or settlement of accounts, languages, and operational difficulties (special communications) in these centers, and consequently, to relieve the group centers from handling these matters.

6.32. Incoming communications

6.321. Communications established without the intervention of a French international operator

The incoming automatic international center switches the call to the associated CT4. The call is then processed and routed under the same conditions as a national call.

6.322. Communications established by a French international operator

The incoming circuit is an automatic circuit.

The code 11 and code 12 operators call lines are accessible only by automatic international centers to which the incoming automatic international circuit is connected.

When there are several beams between a foreign country and France ending in several different French international centers, the foreign operators dial the appropriate number (N1) to reach the code 11 or code 12 operators of a specific French international center. In the originating country, this number makes it possible to select the beam leading to the desired French international center. Within the French network, it does not make it possible to reach an international center other than the one where the incoming call circuit ends.

The N1 numbers are the following:

Paris N1	1
Bordeaux N1	5
Lille N1	2
Lyon N1	7
Marseille N1	9
Nancy N1	3
Nice N1	0
Strasbourg N1	8

Code 12 operators can be called individually. However, at low traffic times, individual calls are indiscriminately directed to concentration positions.

The code 11 or code 12 operator can establish an incoming communication destined for any subscriber in the French network, and in an international transit center, an international transit communication.

To avoid any problem in operation, incoming calls for an individual code 12 operator will only be routed if the N1 number received is actually the correct one for the incoming head of the line center.

The incoming circuit is a manual circuit.

The French international operator has the same facilities available as a code 11 or code 12 operator enabling her to establish

an incoming communication, and in an international transit center, an international transit communication.

6.4. Routing, Signaling

This section concerns only groups (either partially or totally automated) with either an automatic international center, or a local international link, or an international access link.

6.41. The CTR is an automatic international center.

6.411. Communications requested by subscribers of the group center and of the automatic international center's group.

Upon reception of the 19 in the urban register, the call is routed directly to the automatic international center (without going through the CT4, except for S1 automatic switchers directly connected to the CT4) with which the urban, urban transit, and STCT or S1 automatic switchers have direct connections. The CIA sends the second tone and the subscriber dials the following digits in accordance with the directions given him.

If the communication is entirely automatic and is destined for a country directly accessible from this international center, the call is routed on the appropriate beam for the direction requested (with or without the possibility of overload, depending on whether or not it is a transversal beam or normal beam).

If the communication is to be established through an associated manual international center, the call is routed directly to this center (figure 1).

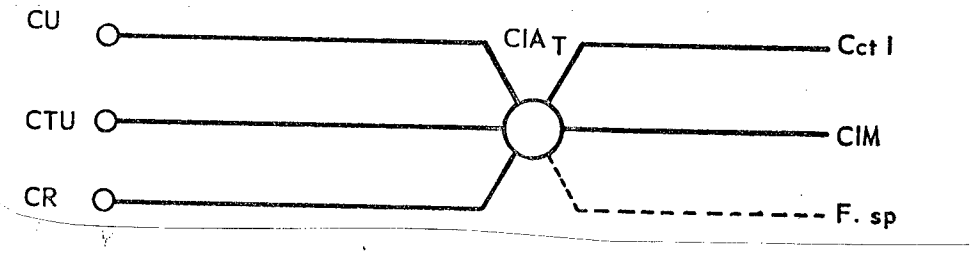


Figure 1.

Key for figures:

CU: urban automatic switcher
CTU: urban transit center
CR: connection link for automatic group switchers (SRCT, S1)
Cct I: international circuit
CIM: manual international center
F.sp.: circuit of specialized beam
CIAT: international head of the line center

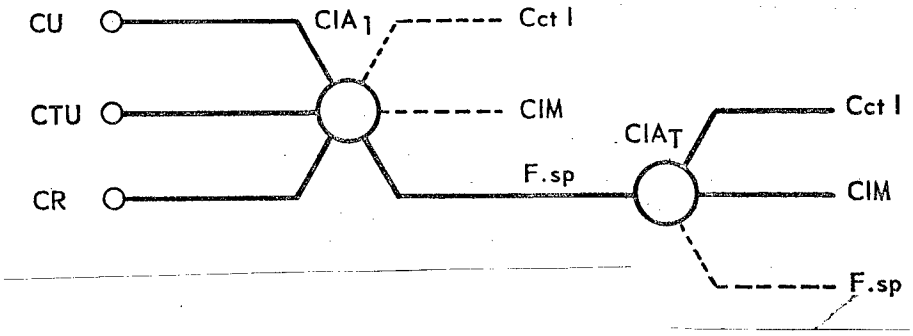


Figure 2.

If the communication is entirely automatic and is destined for a country accessible from another automatic international center (which is necessarily an automatic international center for general traffic), either in normal channels, or on overload channels, the call is routed from the originating international center on a beam of specialized circuits ending at the head of the line international center (figure 2). This beam of circuits is operated in an international code..

The beam of specialized circuits also routes communications for distant manual international centers. The call is preceded by the "transit connection" signal followed by 33 (0) XY if it is coming from a subscriber, and 33 L XY C 15 if it is coming from an operator.

6.412. Communications originating from transit centers and group centers of the regional transit zone of the CIA (excluding the CIA group center).

6.4121. The center has a CLI.

Only centers handling transit between another group center (equipped with an access link) and an international center whose amount of international traffic and whose geographic position justify it are equipped with a CLI.

Communications are routed to the CIA by a specialized beam. They are charged by the local international link.

If the communication is entirely automatic and is destined for a country accessible directly from the CIA, the call is routed on the appropriate beam for the direction requested with or without the possibility of overload, depending on whether it is a transversal beam or a normal beam. If the communication is to be established through an associated manual international center, the call is routed to this center (figure 3).

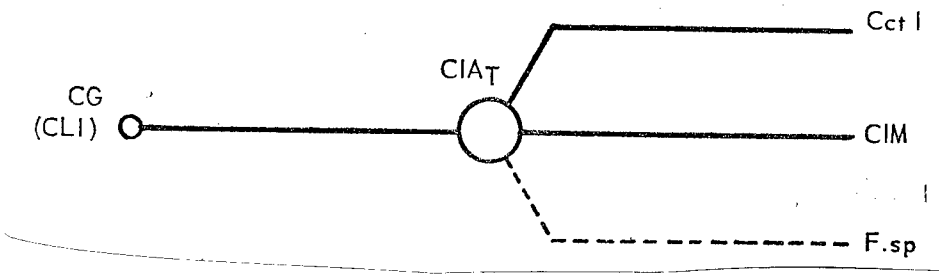


Figure 3.

If the communication is entirely automatic and is destined for a country accessible from another automatic international center (for general traffic) either in normal channels, or in overload, the call is routed from the first head of the line international center (beam operated in an international code). (figure 4).

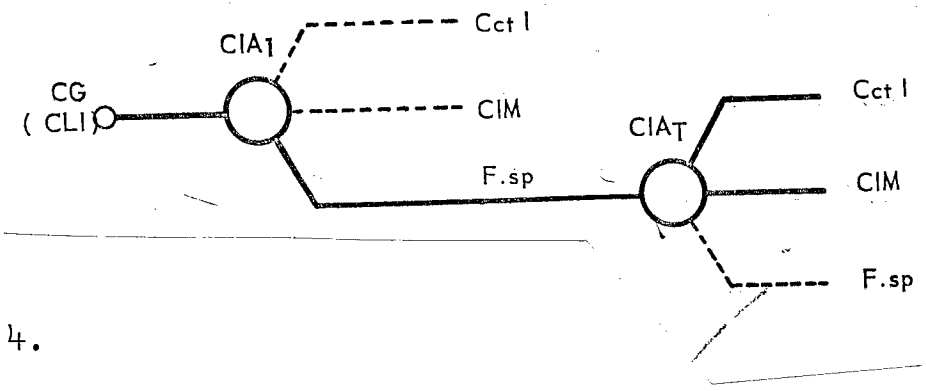


Figure 4.

Circuits between the local international link and the international center CIA 1 are operated in international code.

6.4122. The center has an international access link.

It has a beam of direct circuits with the automatic international center or, if the distance and the traffic do not warrant such a beam, with a transit center equipped with a CLI. Communications are charged by the international center or by the local international link and the charge pulses are retransmitted on a transmission channel adapted for this purpose. (Figures 5 and 6).

