

**STORNO
MULTICHANNEL AUTOMATIC
RADIO TELEPHONE SYSTEM
CAF680 - 2004**

CONTENTS

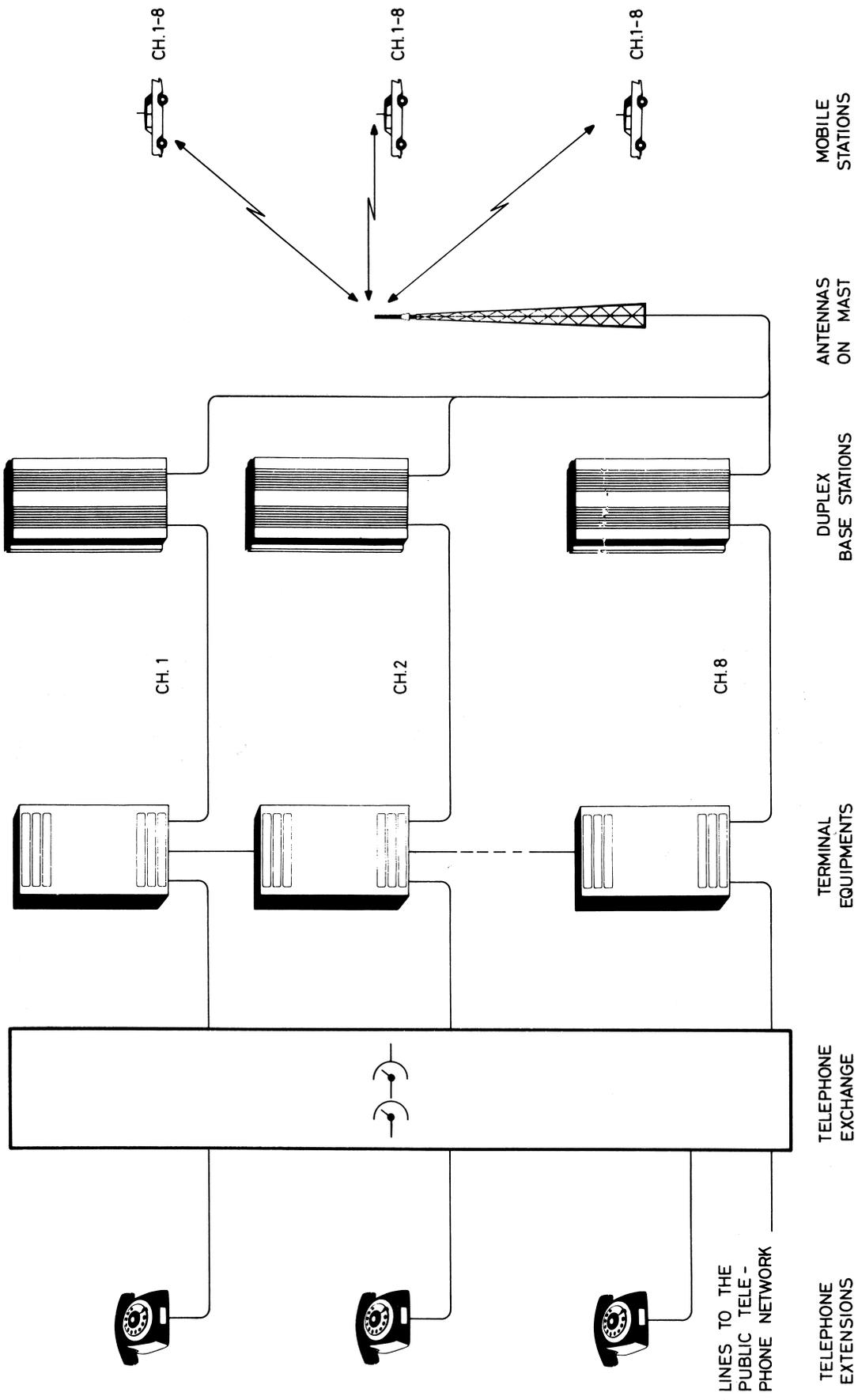
Index	Page
1. General	1
2. Traffic	1
3. Channels and channel scanning	2
4. Signalling	2
5.1 Calling a mobile station	4
5.2 Calling from a mobile station	5
6. Limiting of conversation period	6
7.1 The base station	8
7.2 Diversity reception	9
7.2 The terminal unit	10
7.4 Junction panel	11
7.5 Connections to telephone exchange	11
7.6 Special connections	12
7.7 Mobile equipment	13
Control panels for base stations	
List of contents	

COM6XY-2004

CGF6XY-2004

TE 680-2004

PABX



	model / type CG/MJS part no. 20.10.72	code CAF680-2004	TEGN. N° D401526 2 3
	SYSTEM LAY-OUT AUTOMATIC MULTICHANNEL RADIO TELEPHONE SYSTEM		

CAF680 - 2004
AUTOMATIC MULTICHANNEL
MOBILE RADIOTELEPHONE SYSTEM

1. General

This mobile telephone system makes direct dialling of a telephone subscriber from a mobile VHF/UHF station possible. Conversely, any mobile station linked to the telephone network can be called directly from a wired telephone subscriber.

Thus, the traffic is fully automatic and is handled via several unattended base stations operating simultaneously, each on its own channel.

The purpose of this system is to create a reliable and flexible communications system in areas having large concentrations of traffic while making use of the existing forms for telecommunication to facilitate traffic between mobile and wired subscribers via a base station.

Principally, the system is designed for use in conjunction with a telephone network within a defined area where all the base stations are linked to the same telephone exchange. However, there is nothing to prevent setting up networks to cover larger areas, as parallel systems linked to their individual exchanges can be employed.

2. Traffic

The network traffic is propagated over a pair of corresponding channels; selection of traffic channel is accomplished according to the random access principle, the traffic being randomly distributed over all of the channels.

When in the standby condition, the mobile unit scans all the channels. The channel selector will stop at a particular channel upon:

- a) receiving a selective tone call from a base station

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- b) initiating a call from the mobile unit, which then seeks out an idle (free) channel.

The system allows the following choice of calls:

- a) stationary (wired) to mobile subscriber
- b) mobile to stationary subscriber
- c) mobile to mobile subscriber.

The system also guarantee complete conversation privacy as it is not possible to connect into a channel that is already occupied.

3. Channels and Channel scanning

The number of channels in a particular system will be determined by the traffic capacity desired, in other words the number of mobile stations. Utilised to its fullest, the system can accommodate 8 channels.

The mobile unit scans 8 channels in sequence, no matter how many of them are in operation in the system. A strapping arrangement bypasses those channels that for some reason are not being employed in the system.

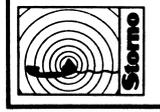
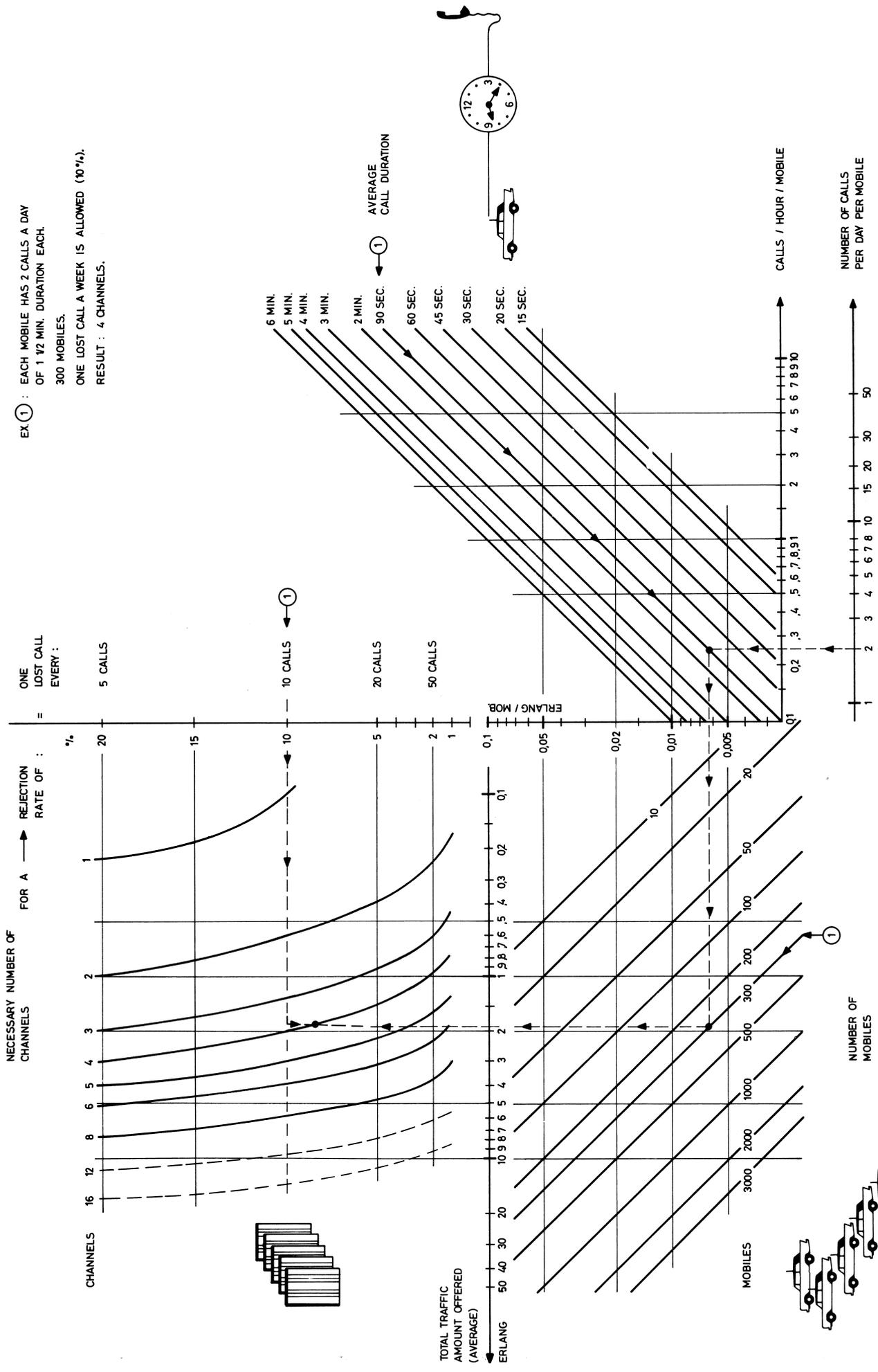
The scanning period for each channel is 50 ms, total channel scanning time for 8 channels is thus 400 ms. The call signal for selective calling of a mobile station begins with a tone signal of 500 ms duration, time enough for the mobile channel scanner to find and stop on the channel over which the call is being sent.

4. Signalling

All signalling between the telephone subscriber, the exchange equipment and the terminal equipment is done as in an ordinary telephone network. In the radio end, all signalling is transmitted as tones within the voice frequency range, a distinction being made between the following types of signals:

- 4.1 Selective calling to mobile stations, based upon a 4 (or 5) - digit sequential tone signal employing the CCIR recommended series of tone frequencies.

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CALCULATION OF TRAFFIC HANDLING CAPACITY
IN MOBILE RADIO NETWORKS

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- 4.2 Automatic acknowledge signal from the mobile unit when called. This is a double toned signal using frequencies in accordance with CCITT standards. The frequency of the tone signal can be changed by means of a push button, which then switches the automatic answering provision in from the base station.
- 4.3 Calling and dialling mobile units is performed with a rapid tone system based upon the CCITT recommended two-tone code. Initiating a call (lifting the handset), dialling of digits (0-9) as well as the clear down signal are all included within the same tone system which is designed so that all digits can be transmitted in rapid succession by activating the various push buttons on the digit keyboard. The total number of digits in any call number is limited to 15.
- 4.4 The signals for mobile identification (M.I.) are based upon the same tone system that is used for digit signalling. When a mobile station calls, a sequence of 6 (or 8) two-tone combinations, each combination lasting 50 ms, is automatically transmitted. Of these, 3 (or 4) tone signals indicate the digits in the mobile unit's call number, and each digit signal is followed by a fixed tone combination so as to separate the individual digits.

The received M.I. digits are then registered in the base station terminal equipment. At the end of a call that has been initiated by a mobile subscriber the subscriber's call number is read out via a relay. In that way, the system can readily be connected to subscriber metering equipment (debiting equipment), if desired.

In order to positively identify the vehicle to be debited for the call, the received M.I. number is transmitted back to the mobile unit as a selective call. Then, a through connection to the exchange is established only after a selective call acknowledge signal is received.

- 4.5 When a call from a telephone subscriber goes through, an intermittent ringing tone signal is sent from the terminal equipment. The tone frequency toward the telephone subscriber is 425 Hz while the ringing tone to the mobile subscriber is 1022 Hz. Also, the 425 tone is sent as a warning tone (clear

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down notice signal) to both the wired and the mobile subscriber prior to being automatically cleared down upon expiration of a predetermined conversation time (refer to sec. 6).

4.6 Other signals sent over the radio link, such as dialling tone, busy tone, ringing tone, number-unobtainable tone, etc. are transmitted from the telephone exchange without being converted.

5. Initiating calls and handling traffic

5.1 Calling a mobile station (see D401.567)

The telephone subscriber dials the mobile station's number just like dialling any ordinary subscriber's number.

When the first group of digits, determining that it is a call to the mobile radio system (radio access number), is dialled the group hunting equipment in the exchange switches the connection via the interfacing units to an idle radio channel terminal unit.