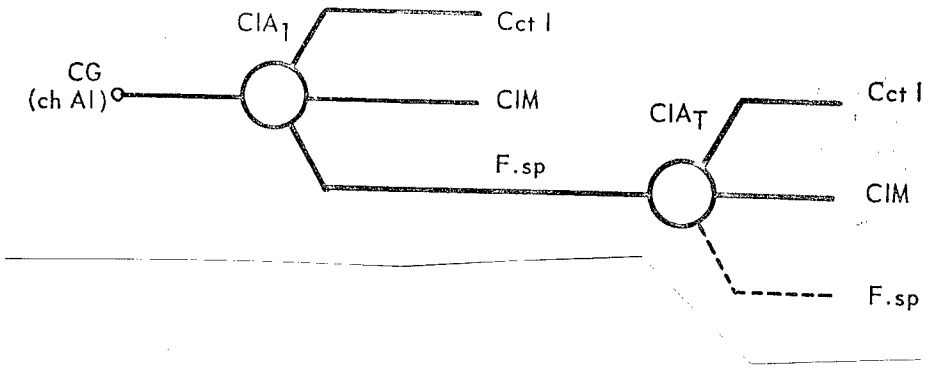


Figure 5.

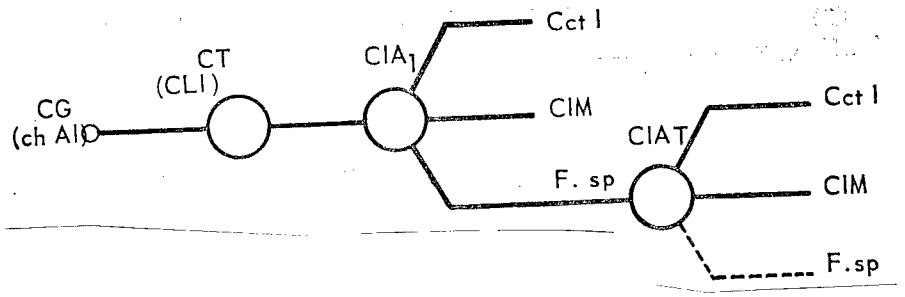


Figure 6.

6.42. The CTR is equipped with a local international link.

6.421. Communications originating from a subscriber of the group center and from the group of regional transit centers equipped with a local international link.

Depending on their destination, calls are routed on the beam of circuits giving access to the general traffic automatic international center for the direction considered (figure 7). The call thus never goes through two international centers, as may happen with some communications discussed in paragraph 5.12. The circuits are operated in international code.

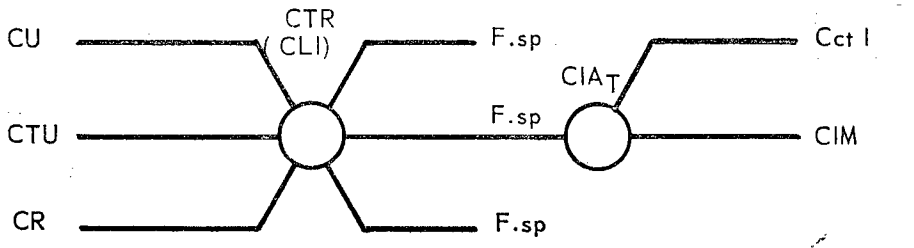


Fig. 7.

Figure 7.

6.422. Communications originating from totally or partially automated groups whose regional transit center has a local international link.

The group center is equipped with an international access link. It has a beam of direct circuits with the local international link.

Communications are charged by the local international link and charge pulses are retransmitted on an appropriate transmission channel (figure 8).

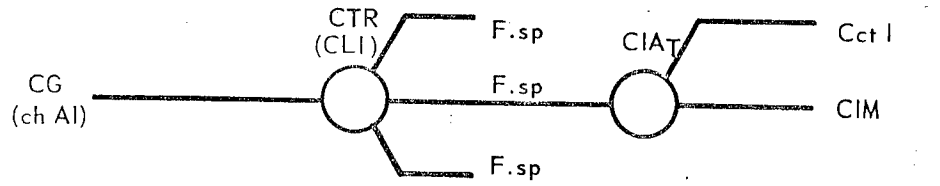


Fig. 8.

Figure 8.

If the traffic and distance do not warrant a beam of circuits between the CG and the CTR, communications may be routed by a transit center, if this transit center has a CLI (figure 9).

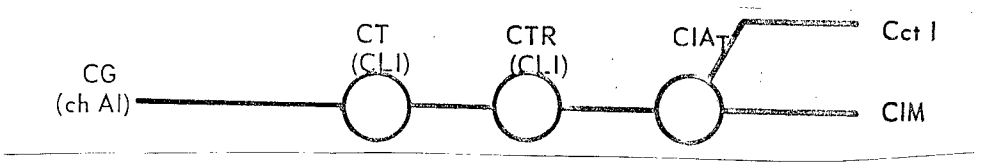


Figure 9.

6.43. Charging

Switching equipment is designed to handle 10 different rate areas. (These may be extended to 20). A maximum of 20 different charge levels can be used (no extensions planned).

A reduced rate may be charged during low traffic times on all or part of the directions in service. This is obtained by multiplying the charging period for the directions concerned by a single coefficient.

6.5. Traffic survey for drawing up international accounts

In entirely automatic operations, accounts between different agencies are established on the basis of the total lengths of conversations (CCITT blue book, note Q 50). International accounts for semi-automatic calls are based on tickets made up by the originating operators. Consequently, the counters used for recording the length of the communication record only the duration of entirely automatic communications. The duration of communications at low rate times may, if necessary, be recorded on separate counters.

The length of conversations is measured by counters in the destination countries. When the destination country has several different charge zones, these measurements are made by the charge zone. If there are several beams going to the same charge zone of a particular country, only a single survey is made.

Border traffic is not included in these traffic statements; each country keeps its own receipts.

In all other cases, entirely automatic traffic is included in the statements, whatever the routing, in the first international center where it appears, or in the local international link if one is used.

Originating traffic going abroad coming from another international center of the French network is, therefore, not included in traffic statements in the international line center.

To learn the traffic sent in a given direction (for example, each charge zone of Italy), the traffic statements for this charge zone made in all international centers and in all local international links of the French network must be added up.

International incoming or transit traffic is not included in traffic statements for establishing international accounts.

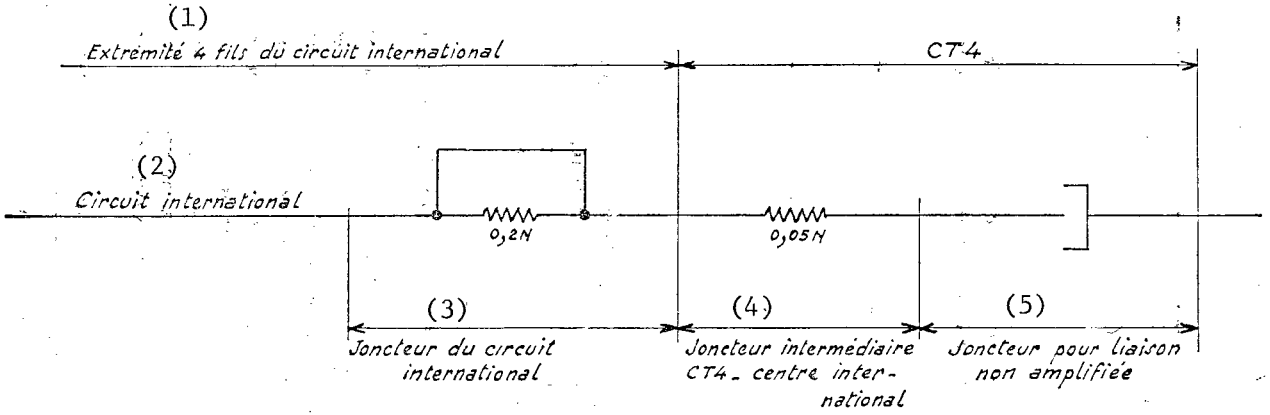


Fig:10 *Commutation "circuit international - Liaison non amplifiée"*

Figure 10: "International circuit--non-amplified connection" Switching

Key: 1. Four-wire end of international circuit 2. International circuit 3. Junctor of international circuit 4. CT4-international center intermediate junctor 5. Junctor for unamplified connection