The terminal equipment converts the dialling pulses representing the last 3 digits of the mobile subscriber's call number to a sequential tone signal which is then transmitted automatically. This signal comprises 4 tones, the first of which is always the same for any selective call signal and its duration is longer than the other tones. The purpose of this first tone is to cause all scanning mobile units to stop on that particular channel before transmitting the 3-tone digit for selective calling.

If no acknowledge signal is received from the mobile station that was called, the exchange equipment sends a busy signal back to the calling subscriber and the radio channel employed is released again. If the vehicle acknowledges, the caller hears the ordinary ringing signal which originates from the terminal unit.

The loudspeaker in the mobile unit turns on at the same time as the call indicator lamp lights up. An audio call signal can then be heard. When the mobile subscriber answers the call by keying his transmitter the ringing and calling signals cease.

The connection can be terminated by either subscriber whereby the circuit clears down, the carrier wave on that channel disappears and the mobile unit becomes blocked, allowing it

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to return to its standby condition where it begins automatic channel scanning again.

Since all mobile stations in service that do not have a call in progress stop on the particular channel from which a selective call is being transmitted, calling over more than one channel at a time is impossible. However, the system can accept dialling information from several wired subscribers simultaneously. The stored, selective calls are then transmitted in random order on one channel at a time.

5.2 Calling from a mobil station to a wired telephone subscriber

The mobile operator initiates a call either by pressing the call button (✕) or by lifting the handset. Channel scanning then stops at the first idle channel (namely, with no carrier wave present).

The call tone combination is then transmitted and is marked as a call in the stationary terminal equipment. The base station then acknowledges the call signal with a single tone signal indicating that the channel is free (idle).

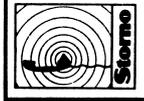
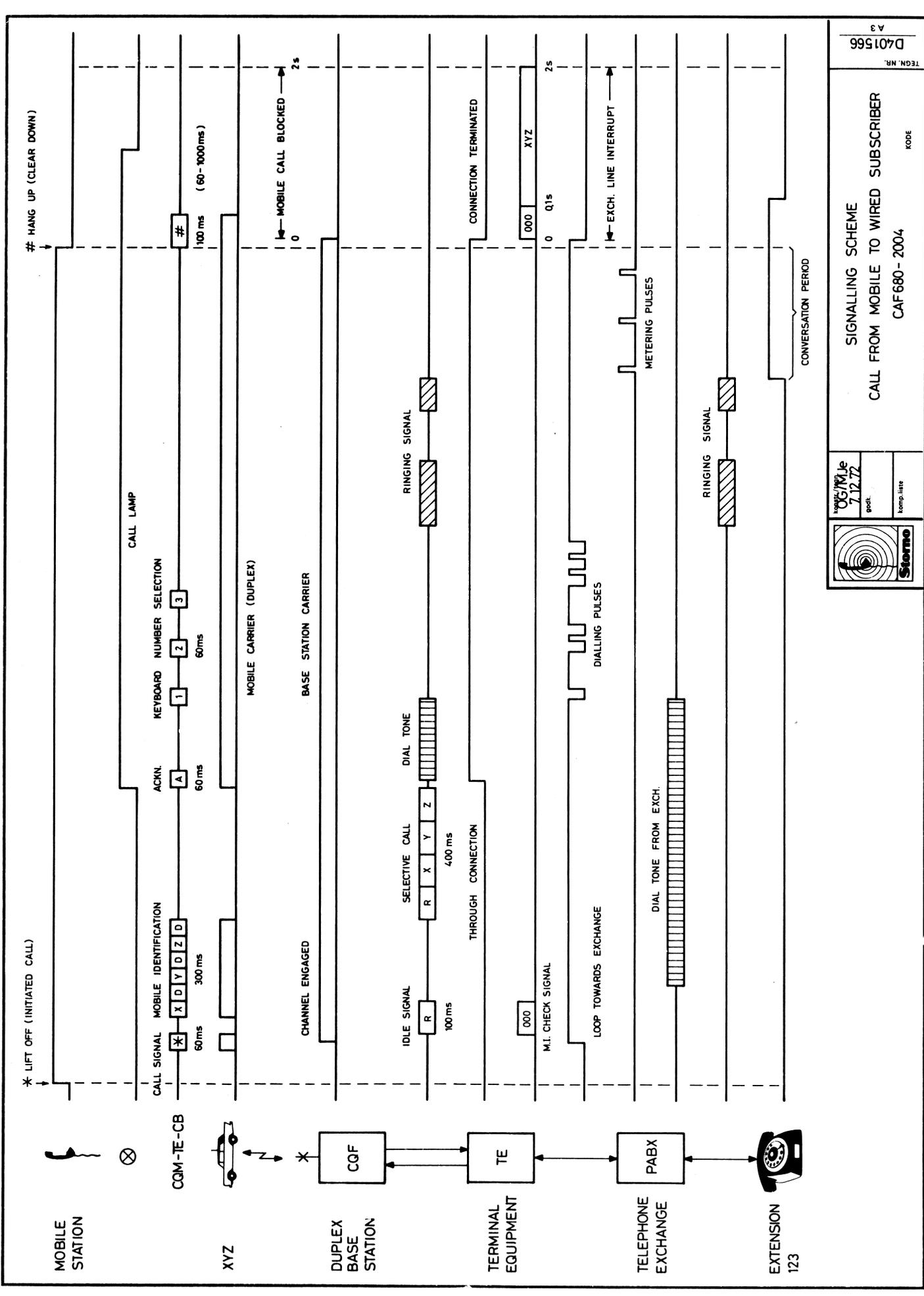
Receipt of the channel idle tone activates the mobile identification generator in the mobile unit. A decoder circuit in the base station registers the identification number. The received M.I. number is then transmitted back to the mobile unit in the form of a tone sequence signal, activating the mobile station's loudspeaker.

The mobile station acknowledges with a double tone signal, which causes the terminal unit in the base station to switch through to the exchange equipment. The dialling tone from the exchange is then heard in the loudspeaker and dialling can begin.

The number is transmitted one digit at a time in rapid succession by entering them into the digit keyboard. A register in the base station terminal equipment stores the digits and converts the pulse trains, sending them via the interface stage to the exchange at a speed that the exchange can accept (e. g. 10 Hz.)

Subsequent ringing or busy signals are heard by the mobile sub-

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TEGN NR. D401566
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SIGNALLING SCHEME
CALL FROM MOBILE TO WIRED SUBSCRIBER
CAF 680 - 2004
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scriber.

As an option a mobile station can also be equipped for automatic dialling of fixed, predetermined call numbers. Each mobile station then has a choice of any five call numbers (8 digit capacity) in the autodialling mode.

Autodialling is begun by pressing the (A) button. Next, after receipt of a dial tone, the actual subscriber call number is transmitted upon pressing one of the five keyboard buttons serving as number selectors.

In both modes, clearing down from the mobile end is done by punching the (#) button or by hanging up the handset, which causes a clear down signal to disconnect the base station equipment.

5.3 Calling from one mobile subscriber to another

Calling is performed by dialling the B-subscriber's number, as described in the preceding section. The traffic will then be handled over two separate channels, and the traffic mode can be either semi-duplex or full duplex. Clearing down is also accomplished as described earlier.

6. Limiting of conversation period and automatic clearing down

- 6.1 For each channel there are two metering circuits which, based on metering of elapsed time, are employed for automatically coupling down of an established connection. The criteria for automatic coupling down are as follows:
- 6.2 One of the timing units monitors the conversation time. Limiting of conversation time can, via a strapping arrangement, be preset to any fixed length of time between 0.5 and 7.5 min. by 0.5 min. intervals.
- 6.3 Time metering begins when a channel becomes occupied. If, afterwards, no dialling occurs or the subscriber being called does not answer the call within the determined conversation time for the system in question, a clear down notice signal will be sent and shortly after the connection will be automatically cleared down.
- 6.4 If the call goes through, the occupancy time meter is reset, allowing a conversation for the full period of time for which

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the timing unit is set.

When the conversation time expires the equipment registers the fact and if all the channels within the system are occupied the clear down notice signal is sent to the conversing parties. Ten seconds later the connection is cleared down.

- 6.5 After clearing down from the occupied condition, a channel will be blocked for reception of calls from the exchange or from a mobile station for 2 seconds to ensure that any mobile unit that happens to be linked in to the channel has time to disconnect.
- 6.6 If, at the expiration of conversation time, there is at least one channel idle no clear down notice signal is sent, nor does automatic clear down take place and the conversation can continue uninterrupted. At this point it is possible for another timing unit to start. This second timing unit starts up if no carrier wave is received from the mobile unit.
- 6.7 If no carrier wave is received from the mobile unit for a period of time that can be set by increments of 10 seconds to anywhere between 10 and 150 seconds, the clear down notice signal is sent.
- 6.8 As long as the mobile transmitter is keyed within 10 seconds thereafter the conversation can continue until once again no mobile carrier is received within the stipulated time.
- 6.9 If, after the predetermined conversation time ends, all channels have become occupied, automatic clear down will take place after sending the clear down notice signal, no matter whether the mobile transmitter is keyed.
- 6.10 If, after answering a call from a mobile unit, a wired subscriber hangs up the second of the two meters just mentioned will be connected into the circuit. In that case, the connection will be compulsorily cleared down upon the expiration of said unit's preset time interval, whether or not conversation time is up, there are idle channels, or the mobile station is transmitting a carrier wave.

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7. Equipment

7.1 The base station

The base station includes the transmitter/receiver equipment, CQF6XY-2004 itself, along with its accessories and antenna system, as well as the terminal equipment for connection to a fully automatic telephone exchange.

System lay-out diagram D401.522 shows an example of the composition of a base station having 4 channels equipped for diversity reception and debiting.

The system upon which the base station is built is very flexible, consisting principally in similar ranks of equipment for each channel. For each channel a terminal unit with a transmitter/receiver section and remote line control equipment, CP680-2004/OX, is used. Thus, the system can easily be expanded with more channels when the need for more capacity is apparent.

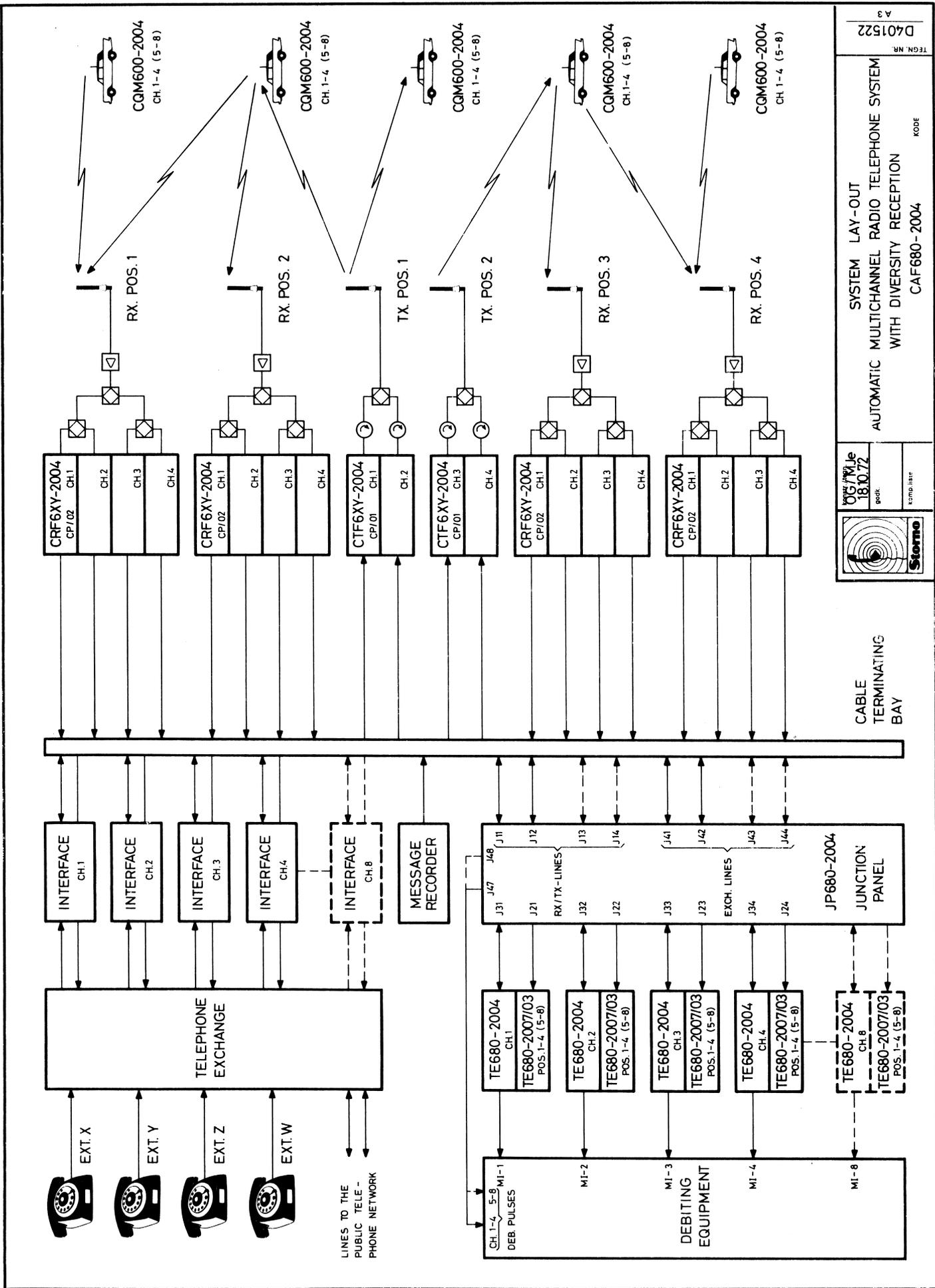
The make-up of the base station antenna system for each project must be built up individually, depending upon number of channels, antenna mast, desired area coverage and other considerations.

The antennas may either be mounted above each other at the top of the mast or along side each other on a crosspiece. Where several transmitter antennas must be located on the same mast, the distance between the individual antennas should be made as great as possible in order to achieve sufficient isolation between them.

Possibly, several antennas might be coupled together with 3 dB couplers or other special antenna coupling equipment. In certain cases a common PA stage can be employed for connecting several channels to the same antenna. To prevent any intermodulation in the transmitter output stages, a circulator should be inserted in each individual transmitter's antenna system.

The choice of transmitter and receiver frequencies for the system is a determining factor whether the maximum number of channels used can operate within the same area without in-

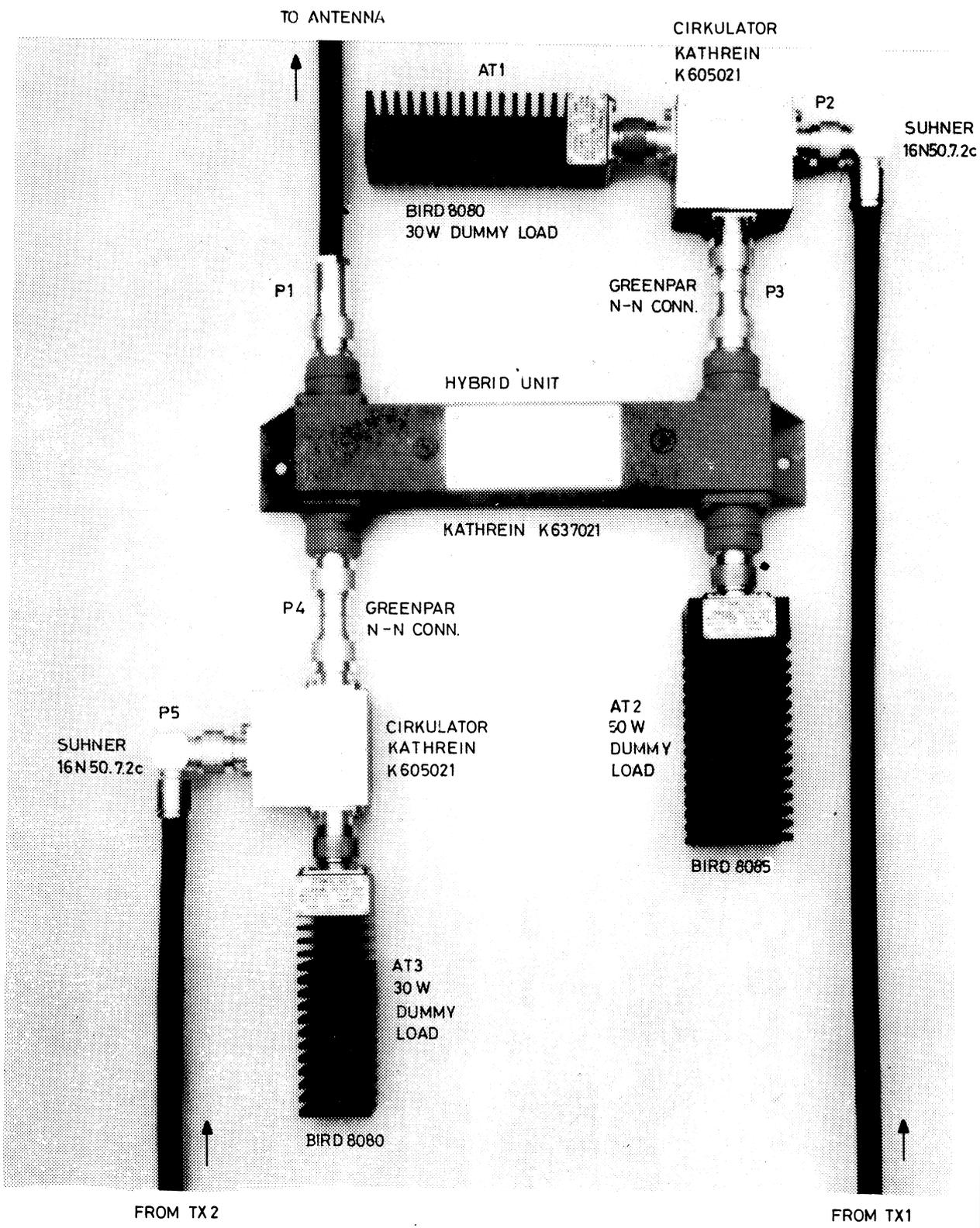
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TEGN NR D401522 A3

SYSTEM LAY-OUT
 AUTOMATIC MULTICHANNEL RADIO TELEPHONE SYSTEM
 WITH DIVERSITY RECEPTION
 CODE CAF680-2004

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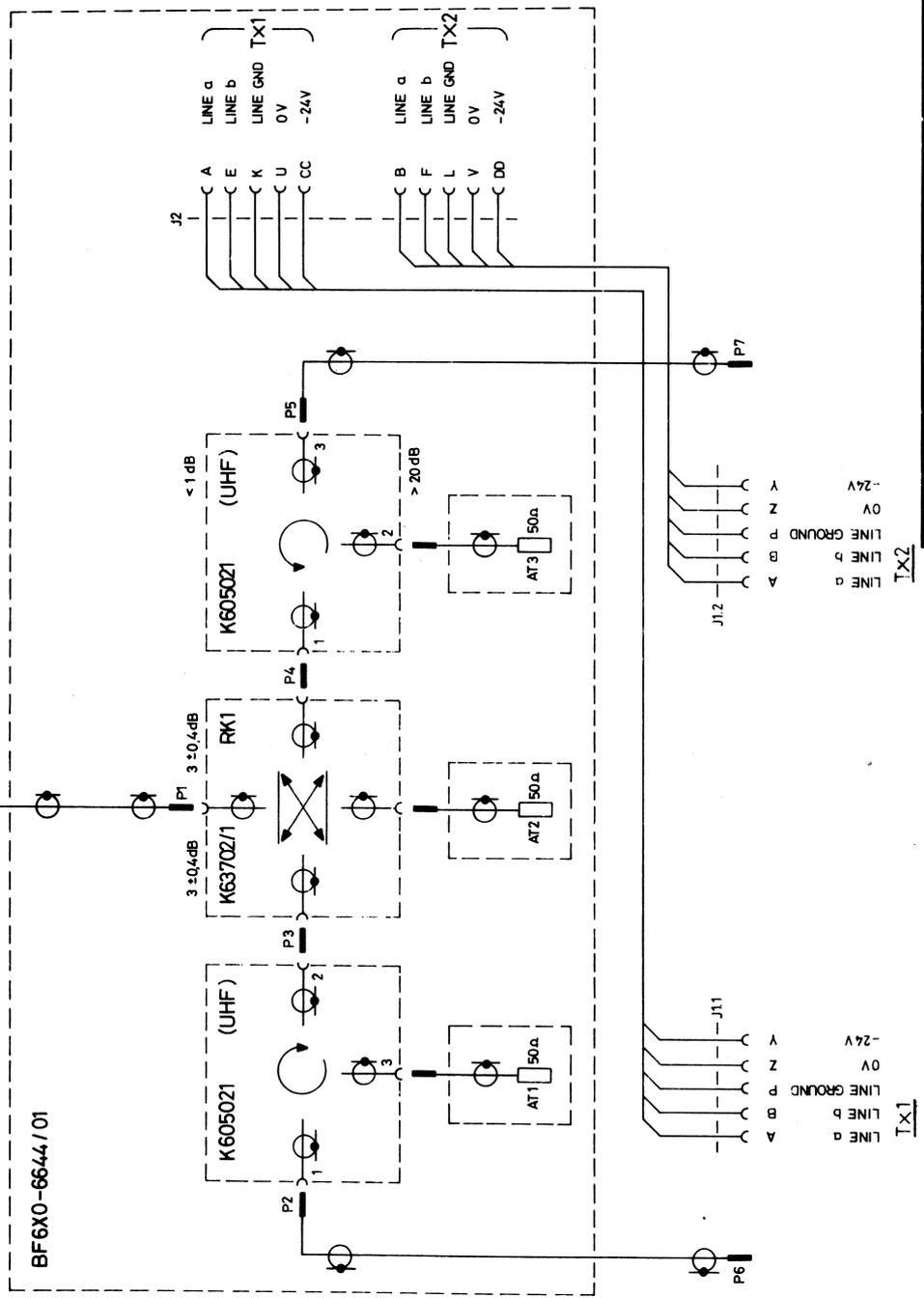
LAY - OUT
ANTENNA BRANCHING NETWORK FOR
TWO UHF TRANSMITTERS
BF660-6644 / 01

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D401777
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ANTENNA BRANCHING NETWORK
FOR 2 UHF TRANSMITTERS
BF660 - 6644 / 01

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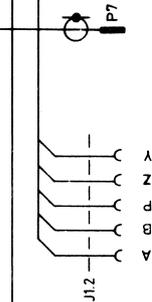
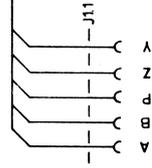


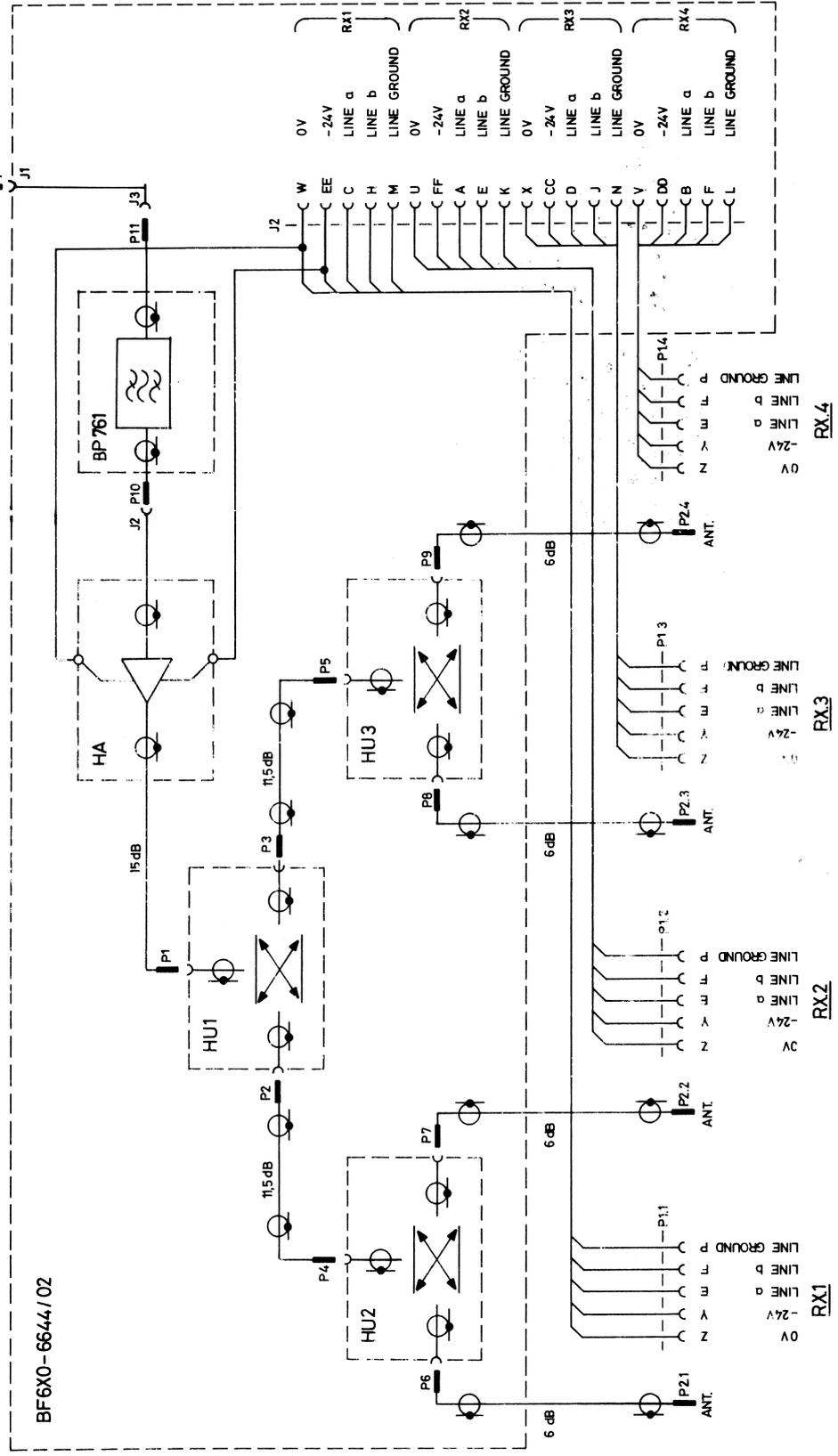
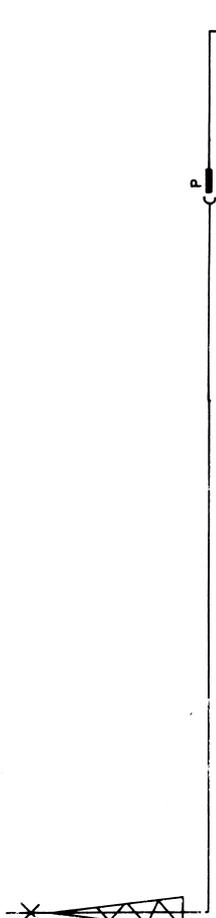
TX1

TX2

LINE a
LINE b
LINE GND
P
Z
OV
-24V

LINE a
LINE b
LINE GND
P
Z
OV
-24V





BF6X0-6644/02

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ANTENNA BRANCHING PANEL
FOR 4 UHF RECEIVERS

BF660-6644/02

Logo for Schematics, Inc. with the text "Schematics" and "Inc." inside a stylized graphic. To the right, the drawing number "D122707" is printed vertically.