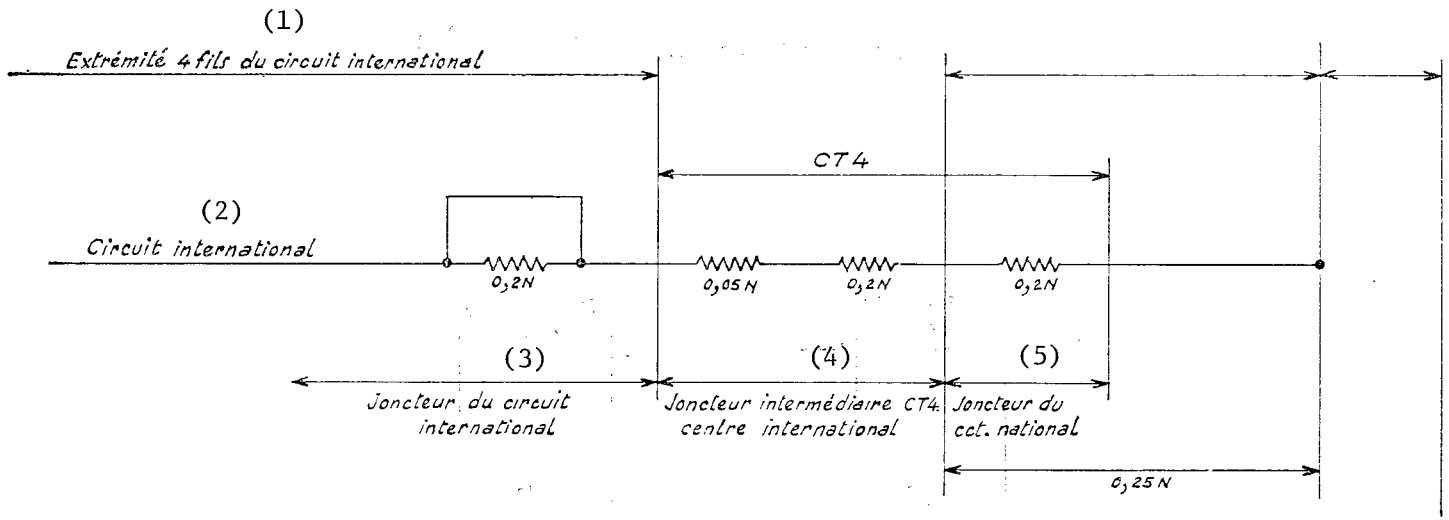


Fig:11 *Commutation "circuit international - circuit national amplifié"*

Figure 11: "International circuit--amplified national circuit" Switching

Key: 1. Four-wire end of international circuit 2. International circuit 3. Junctor of international circuit 4. CT4-international center intermediate junctor 5. Junctor of national circuit

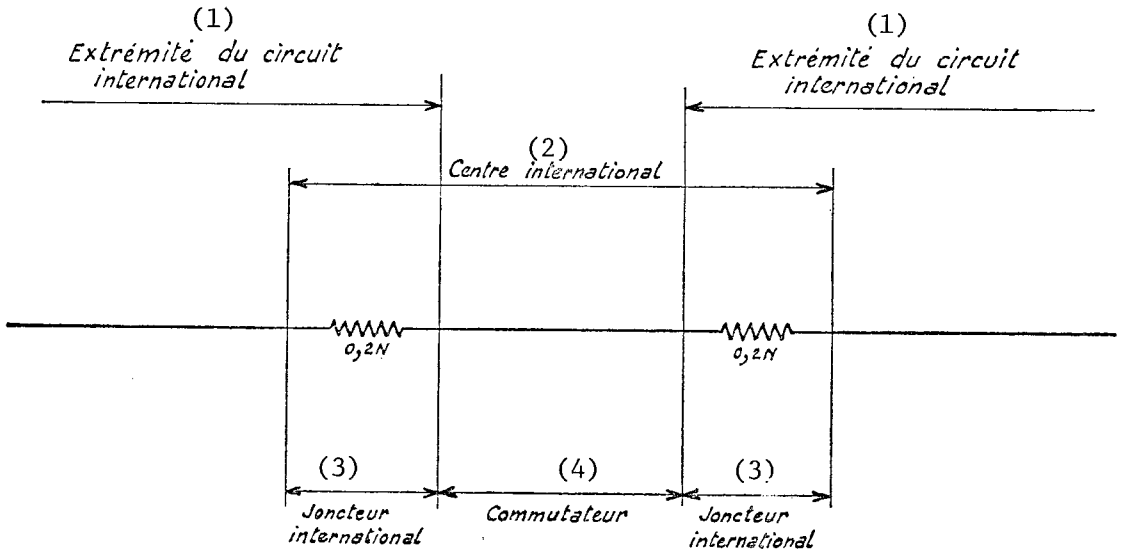


Fig:12 *Transit international*

Figure 12: International transit

Key: 1. End of international circuit
2. International center
3. International junctor
4. Switcher

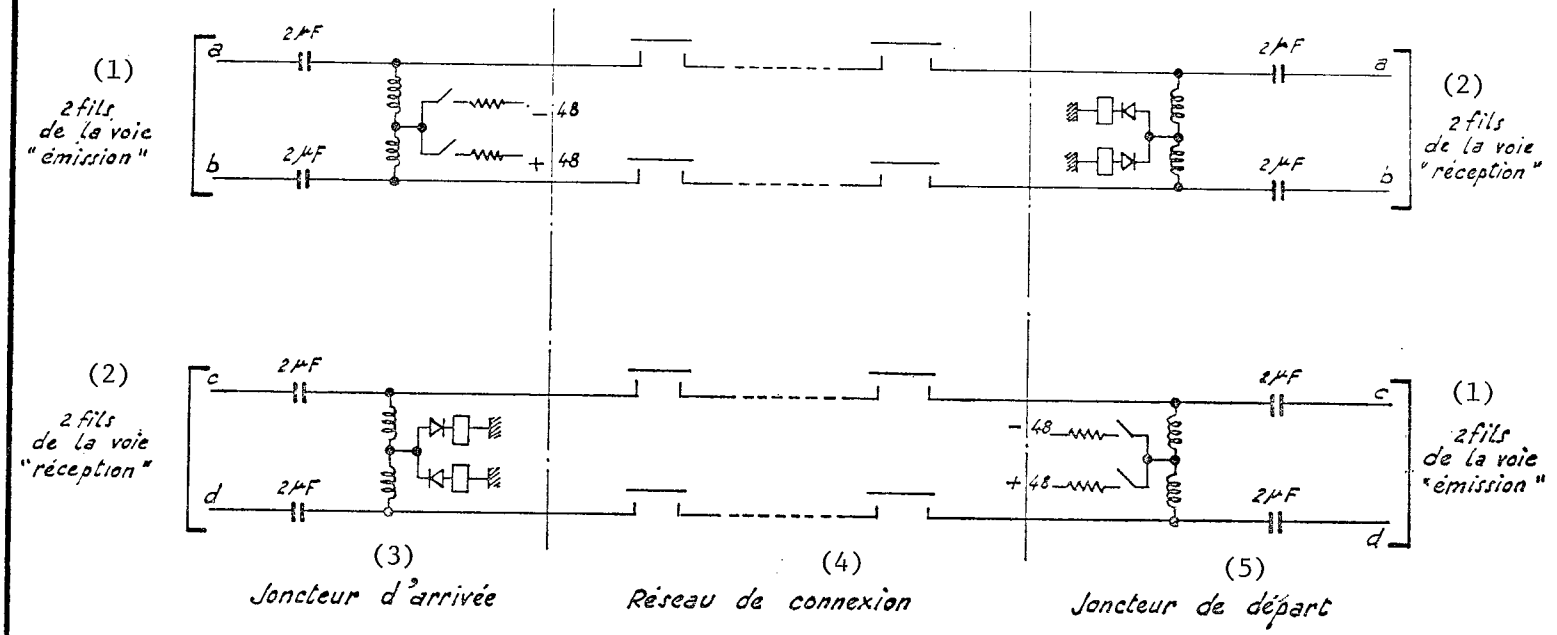


Fig:13 *Le circuit de conversation*

Figure 13: Conversation circuit

Key:
1. Two wires of the transmission channel
2. Two wires of the reception channel
3. Incoming junctor
4. Connection network
5. Originating junctor