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TEGN. NR. A3

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terfering with each other or with other users of the radio services in your area.

Interference (intermodulation) arises as a result of two radio signals being mixed in a nonlinear circuit, say in a transmitter output stage or in a receiver input stage. Within a given frequency band, we are only interested in intermodulation originating from mixing with the third or fifth order of a frequency, as these are the harmonics that can appear within the same frequency band as the fundamental.

Intermodulation in the transmitter output stages are sought avoided in the first instance partly by physically separating the transmitter antenna as much as possible, and partly by inserting circulators in the antenna leads.

On the other hand, intermodulation in a receiver's input stage can arise anywhere two signals are received and where both signal strengths are greater than the minimum called for by the receiver's sensitivity. That means anywhere within the area covered by the system.

In order to restrict the possibility of forming 3rd harmonic intermodulation products one must, when planning a 2004 radio system, carefully choose frequencies according to a definite pattern, taking into account how many channels the system should be able to be expanded to in all.

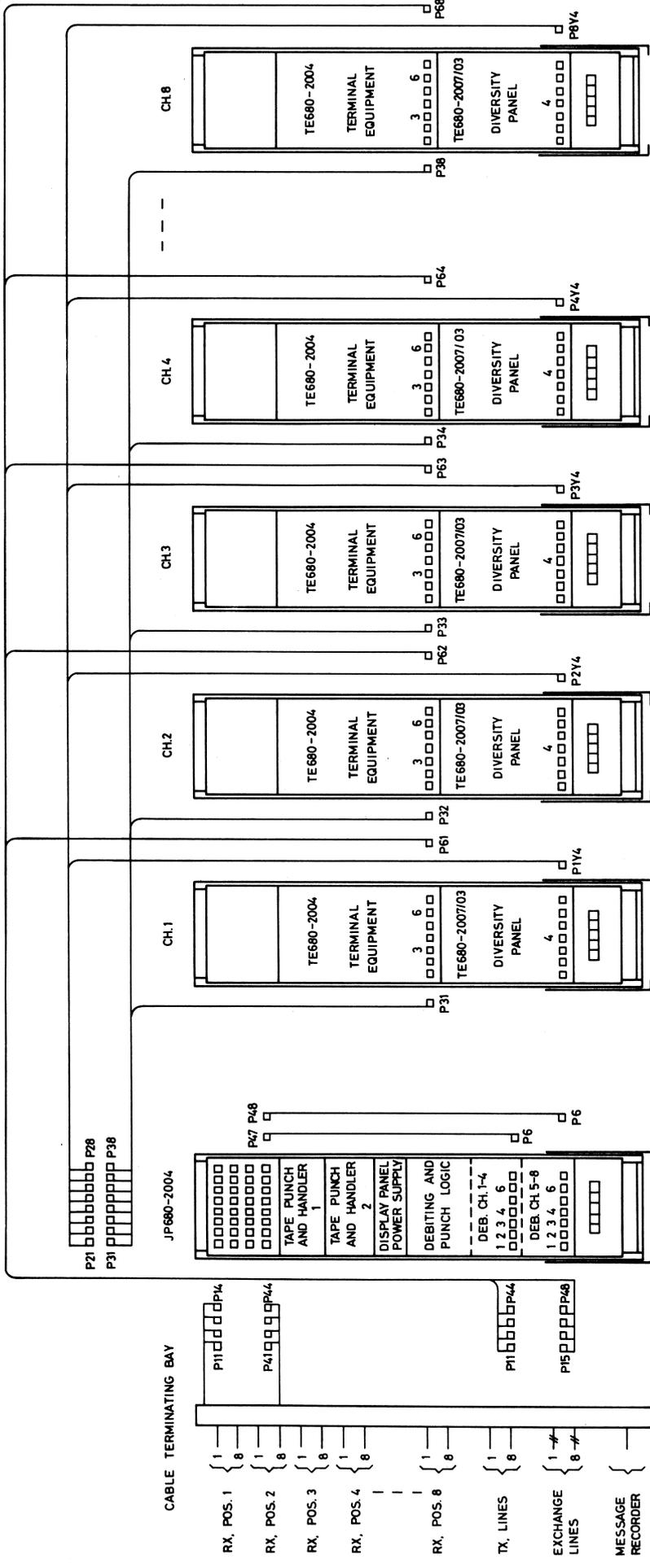
The transmitter/receiver equipment is remote controlled via 2 pairs of telephone lines and can be placed together at one site (CQF) or they can be located at two different positions (CTF6XY-2004 and CRF6XY-2004).

All base station equipment operates on 220 V 50 Hz AC. Besides, transmitters and receivers can, on request, be equipped for 24 V DC operation.

7.2 Diversity reception

By supplementing the base station with receivers placed in forward locations in a diversity arrangement the area coverage of the system can be greatly increased, as this mode attains better balance between the range of the base station and that of the mobile stations.

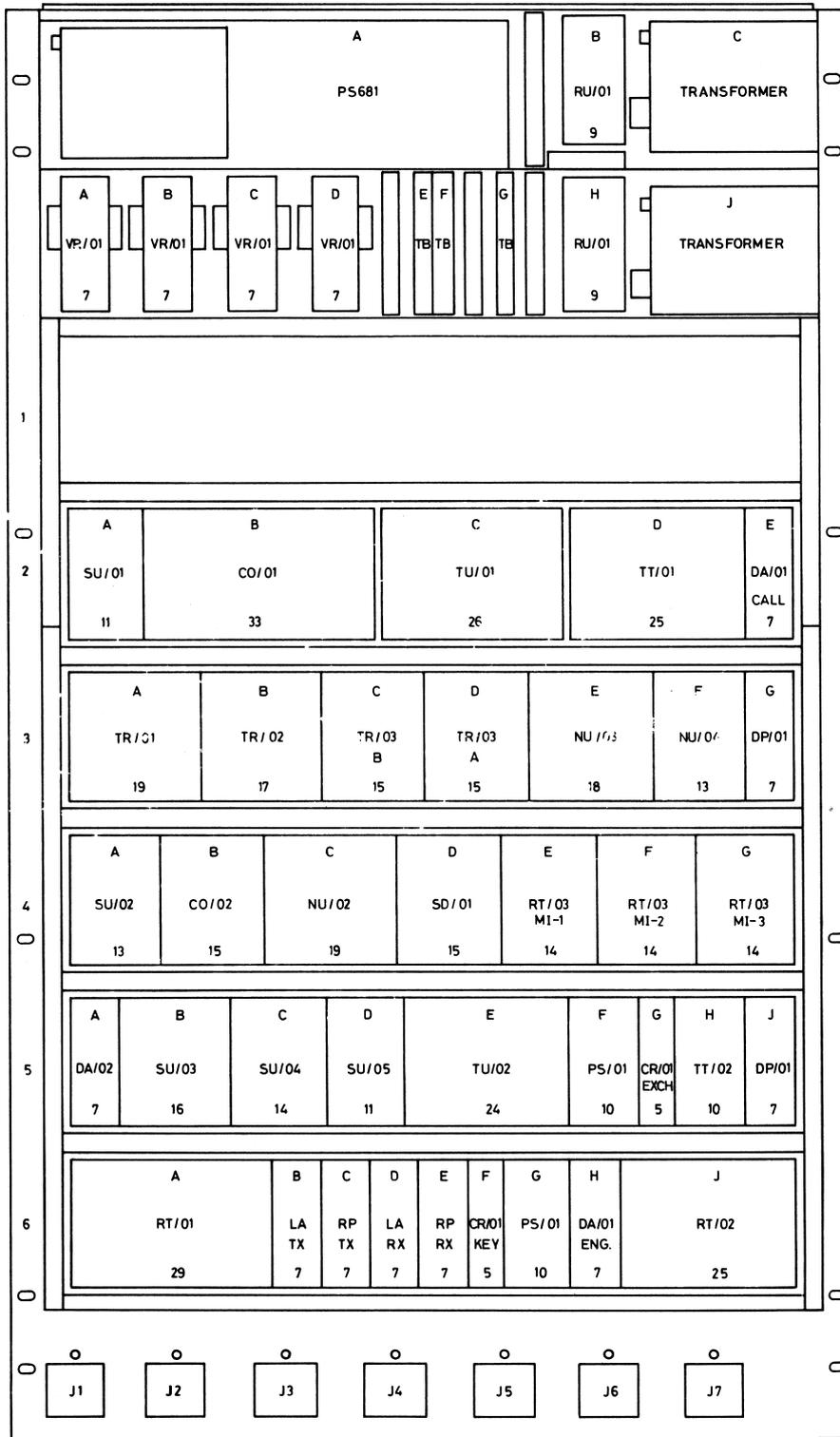
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LAY - OUT
 INTER CABLING OF TERMINAL EQUIPMENT
 CAF 680 - 2004

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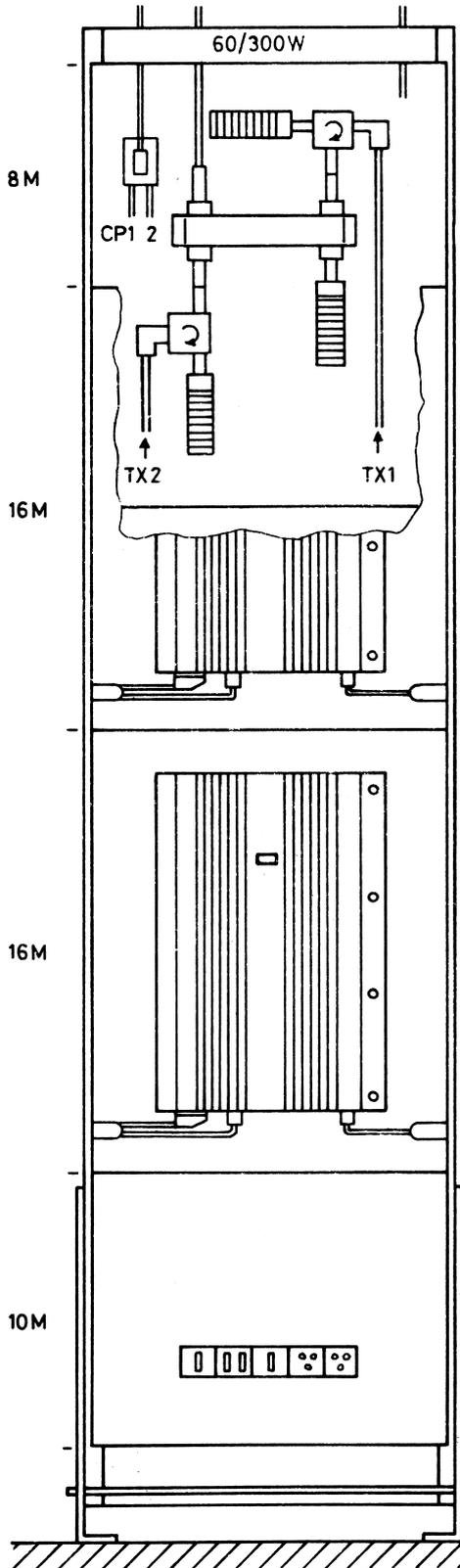