Annexes: Table of Contents

Annex I: SRCT-R6/SOCOTEL S1 type signaling systems

A1.1. Links

Group center to sector center
Intermediate center to sector center
Group center to intermediate center

a. Status code (direct current)

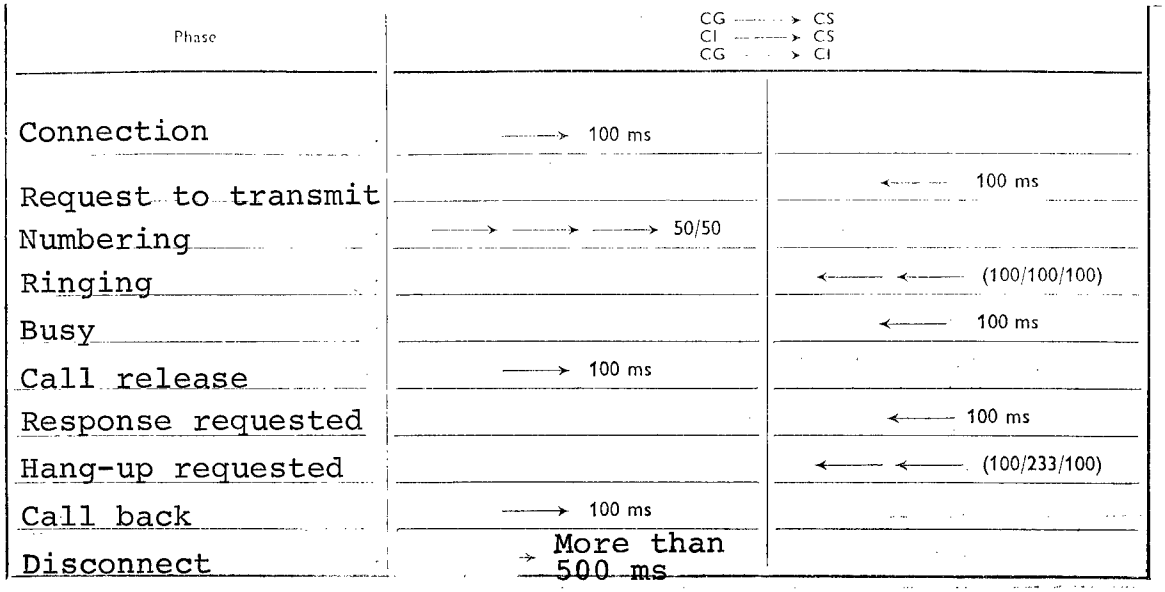
Phase	CG CI CG	CS CS CI
Rest	500 Ω loop	500 Ω loop
Connection	Ground on A; battery on B	500 Ω loop
Good circuit	Power supply	12,500 Ω loop
Request to transmit	Power supply	500 Ω loop
Numbering	Openings of 50/50 power supply	500 Ω loop
Ringing	Power supply	Breaking of loop and 12,500 Ω loop
Busy	Power supply	+ 48 V on A and B
Call release	Opening of power supply: 200 ms	12,500 Ω loop
Response requested	Power supply	500 Ω loop
Hang-up requested	Power supply	12,500 Ω loop
Call back	Opening of power supply: 200 ms	12,500 Ω loop
Disconnect	Definitive opening of power supply then weak loop	500 Ω loop

Comments:

1. The weak loop at rest in the group center is necessary only in the case of a mixed circuit (see table A1.3).

2. The busy signal (+ 48 V on A and B) is given for about 200 ms; it is followed by a 12,500 Ω loop.

b. Pulse code (50 Hz alternating current)



A2.2. Links

Sector center to group center
Sector center to intermediate center
Intermediate center to group center

a. Status code (direct current)

Phase	CS CS CI	CG CI CG
Rest	500 Ω loop	500 Ω loop
Connection	Ground on A; battery on B	Weak loop: 500 Ω
Good circuit	Ground on A; battery on B	12,500 Ω loop
Request to transmit	At center of sector; maneuver tone	500 Ω loop
Numbering	Reversal of power supply (at the rate of dial)	500 Ω loop
Busy	Power supply	Opening of loop
Ringing	Power supply	Return of call
Charging	Power supply	+ 48 V in mid-point
Caller hangs up	Reversal of power supply	500 Ω loop
Disconnection requested	Power supply	Opening of loop
Return to rest	Circuit open then 500 Ω loop	500 Ω loop

Comments:

1. In the case of SRCT or Pentaconta sector center the subscriber hears the maneuver tone transmitted by the connection center.

2. In the case of SOCOTEL S1 sector center, the maneuver tone is transmitted by the sector center after reception of the electrical request to transmit signal.

b. Pulse code (50 Hz alternating current)

Phase	CS → CG CS → CI CI → GC	
Connection	→ 100 ms	
Request to transmit		← 100 ms
Numbering	→ - - → Rate of dial	
Ringing		Return call
Busy		← 1 s
Charging		← ← 125/125
Caller hangs up	→ 500 ms	
Disconnect		← Above 1 s

A1.3. Sub-center, Connection center Links
(Sector center, intermediate, or group center)

A1.31. a. Connection center to sub-center

Status code (direct current)

Phase	Connection center	Sub-center
Rest	670 Ω loop	600 Ω loop
Connection	Ground on A; battery on B, 220 Ω per wire	600 Ω loop
Good circuit	Power supply	12,000 Ω loop
Request to transmit	Power supply	500 Ω loop
Numbering	Opening of 50/50 power supply	500 Ω loop
Busy	Power supply	Ground or + 48 V at mid-point of 500 Ω loop
Ringing	Power supply	12,000 Ω loop
Call release	Opening of 200 ms power supply	12,000 Ω loop
Response requested	Power supply	600 Ω loop
Hang-up requested	Power supply	12,000 Ω loop
Call back	Opening of 200 ms power supply	12,000 Ω loop
Disconnect	Definitive opening of power supply then loop	

Comments:

1. In the case of the SRCT sub-center, there is an opening of the loop (12,500 Ω loop) during the selection; the second digit (unity digit) can only be sent when the 500 Ω loop is reestablished.
2. In the case of a crossbar sub-center, there may or may not be loop opening between digits.
3. The busy signal (ground at mid-point in SRCT, + 48 V at mid-point in SOCOTEL-S1) is replaced after 200 ms by a strong loop.

A1.31. b. Sub-center to connection center

Status code (direct current)

Phase	Sub-center	Connection center
Rest	600 Ω loop	670 Ω loop
Connection	Battery pulse on A and ground on B for 100 m/s (480Ω per wire) then 600 Ω loop, then power supply	670 Ω loop
Request to transmit	600 Ω loop	Power supply and tone
Numbering	Variation in resistance 12,000/600Ω ; rate of dial	Power supply
Ringing	600 Ω loop	Power supply and return call
Busy	600Ω loop	Opening of power supply
Charging	600 Ω loop	100/100 pulse in alternating current (in // on the two line wires). Transmission 80 V ± 15 %
Caller hangs up	12,000Ω loop	Power supply
Disconnect		Opening of power supply
Return to rest	After disconnection, 600Ω loop	670 Ω loop

Comments:

1. The value of the 670Ω loop in the connection center corresponds to the maximum existing in the various systems. It has no influence on the functioning of the sub-center.
2. The counting pulses and the interval between two consecutive pulses must last at least 80 ms.

A1.32. a. Connection center to sub-center

Pulse code (50 Hz alternating current)

Phase	CR → SC
Connection	100 → 100 → 1 000 →
Request to transmit	← 100
Numbering	→ 50 → 50 → 50 → 50 → 50 → 50 →
Busy	← 100
Ringing	← 500
Picking up receiver	← 100
Hang-up	← 500
Call back	→ 100
Disconnect	→ 1000

A1.32. b. Sub-center to connection center

Pulse code (50 Hz alternating current)

Phase	SC → CR
Connection	→ 100
Numbering	→ 66 → 33 → 66 → 33 → 66 →
Charging	← 100
Hang-up	→ 500
Disconnect	← 1000

Annex II: Pulse and Decimal Code Signaling System of the Automatic long-distance Service

A2.1. Originating communications

A2.11. Signal transmission and reception

A2.111. Signalling modes

As soon as an available circuit of the beam selected is taken, signals are exchanged on this circuit with the corresponding center, using the signal code to be defined later.

Depending on the particular circuit, signals are transmitted:

a. In 50 Hz alternating current (voltage under vacuum 100 V, impedance adjustable from 200 to 600 Ω on each wire);

b. In 48 V direct current on the two line wires which act on an outside signaler (supplied and installed by the telecommunications administration);

c. By grounding of a TRON control wire which acts on an appropriate signaler (supplied and installed by the telecommunications administration).

The signals received from the center served by the circuit used or by the last LGD station will be of the same type, that is,' they will be transmitted:

a. In 50 Hz alternating current (voltage above 20 V at the limits of 600 Ω + 2 MF);

b. In direct current - 48 V on the two line wires supplied by an outside signaler (installed by the telecommunications administration).

c. Or by grounding of a RON control wire by an appropriate signaler (supplied and installed by the telecommunications administration).

A2.112. Signaling in 50 Hz current

Transmission

The common source of 50 Hz alternating current at 127 V will be reduced to 100 V on the circuits used and will have a negligible internal impedance before 800 Ω.

The impedance of the 50 Hz transmission circuit must be as close as possible to the impedance of the termination acceptable for the circuits, taking into account control resistances.

Discharge from the cable will be handled by a pure resistance of 600 Ω and not by a short-circuit, as the receiving circuit is open. The duration of discharge will last between 50 and 100 ms; in no case will it exceed 100 ms.

Reception

The "internal" signaler must have the following characteristics, especially for incoming use, where it is handling number selection.

a. On non-synchronous transmission of the last signaler, the signal must be restored to ± 10 ms taking into account voltage variations.

b. The signaler must function correctly with 200 mVA and must have a minimum impedance of 2,000 Ω approximately at 50 Hz.

c. The signaler must have a very high impedance on conversation currents (10,000 Ω at 800 Hz - level 0).

A2.113. Direct current signaling on two line wires

In transmission the direct current supply (-48 V and ground) must be able to be substituted easily for the 50 Hz power supply. The control resistances will be kept in the transmission circuit.

In reception, the 50 Hz signaler must be able to be reused without modification on direct current pulses.

A2.114. Signaling by TRON and RON wires

The acceptable intensity on the RON (reception) wire must be less than 50 mA, no matter what reception equipment is used. All appropriate precautions must be taken to ensure protection of the control contacts.

A2.115. Terminations

At rest and during all the preparatory phases of communication, the circuit must be ended both for outgoing and for incoming traffic on a 600 Ω impedance, no matter what signaling mode is

used in the circuit. If necessary, a pure resistance of 600 Ω in a serial arrangement with a capacity of 1 MF will be accepted as terminal impedance.

In addition, the reception equipment must be entirely separated from the retransmission circuit toward the automatic switcher. In all cases the continuity of the line wires will only be ensured after transmission or reception of the end of selection signals. Whatever the origin of the call, the routing tone must be transmitted to the caller at the end of numbering with a commercially acceptable level until reception of the end of selection signal (level of permanent transmission between 170 and 260 mV measured at the limits of 600 Ω at the incoming part of the circuit, with the circuit eliminated).

Then, in order to avoid that transient currents (originating in the closing or rupture of direct current circuits on line wires in the switcher either before or after transmission of signals may prevent the correct operation of the signal receiver located at the other end of the circuit, the following steps will be taken upon transmission of a signal in the circuit:

a. The circuit will be separated from the center 30 to 50 ms before the start of transmission of the signal in the circuit;

b. The circuit will only be connected in the center 30 to 50 ms after the end of signal transmission in the circuit.

A2.12. Signal code

A2.121. Case of an originating communication with the national automatic service

A2.1211. Connection signal; request to transmit signal

The connection signal lasts 100 ms.

As soon as the corresponding long-distance center can receive and handle the numbering signal, it responds to the connection signal by sending a "request to transmit" signal lasting 100 ms.

The interval between the connection signal and the request to transmit signal must be a minimum of 150 ms.

Upon reception of this signal, the numbering signals are transmitted with a minimum delay of approximately 250 ms.

A2.1212. Numbering signals

These consist of a series of pulses transmitted at the rate of 10 pulses per second; the ratio between the duration of one pulse to the duration of the interval between two successive pulses is equal to 1. The interval between two series of pulses has a minimum duration of 500 ms; the maximum duration of this interval is set at 1 s if the following digit is registered.

The number of series of pulses transmitted may vary between 1 and 9.

The series of pulses transmitted are of the AB1Q type, or are identical to the last 1, 2, 3, 4, 5, 6, 7, or 8 series of pulses received from the calling subscriber (U - DU - CDU - MCDU - QMCDU - PQMCDU - BPQMCDU - APQMCDU). They may be preceded by an additional series of pulses, with either 11, 12, or 13 pulses; the meaning of these pulses is explained later.

The number of series of transmitted pulses is determined by the combination of characters (A, AB, ABP, ABPQ) which was used to determine the beam of automatic long-distance circuits used by the communication.

For some relations normally reached through a CTR or CTD transit center, eight series of pulses identical to the eight series of pulses received should be sent back, preceded by a series of 12 pulses characteristic of a national call.

In order to facilitate the possible use of auxiliary channels, the automatic mechanism must be able to command, in case of congestion of the beam of circuits in the direction considered, the overload towards a predetermined transit center. In this case eight series of pulses identical to the eight series of pulses received are sent back to the transit center in question to characterize the identity of the subscriber being called.

Moreover, these eight series of pulses are preceded by an additional series of 13 pulses meaning that an overload has already taken place. Precautions to be taken in the transit center used by the auxiliary channel will be given later.

A2.1213. End of selection signals; response and hang-up signals

As soon as the incoming long-distance center has completed the selections corresponding to the numbering signals which were sent it, it transmits an "end of selection" signal.

This signal differs, depending on whether the subscriber called is busy or ringing.

If the subscriber called is ringing, the end of selection signal consists of two 100-ms pulses separated by a 100-ms interval.

The incoming long-distance center then sends the call current on the line of the subscriber being called and when he answers, it sends a "response" signal consisting of one 100-ms pulse, transmitted at least 100 ms after the end of the preceding signals.

When the subscriber called hangs up the phone, the incoming long-distance center sends an uninterrupted "hang-up" signal consisting of pulses lasting 100 ms, separated by 233-ms intervals.

If the number called is busy, the end of selection signal consists of a single 100-ms pulse.

A2.1214. Disconnect signal -- minimum duration: 500 ms

This signal is transmitted:

a. As soon as the calling subscriber hangs up his receiver, no matter what the phase of the communication in progress, unless the connection signal itself was not transmitted;

b. Within a 20 to 40 s period after reception of the signal indicating that the subscriber called has hung up his phone. It must be possible to eliminate these special provisions, needed in some directions, whenever they are unnecessary;

c. Within a 2.5 to 5 s period after reception of the signal indicating that the subscriber called has hung up his phone, if the previous arrangements described are not required.

In the two preceding cases, if the hang-up signal stops before the disconnect signal is sent, everything proceeds as if the hang-up signal had not been sent.

d. Upon reception of the signal indicating that the subscriber called was busy at the end of selection.

e. In case of reception of an inappropriate pulse on the circuit (switching mechanisms at rest).

Transmission of the disconnect signal is immediately followed by the complete disconnection of the automatic links.

A2.122. Case of originating communication with regional automatic service

When a circuit of the beam selected is taken, signals meeting the description given previously for the national long-distance service (except in the part concerning the number of series of numbering pulses) are exchanged on this circuit with the center served by this circuit.

The number of series of pulses transmitted after selection of the circuit may vary between 1 and 9. If the number of pulses transmitted is only 1, 2, 3, or 4, these series are identical to the last 1, 2, 3, or 4 series of pulses received.

If the number of series of pulses is over 4, the last four series are identical to the last four series received; the number and type of the first series are determined by the combination of one, two, three, four, or five digits which was used to designate the beam of outgoing circuits.

The first series transmitted must be able to be formed as indicated below:

1. Q, PQ, BQP (series received);

2. P', Q' are substituted for the PQ received;

C. ABPQ (AB is the departmental indicator of the department of the person called). This combination must be preceded by a preliminary series of 12 or 13 pulses.