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LAY - OUT
 TE680-2004

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2 x LINE 1 ANTENNA 220V AC

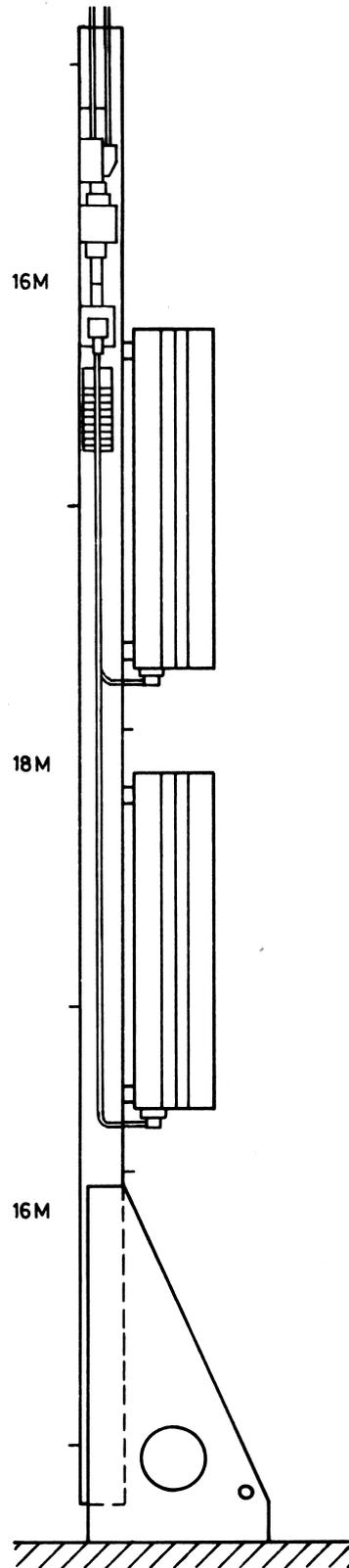


ANTENNA BRANCHING FOR 2 TRANSMITTERS BF6X0 6644/01

CTF6XY-2004 CHANNEL 1, 3, 5, 7

CTF6XY-2004 CHANNEL 2, 4, 6, 8

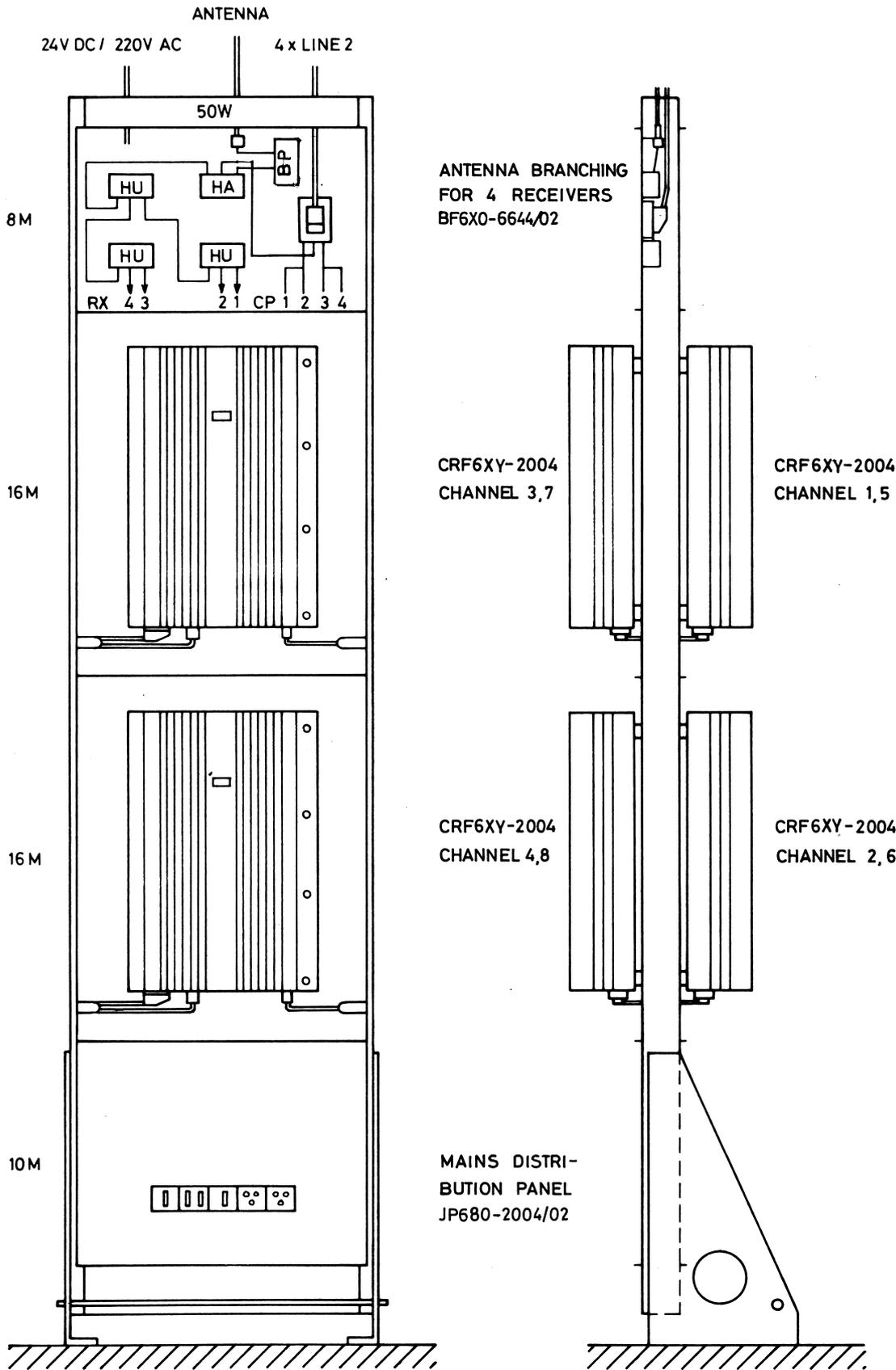
MAINS DISTRIBUTION PANEL JP 680 2004/02



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OG/MJe
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BAY LAY-OUT
 BASE STATION TRANSMITTERS
 FOR 2 CHANNELS
 CAF680-2004

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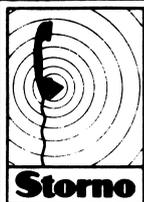
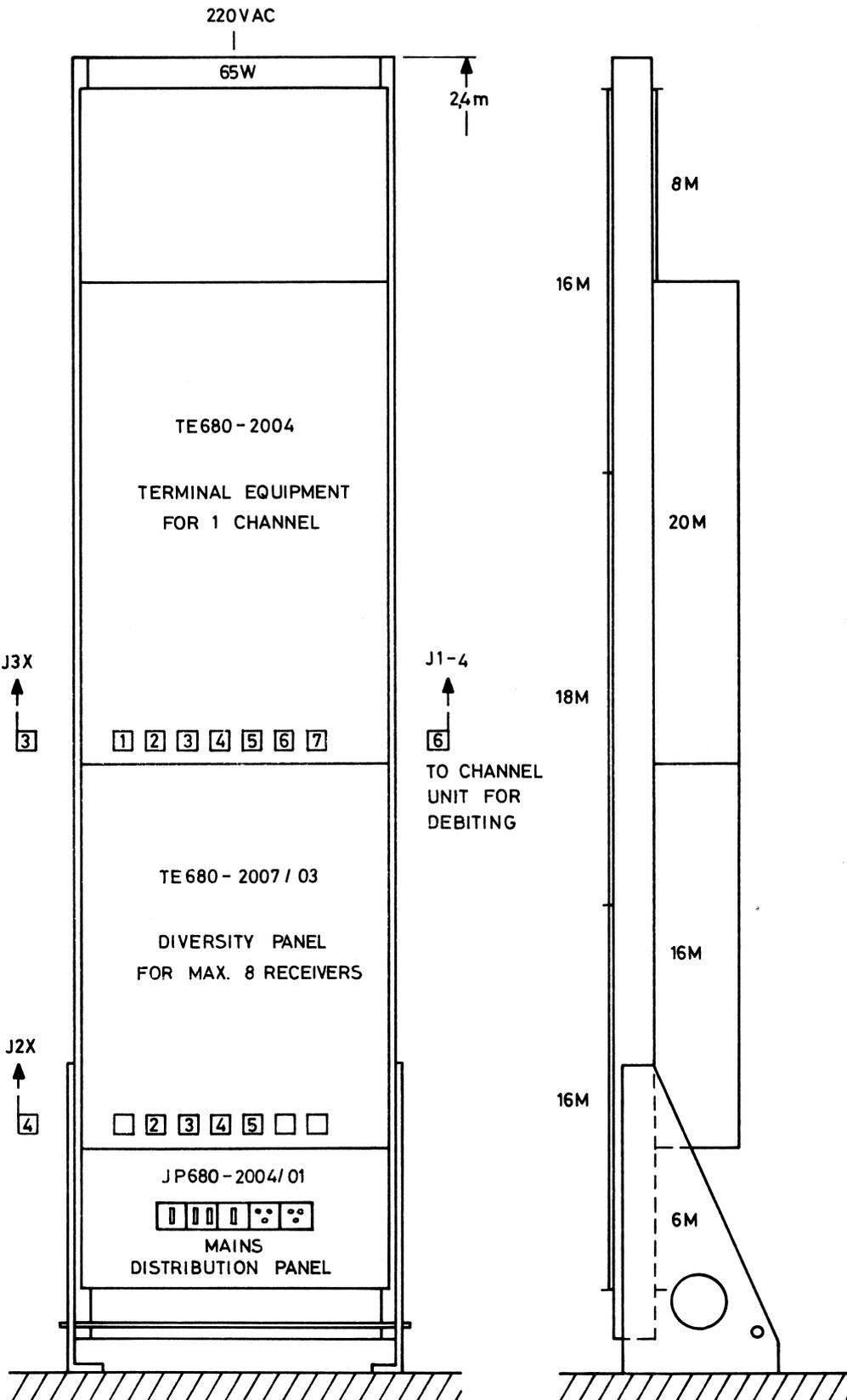


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BAY LAY-OUT
 BASE STATION RECEIVERS
 FOR 4 CHANNELS
 CAF680-2004

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D401437
 A 4

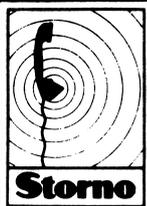
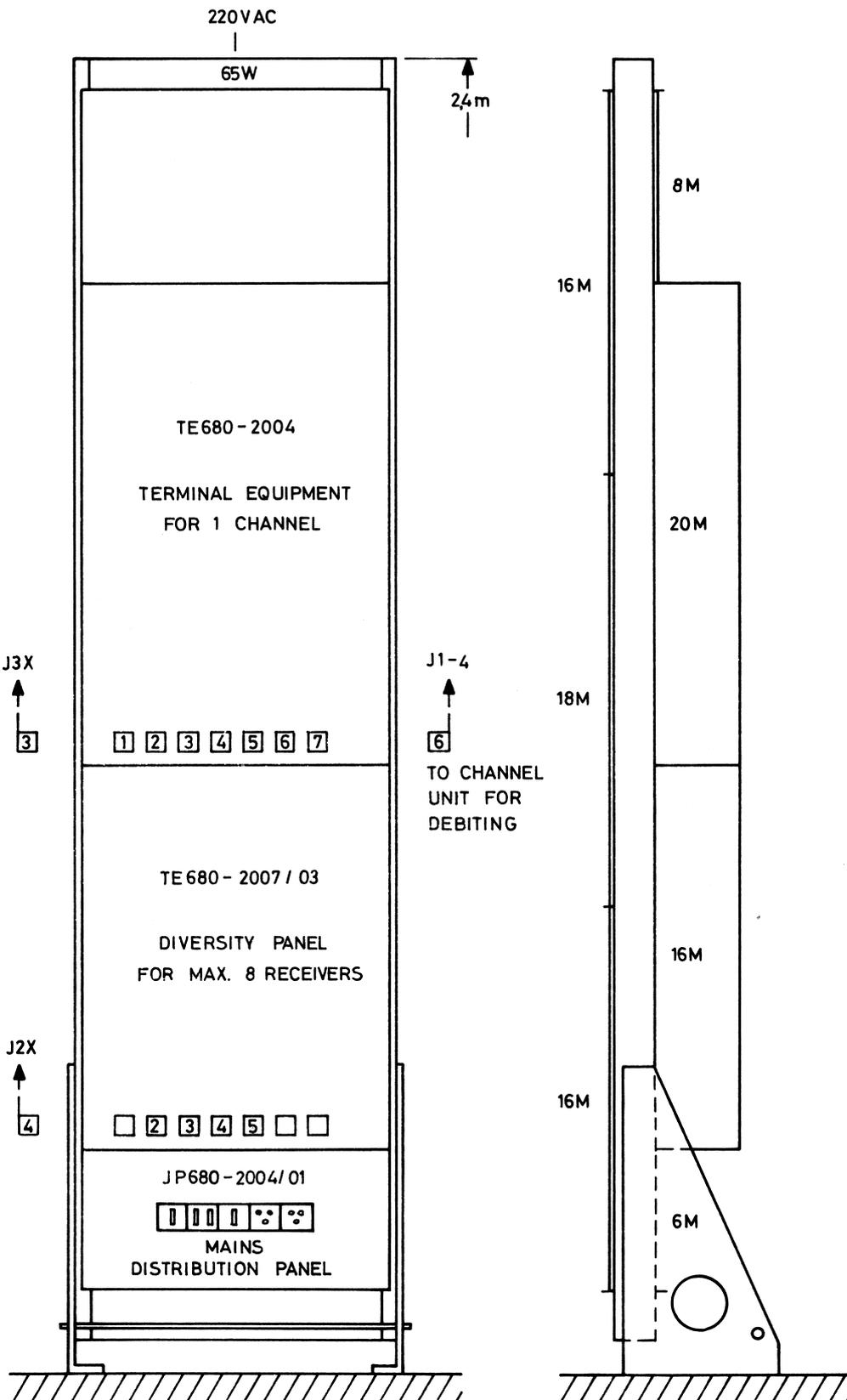


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BAY LAY-OUT
TERMINAL EQUIPMENT AND
DIVERSITY PANEL FOR 1 CHANNEL
CAF680-2004

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BAY LAY-OUT
 TERMINAL EQUIPMENT AND
 DIVERSITY PANEL FOR 1 CHANNEL
 CAF680-2004

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 A4

In diversity reception TE680-2007/XY is employed in connection with TE680-2004. The control panel, CRF680-2004, is suited for direct use in a diversity system.

Where lines from the receiver locations do not have DC connections, the TF680-2007/XY should be altered by being fitted with 2008 units to achieve AC diversity.

AC diversity requires a special control panel in the CRF. One receiver, CRF6XY-2004, is required per channel at each receiver site. By means of an antenna amplifier (HA) and a distribution network (HU) all receiver channels can be connected to the same antenna.

Where receivers are located in the proximity of a transmitter it is recommended that a band-pass filter (helix-filter) be inserted between the antenna lead-in and the antenna amplifier.

7.3 The terminal unit

The TE680-2004 is mounted on a baseplate that is 20 standard rack module units high (1 module unit = 1 3/4") and is designed to fit into a standard 19" rack.

The terminal unit includes circuits for connecting together the speech circuits between the base station and the exchange equipment and circuits for tone signal transferring and for controlling the system functions.

30-way TFA connectors that plug into the rear of the terminal unit are employed for connecting cables from the exchange interface circuits (P2), terminal units from the other channels (P4, P5) and any connecting debiting equipment (P6).

All connections are electrically isolated from the terminal unit power supply by means of relays, transformers or optic coupling devices.