To permit the possible use of auxiliary channels, it must be possible to command, in case of congestion of the beam of circuits toward the direction considered, an overload to a predetermined transit center.

In this case the number and type of the series of pulses retransmitted on auxiliary channels will be:

a. six or seven series received, preceded by an additional series of 11 pulses if the transit center is in the same regional numbering zone as the subscriber called;

b. eight series preceded by an additional series of 13 pulses if the transit center can only reach the subscriber called in the national numbering system.

A2.123. Signal tolerances

The duration of the transmission constituting the connection signal must be kept to within ± 10 percent. The duration of transmission of the numbering signal must be kept to within ± 10 percent; the duration of the disconnect signal must be kept between 500 and 750 ms.

The duration of the signals received (request to transmit, end of selection, response, hang-up) may vary by ± 20 percent around the values indicated, including the interval between the two "end of selection - ringing" pulses.

A2.2. Incoming Communications

The signals exchanged on the circuit satisfy the conditions stated in Annex II. In particular, the conditions indicated for the termination of the circuit during all phases of the originating communication are applicable to the incoming communication.

A2.21. The various signals transmitted are the following:

A2.211. Request to transmit signal; duration: 100 ms.

As soon as the circuit is taken, the originating center transmits a connection signal lasting 100 ms on this circuit.

As soon as the mechanisms of the incoming center are in a suitable position to receive and handle the request from the originating center, the request to transmit signal is sent to the originating center. The interval between the end of the connection signal and the start of transmission of the request to transmit signal must in all cases be greater than 150 ms. The originating center then transmits numbering signals which, depending on the particular case, consist of 2, 3, 4, 6, 7, 9, or 10 series of pulses, according to the following possibilities:

A2.212. Numbering signals

a. Two and three-digit numbering signals beginning with the digit 1.

In principle, these are used to reach special services handled by the internal automatic switcher (if there is one). However, some originating centers (considered part of the group) will have access to special services made available to subscribers of the incoming center.

The allocation of any incoming circuit equipment must in any event create no problems.

b. Numbering signals with 2 or 4 characters in format 10 or AB1Q.

These numbering signals are allocated to the incoming semi-automatic long-distance service for calls between operators; subscribers can not call operators with 2 or 4 digits (this impossibility is built into the system from the starting point).

These signals may be of the 2-character type: 1Q,Q which may take the values:

8: national operator
7: international operator
3: information operator or of the 4-character type: AB1Q

AB is the departmental prefix and Q has the meanings given earlier.

c. Four-digit numbering signals beginning with 10,11, or 12.

In principle, these are used to reach long-distance tables by the internal automatic switcher (if it exists). The originating center mentioned earlier in a, considered to be part of the group, will not have this capability.

d. Six or seven-digit numbering signals.

These are used to reach subscribers of the center, subscribers of automatic group networks, and subscribers of automatic networks included in the 6 or 7-character regional numbering zone.

e. Numbering signals with 7/8 characters.

These are formed of numbers with six or seven characters preceded by a prefix consisting of a series of 11 pulses meaning that the number to follow is a complete regional number with six or seven characters, but that as a diversion has already been made, no additional or supplemental channel is to be used.

f. Numbering signals with nine and ten characters.

These are used to reach automatic networks accessible by the automatic long-distance service coming from a great distance, using eight-character numbers preceded by a prefix of one or two characters with the following meanings:

1. one-character prefix consisting of a series of 12 pulses; this prefix means that the number to follow is a complete national number of eight characters and that an auxiliary channel may possibly be used in case of congestion on the normal channel.

2. one-character prefix consisting of a series of 13 pulses; this prefix means that the number to follow is a complete national number with eight characters but that a diversion has already been made, and no additional auxiliary channel is to be used.

3. two-character prefix. This prefix consists of one pulse followed by a series of six pulses. It has the same meaning as the series of 12 pulses.

Reception of these signals prepares for the connection by automatic mechanisms between the incoming long-distance circuit and the line of the subscriber called or the circuit used in transit.

In the case of transit:

Upon reception of a preliminary series of 12 pulses on the incoming circuit:

a. a preliminary series of 12 pulses will be transmitted on the originating circuit if this circuit belongs to the normal channel;

b. a preliminary series of 13 pulses will be transmitted on the originating circuit if this circuit belongs to the auxiliary channel.

Upon reception of a preliminary series of 13 pulses on the incoming circuit, a preliminary series of 13 pulses will be retransmitted on the originating circuit, which means that the overload indicator must be kept until reaching the incoming center.

Depending on the nature of the signals, the communication will be an incoming, regional transit, or a national transit communication.

If it is a transit communication, these signals are used to take an originating automatic long-distance circuit in the same conditions as those required for routing a call from a local subscriber to a long-distance originating circuit and to verify, if need be, that there is compatibility between the AB and the PQ received in the last transit center.

If it is an incoming communication, these signals are used to make all the selections needed inside the group, whether the subscriber called is linked to the main automatic switcher or is on a local automatic center, which will sometimes require analysis of the first six digits, ABPQMC.

A2.213. End of selection signal - subscriber busy

If the subscriber called is busy, either he has only a single line, or he has several and all were busy, or if the selection can not get through for lack of mechanisms available at any stage of selection, an "end of selection - subscriber busy" signal is sent on the long-distance circuit to the originating center.

This signal may consist of:

a. one single pulse lasting 100 ms

b. a series that is uninterrupted until disconnection of 100 ms pulses, separated by intervals of 233 ms (case of semi-automatic incoming circuits)

c. the sending of an audible busy tone to the originating center.

A modification of connections of a very simple nature will make it possible to use the appropriate type of signal on each circuit.

A2.214. End of selection signal -- ringing

If the number called is ringing, either the subscriber has only a single line, or he has several and at least one is free, and the "end of selection - ringing" signal is sent on the long-distance circuit to the originating center.

This signal consists of two 100-ms pulses separated by a 100-ms interval.

However, on semi-automatic long-distance circuits for which the "end of selection - busy" signal consists of an uninterrupted series of 100-ms pulses separated by 250 ms, no "end of selection - ringing" signal is sent; only the return call tone is sent to the originating center.

A2.215. Response signal

The call current is sent on the line of the subscriber called, when ringing according to the conditions described for establishing a local communication (TL traffic).

Upon the response of the person called, the "response" signal is sent on the long-distance circuit to the originating center.

This signal consists of a pulse lasting 100 ms transmitted at least 100 ms after cessation of the end of selection signals, if there are any.

A2.216. Hang-up signal

This signal consists of a series of pulses, each lasting 100 ms, separated by intervals of 233 ms, uninterrupted until disconnection or until the telephone receiver of the person called is picked up again.

A2.217. Disconnect signal

Whatever the phase of the communication, whether completely established or not at the time when this signal is received, the "disconnect" signal consisting of a single transmission lasting more than 500 ms causes the disconnection of the automatic links.

A2.22. Duration of pulses

The durations of transmissions forming the request to transmit, end of selection, response, and hang-up signals must be kept to within $\pm$ 10 percent.

The rate of sending of 100-ms pulses spaced by 250 ms used for hang-up signals of the person called or possibly for busy signals must correspond to 100 pulses in 35 s, within $\pm$ 10 percent.

The incoming equipment must operate within the following limits for signals received:

a. Connection signal: 70 to 130 ms
b. Numbering signals

Numbering pulse reception and recording devices must operate correctly under the following conditions:

1. With pulses whose speed of transmission may be between 8 and 12 pulses per second, that is, whose total duration (active part + interval) may vary between 125 and 83 ms;

2. With pulses whose active part may have a minimum duration of 30 ms, the interval between the successive pulses is the complement of the total duration of a pulse defined by the two extreme speeds listed above;

3. With active pulses spaced by an interval of a minimum duration of 20 ms, the duration of the active pulse is the complement of the total duration of a pulse defined by the two extremes listed above.

c. Disconnect signal: a minimum of 450 ms

The first maneuver tone scheduled will not be transmitted.

The second scheduled maneuvering tone will only be transmitted upon reception of the prefix 16 if a period of time is required between the reception of this indicator and the reception of the following series of pulses, and not after a prefix consisting of a series of 12 or 13 pulses.

After sending the end of selection - ringing signal, or when such a signal is not systematically sent at the end of selection, the return call tone is sent on the long-distance circuit until the response of the person or service called.

The response signal -- which starts the charging process in the originating central office -- must not be sent when this is a call destined for a line that has been canceled, transfered, etc., or a call switched to information after some problem (incorrect prefix, level not used, etc.) but the operator or the recording device (see 4.14) must in this case simply cause the cut-off of the return call and establishment of conversation circuit, without sending the response signal.

Annex III: SOCOTEL Multifrequency Signaling System applicable between Crossbar Centers

A3.1. Signaling Categories

Signals exchanged for the establishment of a communication may be classified in two categories.

A3.11. Register signals

These signals provide transmission of information concerning numbering and the nature and status of subscribers' lines. They are exchanged between common circuits (registers, common transmission or reception mechanisms) during the establishment phase of the communication.

A3.12. Line signals

These signals handle connection of mechanisms, supervision of the communication and disconnection. They must be transmitted even

outside the time of utilization of the recording mechanisms, by junctors of circuits using the customary transmission modes: 50 Hz, dc, voice, or interband frequency signaling).

A3.2. Register signals

A3.21. Type of signaling

The system is of the "caller-controled" type using five signaling frequencies and one control frequency. A sixth signaling frequency is scheduled for use of the system in international traffic.

A3.22. Frequency code

Code 0 - 1 - 2 - 4 - 7 in 2 among 5 using the 5 frequencies (in hertz):

$f_0 = 700$, $f1 = 900$, $f2 = 1100$, $f4 = 1300$, $f7 = 1500$.

The value of the control frequency is $fc = 1900$ Hz.

This code is used to obtain 10 multifrequency signals. The frequency $f11 = 1700$ Hz is used to create 5 additional forward signals (code 0 - 1 - 2 - 4 - 7 - 11 in 2 among 6) for international traffic.

A3.23. Mechanism of signal exchange between registers

When two registers are present together, the transmission of a two-frequency signal is done by one of the registers; the other is in reception position for these frequencies. Control of the signal transmission is done by using the control frequency, as follows:

The "downstream" register, for example, transmits a back signal. The "upstream" register, upon recognizing this signal, transmits forward the control frequency fc. When the downstream register recognizes this frequency, which gives it the control that its signal was received, it interrupts the transmission of this signal. The recognition of the cessation of the signal by the upstream register causes the end of transmission of the frequency fc.

Each of the two registers controls directly on the line the disappearance of frequencies or of their possible echos before a new signal is transmitted.

In this way each end transmits or receives signals according to a program determined by using signal codes. The same signaling frequencies may therefore be used forward and backward. The monitoring of sending a signal is done by the frequency fc, and the program is such that a transmission of fc must never respond to a transmission of fc.

A3.24. Signal codes

They include either the forward or backward signals indicated in the corresponding tables. Some signals without a particular denomination are kept in reserve for future requirements of national or international operation. The abbreviations of the signals indicate their essential meaning. Their use calls for the following remarks:

A3.25. Forward signals

There are three types of forward signals: signals corresponding to the digits to be transmitted (numerical code), preliminary recognition signals indicating the nature of the communication to be established (access code, with one of the last signals necessarily preceding the sending of the first digits of the number being called), and signals corresponding to the category of the caller.

Signals of the numerical code are used to transmit selection information; they are also used (upon request for a C signal backward after passage to code C) to transmit information concerning the caller.

Comments concerning these different signals are given below, during the examination of the backward signals requesting the corresponding information.

The use of signals reserved for international traffic is given later.

A3.26. Backward signals.

These signals have been classified in three categories: A, B, and C, based on the data concerning selection, status of the line called, identification of the caller, respectively.

A3.261. A Signals

These signals are used to request or to transmit information needed for selection.

a. A1 and A2 signals

Whatever the nature of the call, a single A1 signal, "send the access signal and the first two or four digits," has been designated. This makes it easy to control the number received in all instances, as shown in the following table (access signal + four digits).

	Undiverted call	Diverted call
National case	3 a b p q	4 a b p q
Paris region	1 b p q m	2 b p q m
Provincial region	1 p q m c	2 p q m c

The A2 signal, "send the last digits," is used to complete the number of the person called. The A2 signal not preceded by the A1 signal means, "send the last four MCDU digits."

The use of these two signals makes it possible to avoid repetition of the complete number of the person called in each transit center which is involved in establishing the communication.

b. A3 signal (passage to code B)

This signal is transmitted by the incoming register when it knows the status of the line called.

c. A4 signal (passage to code C)

This signal may be transmitted at any time during the establishment of the communication by the incoming register or transit register when it is necessary to know the category and number of the caller.

d. A5 signal (send the category of the caller).

This signal is used instead of the A4 signal when it is necessary to know only the category of the caller.

e. A6 signal (normal transit) and A7 signal (diverted transit)

The register of a transit center transits the A6 signal if it is routing the communication by a normal channel, and the A7 signal if it is routing the communication by a diverted channel.

The A7 signal indicates to the originating register that a diversion was made, and that it must modify the access signal (which becomes 2 or 4, instead of 1 or 3) to prevent a later diversion.

The A6 signal fixes for the originating register the interpretation of the following A2 signals without using the A6 signal. Therefore, the A2 signal means: "Send the last four digits (MCDU)," while the A2 signal received after the A1 signal without an intervening A6 signal means: "Send the last digits (MCDU, CDU, or DU)."

f. A9 signal (congestion)

This signal is transmitted by the register of an incoming center or transit center which finds either an internal blockage or that no normal or diverted channel is available. It will be interpreted at the originating center according to the capabilities of this center (rerouting at origination, return to an operator, recording machine).

A3.262. B signals

These signals indicate to the originating register the status of the line called. They are transmitted after the moment when the last circuit permitting use of the register signals is informed of this status. They are preceded by the A3 signal (passage to code B).

a. B2 signal (line called ringing without charge)

Through the introduction of this signal, the response signal (line signal) may be transmitted during the establishment of a non-charged communication, thus giving correct supervision of the person called. Moreover, the establishment of allowance cards in the case of calls made by telecommunications administration employees from the phone of the subscriber to test or maintenance tables becomes unnecessary.

b. B4 signal (passage to conversation)

This signal is scheduled for possible utilization in international automatic service to permit an immediate disconnection of the TASI channels during return call transmissions which will be transmitted at the point of origination.

In regional and national traffic, the return call tone will always be given by the incoming end.

c. B8 signal (passage to supplemental code)

This signal makes it possible to introduce 10 supplemental signals which constitute a "supplemental status code of the called number," defined as follows:

B-81
B-82
B-83
B-84, number canceled
B-85, number transferred
B-86
B-87, number suspended or out of order
B-88, number or level not used
B-89
B-90, subscriber absent

This code is used in cases when, after the call has reached a canceled line (R), a transferred number (T), a suspended or out of order number (S), a level not used (NNU) or a number transferred to an absent subscriber (AA), it is desired to reroute the communication from a preceding center. From this center, the circuits are disconnected and the call is switched to an information and public service position (or to a recording machine). Such a rerouting avoids the use of return pairs between the incoming center (without manual positions) and the center which is to handle the call, which enables the limits prescribed for equivalents to be respected more economically.

The register of the center which makes the rerouting must "act in tandem" for all communications destined for centers whose handling of calls to RTS, NNU, and AA uses the supplemental code. When the supplemental code is used, this register retransmits "upstream" the B0 signal for absent subscribers, and the B2 signal for other cases.

If calls to RTS, NNU, and AA are handled at the incoming office (by recording devices or by an operator), the supplemental code is not used. The B0 signal is sent for absent subscribers and the B2 signal for other cases.

d. B0 signal (subscriber absent)

This signal is planned for possible use in international automatic service. In regional and national traffic, it must be interpreted as B1 (number called ringing with charge).

A3.263. C signals

These signals are used to ask the category and the number of the caller. They may be sent at any time during establishment of the communication if they are preceded by the A4 signal (passage to code C).

The caller's category code, used to answer the C1 signal (or the A5 signal) has, like the B code described above, the capability of introducing, using the C8 signal, a supplemental code. This code may use one or more digits, which will be transmitted after the 8 frequency combination (f1 + f7).