In order to obtain a secondary power supply for the optic devices used in interface signalling between the terminal units of the various channels a connector (P5), wired to make strapping connections, is plugged into the terminal unit for channel 1.

At the time of installation, another connector (P4) is wired for strapping connections and fitted with resistors for matching to

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the type of telephone exchange in use.

To accommodate customer desires for special modifications and options the terminal unit comes with an empty panel on which extra units can be mounted and two extra connectors (P1 and P7) are supplied with the equipment.

7.4 Junction panel

The JP680-2004 consists of a baseplate, 8 modular units high, fitted with 4 rows of 8 TFA connectors (see diagram D401.577). This unit can be used to connect terminal units with diversity equipment, TE680-2007, debiting equipment, various external optional equipment and lines to the exchange (perhaps via the exchange main distribution frame) and to the base station equipment. Refer to diagram D401.525.

Where the terminal equipment is wired together directly with cables to each terminal unit, without the use of a JP, the strapping arrangements and matching resistors from P4 and P5 mentioned in item 7.3 must be wired in along with the cabling.

7.5 Connections to the telephone exchange

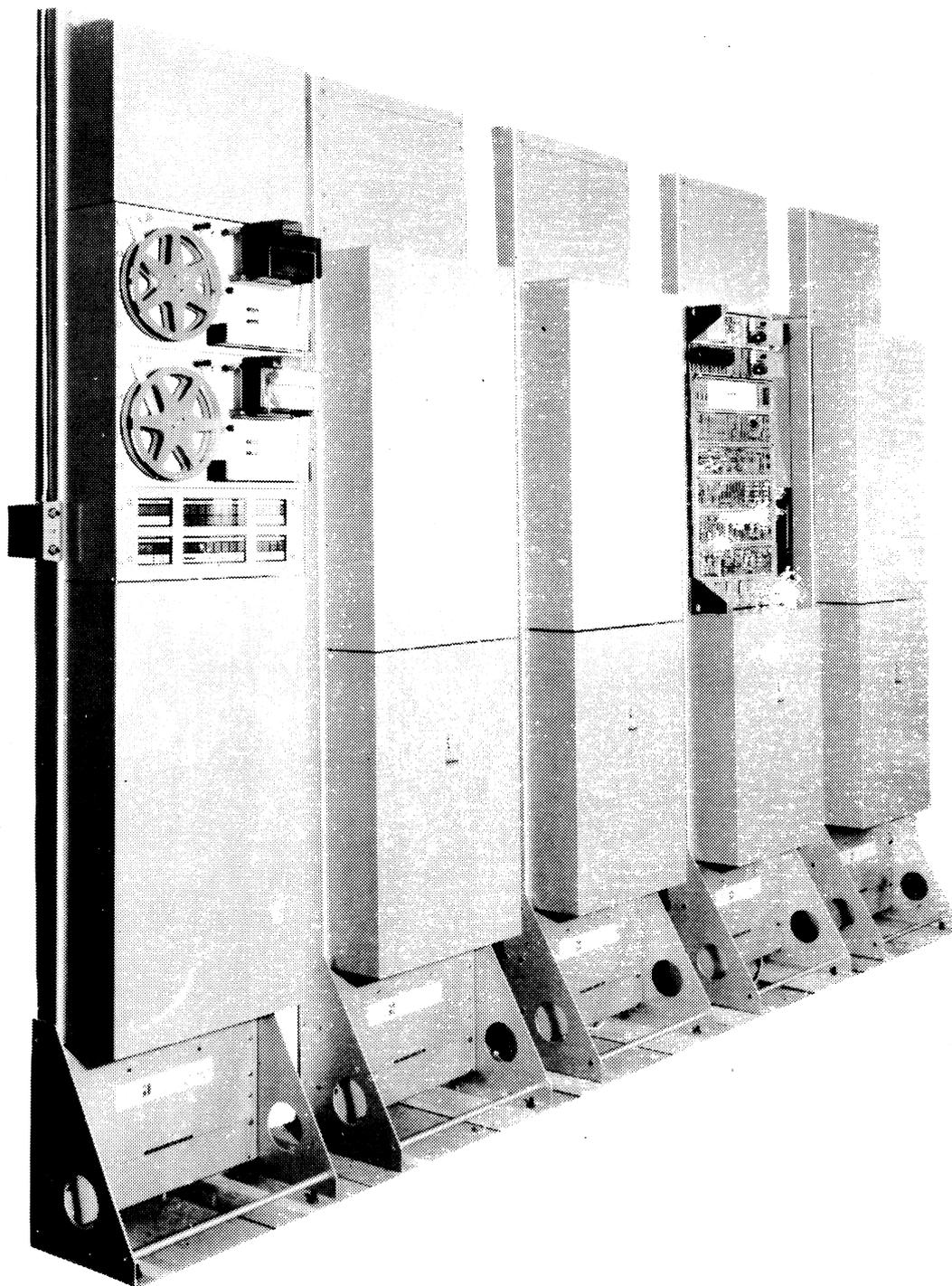
For each installation, connecting of the terminal equipment to the telephone exchange (PABX) also entails individual matching of the equipment to the exchange involved.

For automatic selection of idle lines to the radio system terminal equipment it is also necessary for the exchange to include a so-called group hunting arrangement with a maximum of 8 simultaneous connections.

In addition, the exchange needs also to be equipped with a suitable type of bi-directional transfer (interface) unit with paired wire connections to the terminal unit. One interface unit is required for each channel.

Calling between the exchange and the terminal equipment can be accomplished by establishing a loop or a voltage (current) connection from the calling end. The calling mode from the exchange end can differ from that from the terminal end and vice versa. Refer to drawing D401.597.

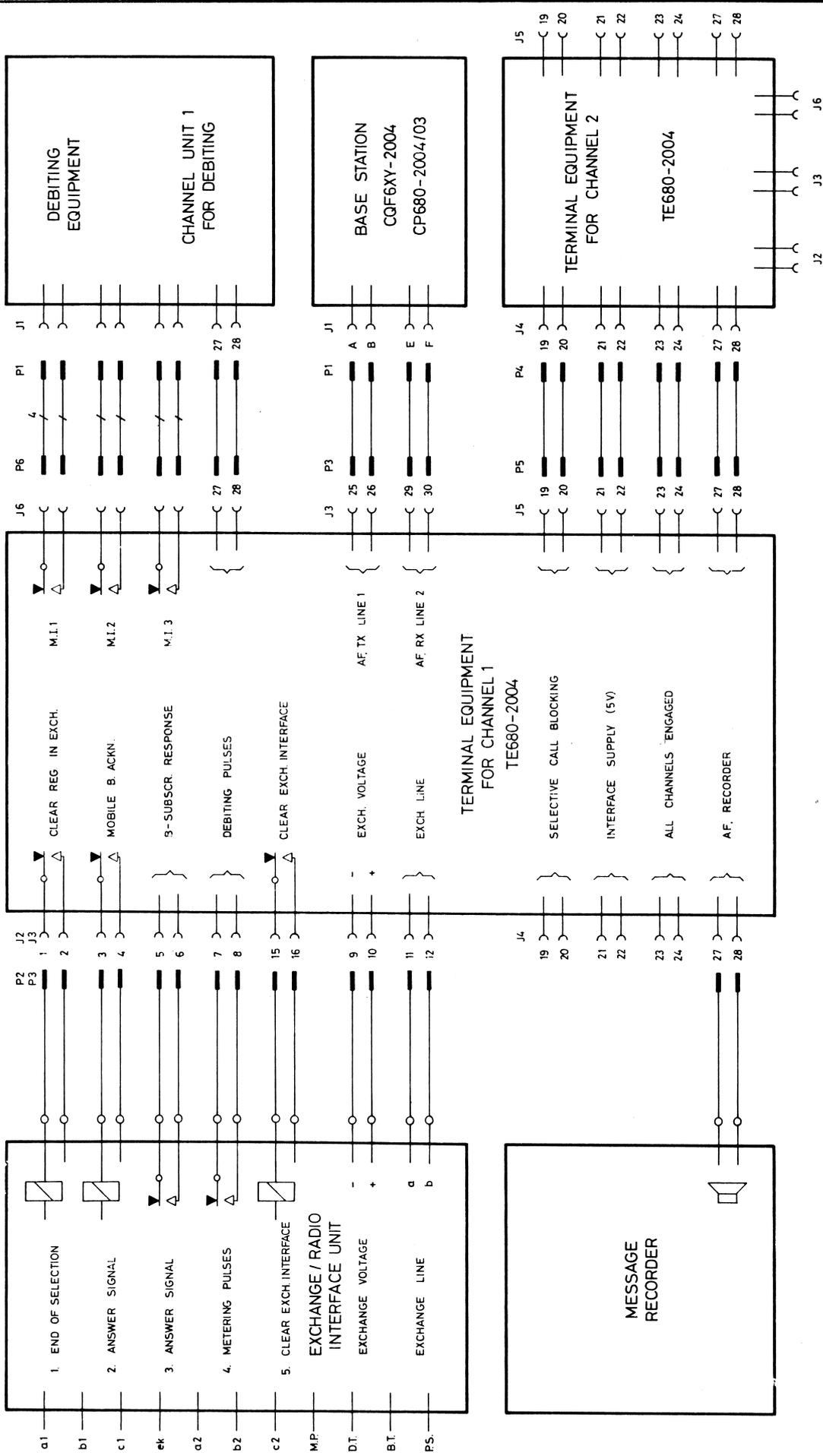
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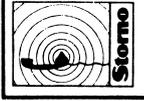
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DEBITING AND TERMINAL EQUIPMENT
AUTOMATIC MULTICHANNEL
RADIO TELEPHONE SYSTEM
CAF 680-2004
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TEGN. NR.
D 123.983
A 4



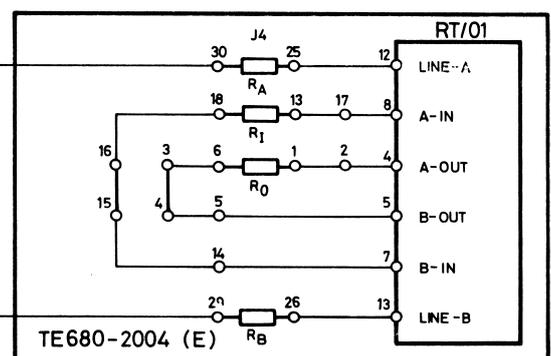
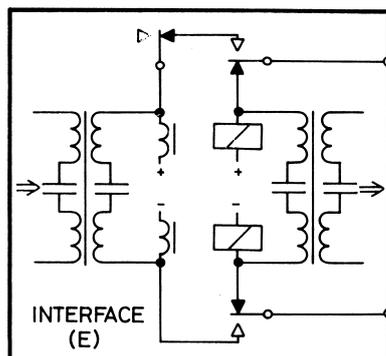
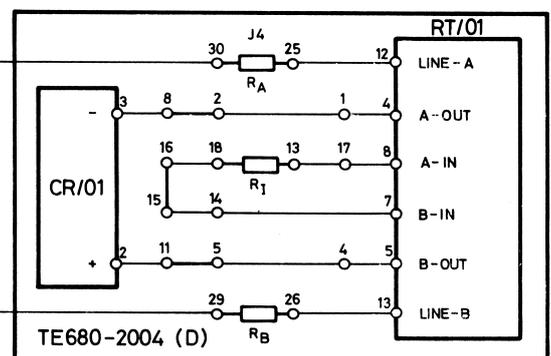
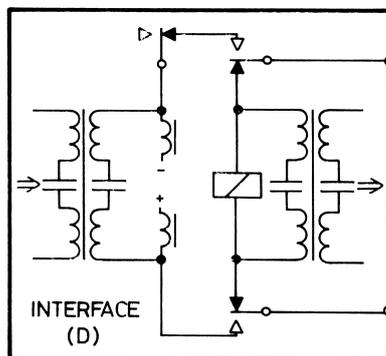
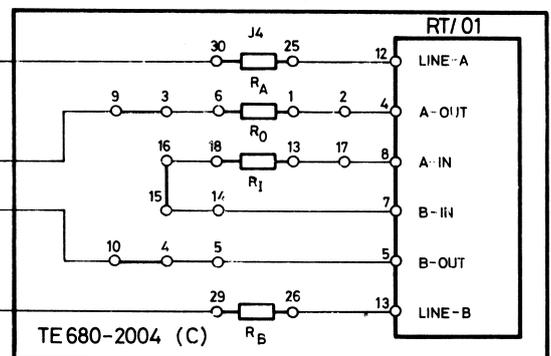
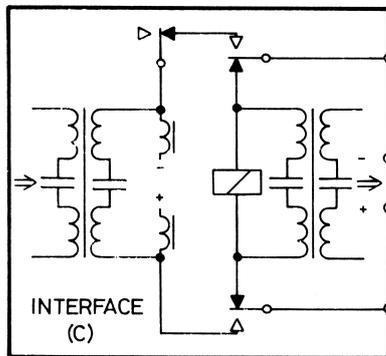
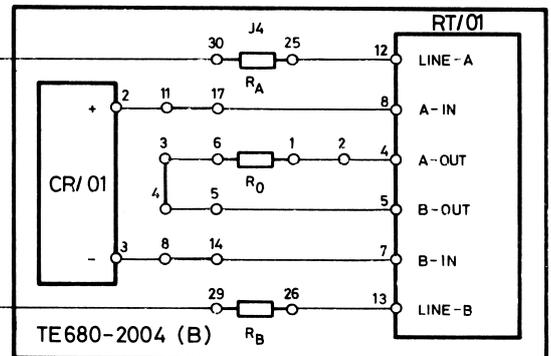
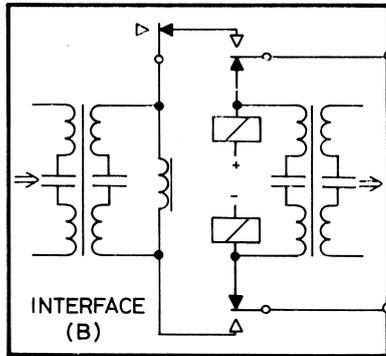
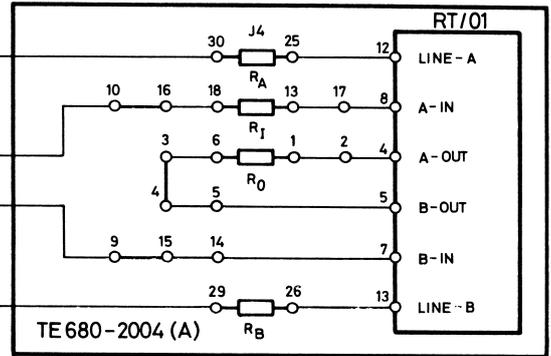
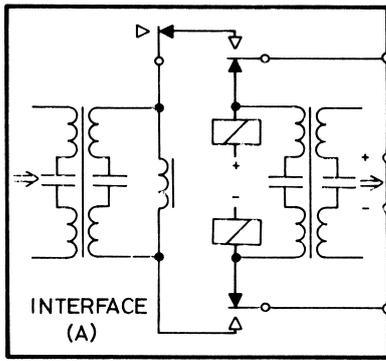
CABLES TO J2 (1-10), J4 (27-28) AND J6 ARE NOT USED IN SYSTEMS WITHOUT SPECIAL INTERFACE FUNCTIONS, MESSAGE RECORDER OR DEBITING EQUIPMENT.