A3.27. International traffic

In international traffic, the use of the supplemental frequency f11, in association with the five code frequencies, makes it possible to have five supplemental forward frequencies defined as follows:

Signal no 11 (f0 + f11) = call to code 11 operator
Signal no 12 (f1 + f11) = call to code 12 operator
Signal no 13 (f2 + f11) = call to maintenance equipment
Signal no 14 (f4 + f11)
Signal no 15 (f7 + f11) = end of numbering.

Moreover, after reception of the A2 signal (send the last digits) the originating register systematically induces passage from signal transmission position to reception position when there are no more digits to be sent. The later registering of a new digit to be transmitted causes this digit to be transmitted, then a return to receiving position.

Signals 11, 12, 13, 14, and 15 forward will be monitored by the control frequency fc.

Generators and receivers of the frequency f11 only have to be provided for equipment to be used with international traffic.

A3.3. Clauses concerning transmission for multifrequency signaling transmitters and receivers

These clauses are defined in the general technical specifications.

A3.4. Register signal codes; forward signals

Combination (2 of 5)	Frequencies (in Hertz)	Access code (preliminary data)	Numerical code (numerical data)	Caller categories code
f0 + f1	700 + 900	a1.--Regional	b1.--Digit 1	c1.--Subscriber on dial
f0 + f2	700 + 1,100	a2.--Diverted regional	b2.--Digit 2	c2.--Subscriber on dial with account justification
f1 + f2	900 + 1,100	a3.--National	b3.--Digit 3	c3.--Caller absent
f0 + f4	700 + 1,300	a4.--Diverted national	b4.--Digit 4	c4.--Subscriber can not be identified
f1 + f4	900 + 1,300	a5.--2-digit call	b5.--Digit 5	c5.
f2 + f4	1,100 + 1,300	a6.	b6.--Digit 6	c6.--Subscriber on switchboard
f0 + f7	700 + 1,500	a7.	b7.--Digit 7	c7.--Subscriber on switchboard with account justification
f1 + f7	900 + 1,500	a8.	b8.--Digit 8	c8.--Passage to supplemental category code
f2 + f7	1,100 + 1,500	a9.--Semi-automatic international	b9.--Digit 9	c9.--Night booth
f4 + f7	1,300 + 1,500	a0.--Automatic international	b0.--Digit 0	c0.--Operator

Combination (2 of 5)	Frequencies (in Hertz)	Access code (preliminary data)	Numerical code (numerical data)	Caller categories code
		Complementary code (international traffic)		
f0 + f11	700 + 1,700	a11.	b11.--Code 11 operator	
f1 + f11	900 + 1,700	a12.	b12.--Code 12 operator	
f2 + f11	1,100 + 1,700	a13.--Diverted international call from operator	b13.--Maintenance equipment	
f4 + f11	1,300 + 1,700	a14.--Diverted international call from subscriber	b14.	
f7 + f11	1,500 + 1,700	a15.	b15.--End of numbering	

A3.5. Register signal codes; backward signals

Code A (selection code)		Code B (status code of party called)		Code C (caller identification code)	
A1:	Send the access signal and the first two or four digits	B1:	Ringing with charge	C1:	Send the caller category and the first four digits of his national number (ABPQ)
A2:	Send the last digits	B2:	Ringing without charge	C2:	Send the last four digits of the caller's number (MCDU)
A3:	Passage to code B	B3:	Busy	C3:	Passage to code B
A4:	Passage to code C	B4:	Passage to conversation (only in international)	C4:	Passage to code A
A5:	Send the caller category	B5.		C5.	
A6:	Normal transit	B6.		C6.	
A7:	Diverted transit	B7.		C7.	
A8.		B8:	Passage to supplemental code	C8.	
A9:	Congestion	B9.		C9.	
A0.		B0:	Person called absent (only in international)	C0.	

Comment: The frequency combinations used are the same as those for the forward signals.

A3.6. Line signals

Most of the information needed in a communication is transmitted between registers by multifrequency codes defined in the first part. Information that can not be exchanged between registers is transmitted by circuit junctors using line signals.

These signals must ensure the connection of mechanisms, supervision of the communication, disconnection, and possibly permit the recall of the party called by an operator.

The transmission of information can be done either by sending pulses or by modifications of permanent currents resulting from status changes made at the ends.

The junctors must be designed so that the common mechanisms, particularly the registers, can function with junctors of different types, and so that the passage from one type of signaling to another on the same circuit may be done by a simple replacement of the junctors at the ends, without resulting in a modification in the structure of the common mechanisms.

The following tables define the codes that may be used for line signaling. These tables show a pulse code and a dc (status change) code used for signaling in urban networks.

A3.61. Line signaling. Pulse code

Meaning of signals	Duration (in ms) and direction of transmission	Transmission tolerances
Connection	150 →	± 20 %
Response by party called	150 ←	± 20 %
Party called hangs up	150 ← 350 150 ← 350	150 + 20 % et (150 + 350) + 6 % – 15 %
Party called recalled	150 →	± 20 %
End	750 →	0 % + 50 %

The connection signal must not be transmitted less than 100 ms after cessation of the transmission of the end signal.

Depending on the particular circuit, the signals transmitted consist of:

a. Pulses of 50 Hz alternating current on the two line wires (voltage under vacuum 100 V, internal impedance of the power supply 800 Ω)

b. Direct current pulses - 48 V on the two line wires

c. or ground pulses on a TRON control wire

The signals received are of the same type and consist of:

a. Pulses of 50 Hz alternating current (voltage above 20 V at the limits of 600 Ω - 2μF)

b. Direct current pulses - 48 V on the two line wires

c. Or ground pulses on a RON control wire

In all these cases, the resistance of the RON wire (including reception relay) must be above 1,000 Ω. Protection will be provided by a varistor or by an equivalent device.

While the conversation link is not established, the circuit will be closed at each end on an impedance of 600 Ω (possibly in a serial arrangement with a capacity of 1μF).

The circuit will be separated from the office side 30 to 50 ms before the start of transmission of a signal, and will only be connected 30 to 50 ms after the end of this transmission.

The incoming equipment must function within the following limitations for the duration of signals received, expressed in milliseconds:

a. Connection, response, call back signals: 80-220

b. Hang-up signal: 100/400

c. End signal: minimum duration 500

A parasitic transmission lasting less than 35 ms will not be interpreted as a signal.

A signal lasting longer than 500 ms must not be able to be interpreted as the arrival of a connection signal and must not engage the incoming junctor.

Moreover, the provisions required for the recall signal to be transmitted in its entirety during the duration of a phase of silence of the person called's hang-up signal must be made. The reception of the recall signal will cause, in the incoming equipment, the elimination of the transmission of "alternated pulses."

A3.62. Line signaling; status code (direct current)

Meaning of status or change of status	Originating	Direction of data transmission	Incoming	Remarks
Control of availability	B	←	A	The loop current, inactive at incoming, at the point of origination makes possible control of circuit availability.
Connection	B → b	→	A	The loop current acts at incoming by causing connection of mechanisms.
Control of connection	b	←	A' ← A	The reversal of power supply by incoming equipment supplies control of connection at originating point.
Selection; call of party being called	b		A'	Exchange of register signals.
Response of party called	b	←	A ← A'	Reversal of power supply upon response of party called.
Party called hangs up	b	←	A' ← A	Reversal of power supply upon hang-up of party called. Timing of disconnection from originating point or blocking by operator.
Party called recalled	+48//ab	→	A'	Engaging of call by differential relay at incoming (50-ohm windings)
End (disconnection by party called hanging up)	b → O	→	A'	Disconnection of incoming upon breaking of loop current
End (disconnection by caller hanging up)	b → O	→	A	Disconnection of incoming upon breaking of loop current

In the preceding table, the following abbreviations were used:

0: open circuit
B: closed circuit on strong resistance
b: closed circuit on weak resistance
A: + on wire a
   - on wire b
A': - on wire a
   + on wire b
   } through resistances (relay windings)
+48 // ab: potential of +48 V in a parallel arrangement on wires a and b.

The resistance per wire between origination and incoming must be kept less than 1,200 Ω and the insulation resistance between wires, including ground losses, above 50,000 Ω.

Disconnection conditions

During release of the originating junctor, the circuit remains open for at least 50 ms.

The "B" loop may appear as soon as this period has elapsed.

The incoming junctor must be disconnected at the latest 300 ms after opening of the loop.

A new connection loop, b, must not appear in the originating junctor before a period of 500 ms has elapsed after the start of opening of the circuit.

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