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INSTALLATION CABLING
 AUTOMATIC MULTICHANNEL RADIO TELEPHONE SYSTEM
 CAF680-2004
 KODE

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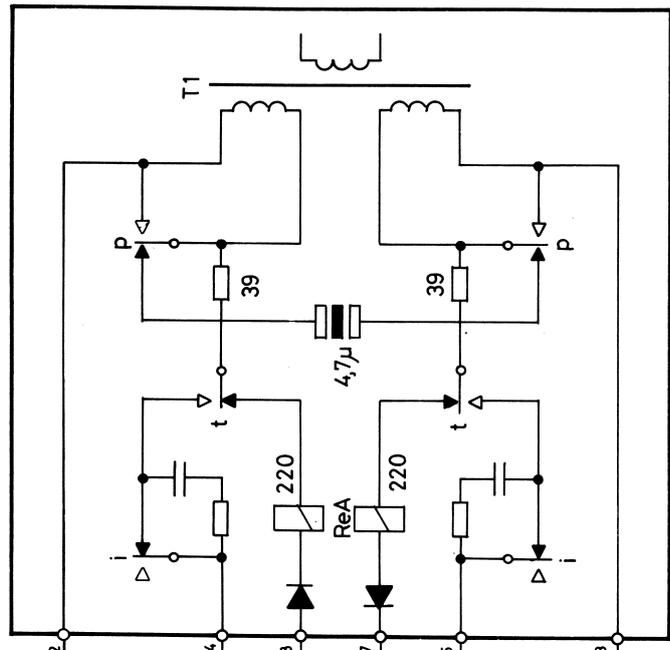


TE 680-2004
TE 680-2004
TE 680-2004

EXAMPLES OF DIFFERENT CONNECTIONS OF
TERMINAL EQUIPMENT TO EXCHANGE INTERFACE

RT680-2004/01

J2, J3



LINE TO EXCHANGE A

EXCHANGE VOLTAGE -

EXCHANGE LINE CURRENT

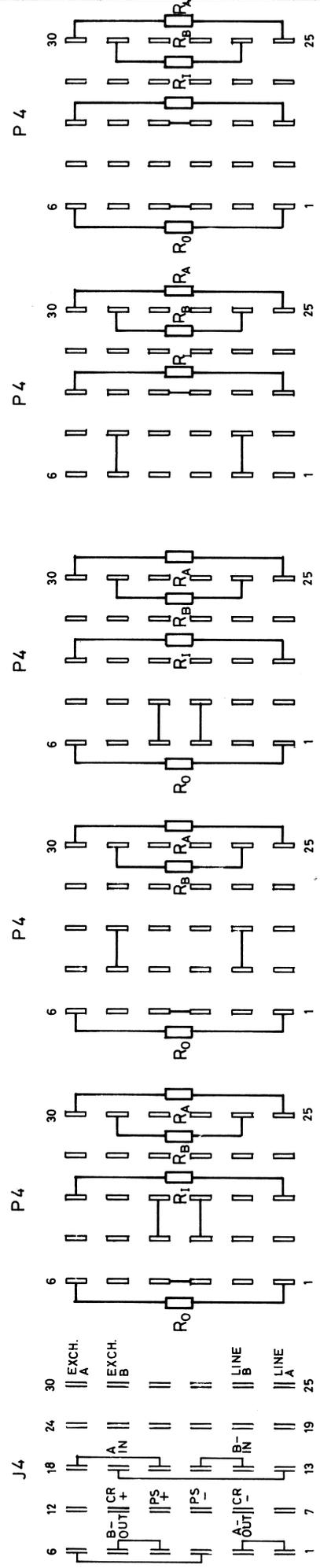
EXCHANGE VOLTAGE +

LINE TO EXCHANGE B

R_A, R_B : CAN BE USED TO ATTENUATE THE AF LEVEL AND THE LINE CURRENT OF THE TWO-WIRE LINE. USE EQUAL RESISTANCE VALUES.

R_1 : MOUNT RESISTANCE VALUE WHICH GIVES LINE CURRENT OF 22mA WHEN THE TERMINAL IS ENGAGED BY A CALL FROM THE EXCHANGE.

R_0 : MOUNT RESISTANCE VALUE WHICH GIVES NOMINAL LINE CURRENT WHEN THE LINE IS ENGAGED BY A CALL FROM THE RADIO TERMINAL (CALL FROM MOBILE).



INTERFACE TYPE : A B C D E

(SEE D.401.597)



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ADAPTION OF RADIO TERMINAL TE680-2004 TO DIFFERENT EXCHANGE INTERFACE UNITS

TEGN. NR. D 401.597

Included in the terminal unit is an electrically isolated power supply and a constant current generator (24/48 V - 22 mA) which are available for supplying the interfacing circuitry in the exchange end.

Dialling pulses at 10 Hz (8-22 Hz) is accomplished in both directions by means of line breaking pulses.

7.6 Special connections to the TE .

Besides the paired wire connections for sending speech information and dialling pulses, several other wire pairs can be connected to the terminal unit as follows (see D401.527):

- a. A wire pair for exchange supply voltage is employed when calling toward the exchange is accomplished by establishing a voltage connection, or when calling from the exchange by closing a loop. Normally, the built-in voltage supply and current generator of the TE is used for these purposes.
- b. A wire pair for marking of the B-subscriber's acknowledgement from the exchange. Closing a relay contact resets the conversation timer unit in the TE to zero when the called subscriber answers.

When the B-subscriber hangs up, a relay contact opens, whereby a timing unit in the TE is coupled in, causing automatic clear down at the end of a fixed time interval.

- c. A wire pair that marks, via a relay make from TE, when a called mobile subscriber answers a call and thus can be used to start debiting equipment or for traffic metering.
- d. A relay closing from TE for $150 \text{ ms} \pm 30 \text{ ms}$ indicates that the 3 (4) digits for selective calling have been received by TE. This can be utilised where the exchange equipment is of the type that requires a signal for clearing down the register.
- e. Tape equipment with a prerecorded message can also be connected to TE. The recorded message is then heard by any telephone subscriber calling a mobile subscriber who has temporarily left his car and who has pushed the **OO**

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button in.

- f. Where provisions c. or d., above, are not used, either of the connections can then be employed for some other outgoing marking from TE, when the connections in TE are rewired to accommodate the desired function.
- g. To avoid the possibility of calling and connecting into a channel that is faulty or undergoing repairs it is recommended that marking for that condition be effected between the exchange interface and the terminal unit. A closed relay contact from TE can be used to indicate when the terminal unit has power applied to it and that the channel is free (idle).

The CLEAR PULSE in TE is applied to relay circuit RT/04 and the above mentioned marking will thus also be interrupted for 2 seconds after clearing down at the end of each channel occupation.

In the exchange interface equipment there is normally a blocking switch used for disconnecting the interface unit. To prevent calls from mobile stations coming in over a channel whose interface unit is disconnected, marking of that condition can be transferred to TE. TE then allows the choice between breaking off for reception of mobile call signals or keying the transmitter for the channel in question to indicate a busy condition when the blocking switch has been activated.

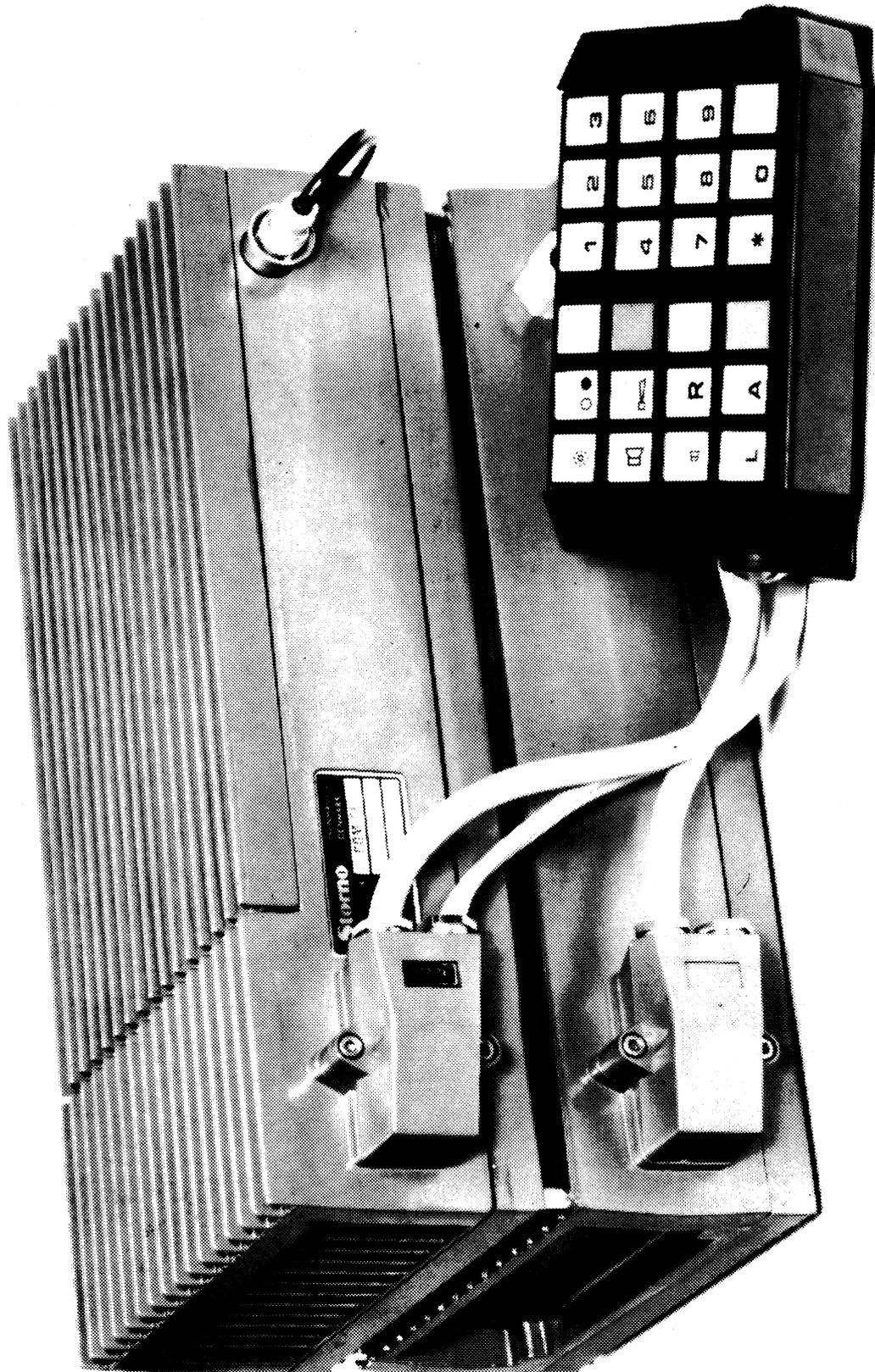
CAF680-2004 can accommodate debiting equipment able to register fee, mobile identification, date/time, etc. Debiting pulses are fed from the interface unit (via JP680-2004, where applicable) to the debiting equipment over wire pairs, one pair for each channel.

7.7 Mobile equipment

A modified version of CQM600, employing a maximum of 8 channels, is used as the mobile station. The mobile unit can be equipped for simplex service (CQM6XY-2004) or for duplex service (CQM6XY-2004D).

A battery supply of either 12 V or 24 V can be used. The mobile station utilises a power supply that electrically isolates

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MOBILE STATION
AUTOMATIC MULTICHANNEL
RADIO TELEPHONE SYSTEM
CAF 680 -2004

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TEGN. NR.

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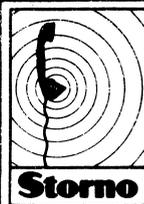
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CONTROL BOX
CB 700 - 2004

KODE

TEGN. NR.
D 123616
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13.5.75 Multikabel ændret fra 20 x 0,125 mm² til 2 x 1,0 mm² + 22 x 0,14 mm²



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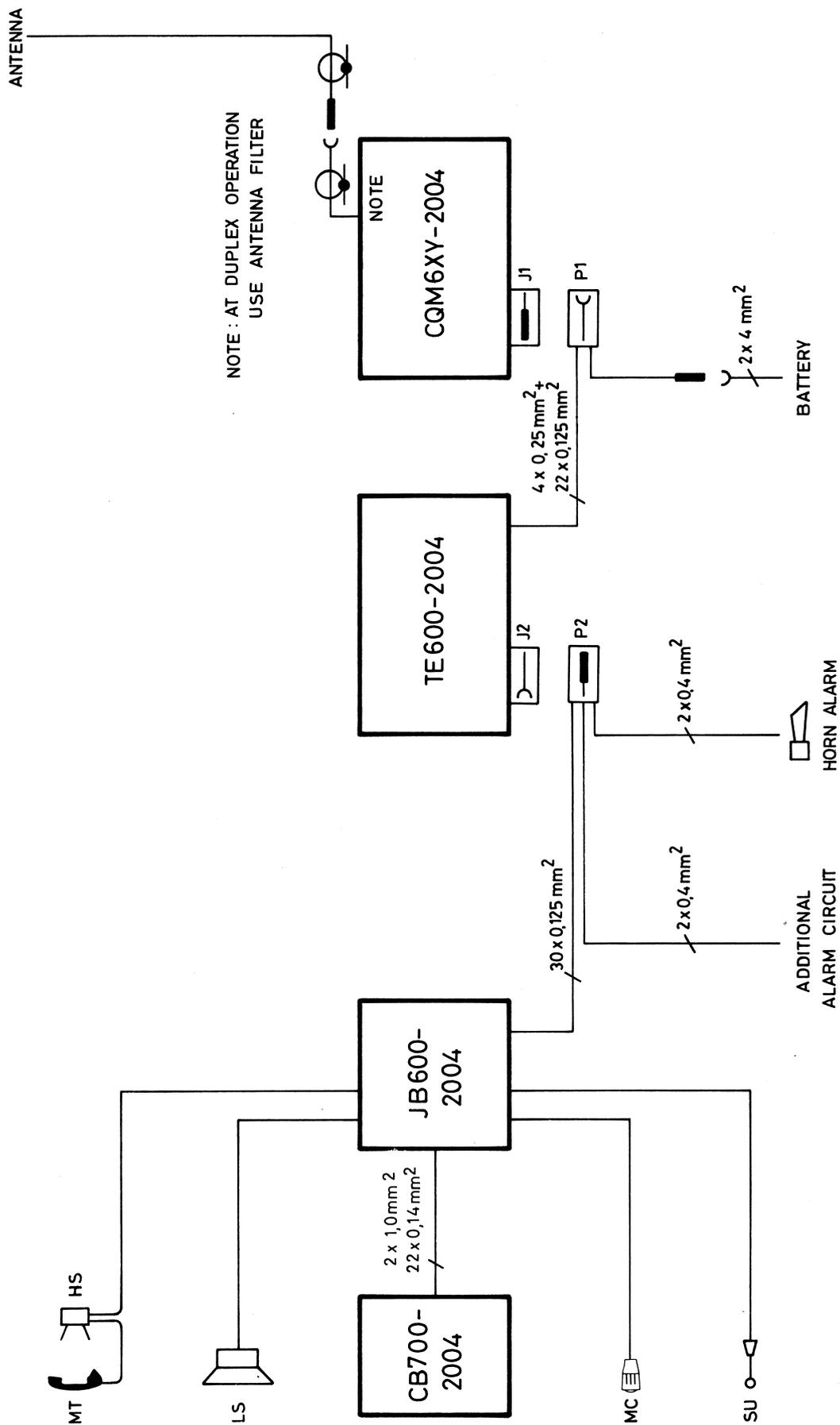
MOBILE STATION LAY-OUT
AUTOMATIC MULTICHANNEL RADIO TELEPHONE SYSTEM
CAF 680-2004

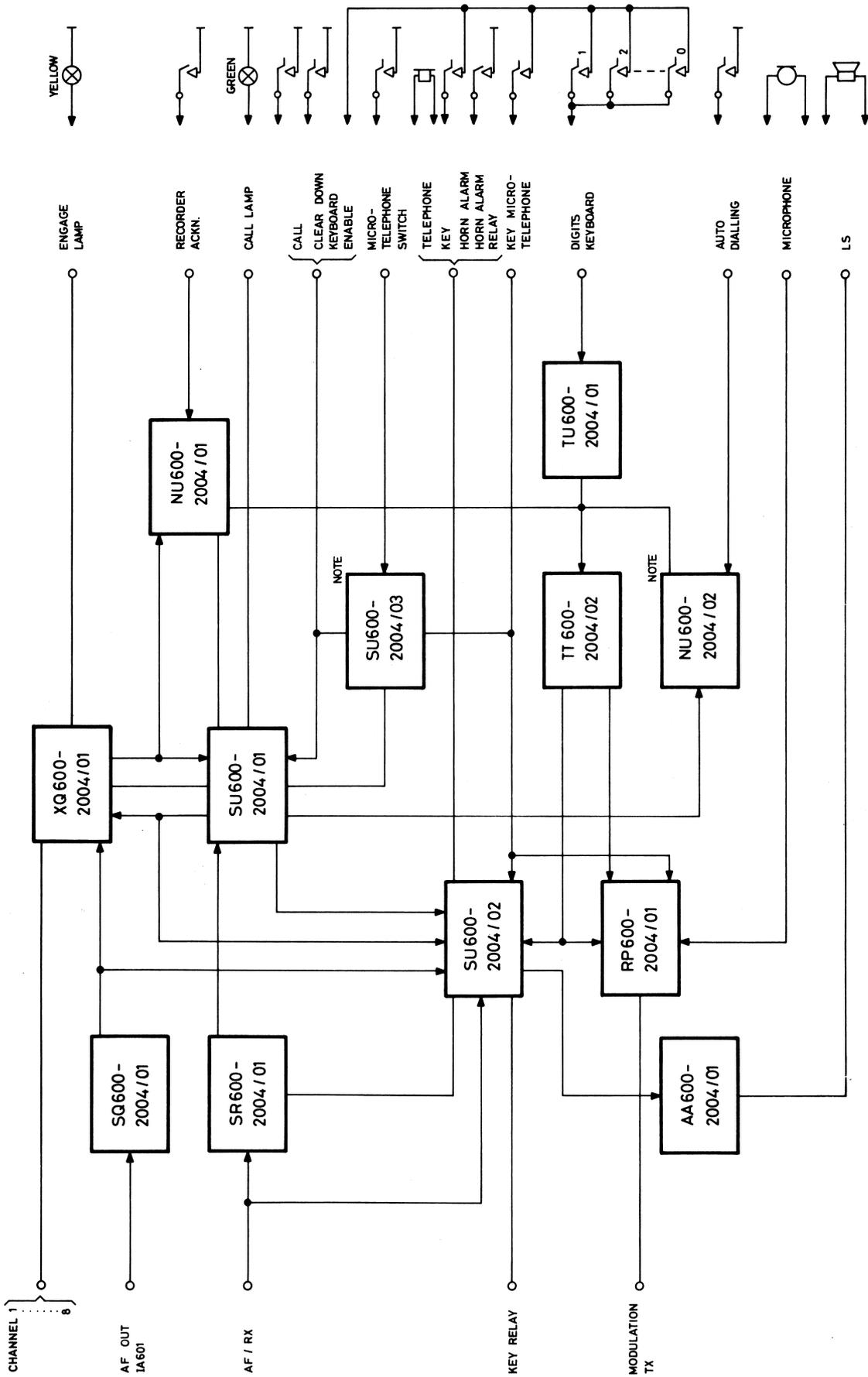
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NOTE: TE600-2004 IS WITHOUT SU600-2004/03 AND NU600-2004/02
 TE600-2004/01 IS WITH SU600-2004/03 AND WITHOUT NU600-2004/02
 TE600-2004/02 IS WITHOUT SU600-2004/03 AND WITH NU600-2004/02
 TE600-2004/03 IS WITH SU600-2004/03 AND NU600-2004/02



by **Leif Mjelle**
 17.11.72
 gork.
 komp. liste

BLOCK DIAGRAM FOR
 TE600-2004

KODE

the radiotelephone from the car battery. The power supply also features a circuit for electronic keying of the transmitter.

The mobile equipment comprises the radio unit CQM6XY-2004 (D) itself, terminal unit TE600-2004, junction box JB600-2004, control unit CB700-2004, as well as miscellaneous accessories such as loudspeaker, microphone, handset, steering column keying switch, duplex filter, antenna, etc.

The terminal unit comes in the following versions, with or without options:

TE600-2004: Standard version of TE.

TE600-2004/01: TE equipped for automatic calling and clearing down by lifting the handset and replacing it in its bracket.

TE600-2004/02: TE equipped for autodialling of 5 predetermined telephone numbers of maximum 8 digits each.

TE600-2004/03: TE featuring the capabilities of both TE/01 and TE/02.

The terminal unit is connected to the radiotelephone and can be placed wherever convenient and, of course, where there is room enough.

The control unit CB700-2004 is a purely passive unit used for operating the radiotelephone. The unit can be mounted in a variety of positions by means of its mounting cradle for optimal ease of operation.

The control unit has a keyboard on it with the digits 0 to 9 for dialling and a push button for calling (✱) and one for clear down (#).

Four coloured lamps indicate the following conditions:

WHITE The system is switched on.

RED The transmitter is keyed.

YELLOW All channels occupied. Indication only after attempting to make a call. The lamp goes out again when an idle channel becomes available.

GREEN Mobile station in contact with a main station chan-

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nel. The lamp lights upon established contact as a result of a call from or to the mobile station. The lamp goes out if no carrier wave is received from the base station for approx. 1.6 second.

In addition, the keyboard also contains the following 8 function buttons:

-  : The system switches on when pressed in, and off when punched out.
-  : When pushed in, the intensity of the white ON indicator lamp increases.
-  : Volume control, raises the sound level 16 dB when depressed.
-  : Raises volume 8 dB. With both buttons in, full loudness is obtained (24 dB increase).
-  : Transmitter key for use with fixed microphone.
-  : With this button pushed in a relay closure of approx. 1 second's duration is obtained upon receiving a call from base station. For applying to an external alarm (e.g. horn).
-  : When pushed in and a call is received, a special tone signal is generated to switch in a prerecorded message for the telephone subscriber.
- A** : To be used as the calling button prior to activating one of the digit buttons for autodialling.

Junction box JB600-2004 is where all the cables from the control unit, the terminal unit, loudspeaker, microphone, handset and steering column switch are connected. All the cable conductors are wired to solder lugs connected to a printed wiring board. This p.c. board can accommodate a relay for switching off the keying on the handset or fist microphone when the car ignition is turned on.

Accessories

The mobile station can always be operated in simplex, namely by

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means of a fixed microphone, the keying button and a loudspeaker, even if the station is a duplex system.

Additionally, it is possible to connect a handset and switch hook, MT604-2003, or a fist microphone, MC606.

Where no loudspeaker is used with a duplex set, but only a handset, a bell or buzzer can be connected as an audio ringing signal for incoming calls.

When using a handset, a choice is available between keying via a built-in keying switch in the handset or automatic, continuous keying by lifting the handset off its rest (only with duplex operation).

Keying the transmitter always blocks the audio path to the loudspeaker.

Standard antenna cable and auto antennas are employed while multi-cables and installation kits are specially designed items (17.0070-00).

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CONTROL PANELS FOR CAF680-2004 BASE STATIONS

General

In the CAF680-2004 radio system the base station equipment consists basically of a terminal unit and a transmitter/receiver section for each channel.

Signalling and remote control between these units are accomplished via 2 leased telephone lines. The base station transmitter (CTF6XY-2004) and receiver (CRF6XY-2004) can be placed either at separate locations or all together in the same cabinet (CQF6XY-2004) at one location.

The radio units connect to the remote control lines via fuseboxes and control panels CP/01 (for CTF), CP/02 (for CRF) or CP/03 (for CQF).

The control panels consist of metalplate chassis panels upon which the various circuit modules are fitted. Each panel comes with two connectors, one mounted on the panel and into which the connector from the radio equipment plugs, and a second connector on a short cable to be plugged into the station cabinet.

General specifications for the leased telephone lines are: that the impedance must be $600 \Omega \pm 20\%$, that the loop resistance should be less than $2 \text{ k}\Omega$ and that signal attenuation is less than 10 dB (measured at 1 kHz). In addition, with a maximum of 9 dB equalization at 3 kHz (in the line amplifier on the receiver side), it should be possible to obtain a linear frequency response between 300 Hz and 3 kHz (3 dB down points).

In practice, with the use of long telephone lines (5-30 km) the desired line specifications will not be met.

The impedance of telephone lines is seldom 600Ω ($> 800 \Omega$) and the frequency response normally displays rather large fluctuations ($\leq \pm 6 \text{ dB}$) within the specified frequency band. Moreover, the resulting frequency response for the entire line circuit, even with

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maximum equalization, will display strong attenuation of frequencies above 2.2 kHz.

Operating limits for remote control lines to CAF680-2004 must therefore be: loop resistance $< 3 \text{ k}\Omega$, upper frequency response limit $> 2.2 \text{ kHz}$ and line attenuation $< 20 \text{ dB}$.

With use of lines having poorer data than the general specifications, however, complications such as poor speech quality and signal-to-noise ratio must be expected. Furthermore, signalling and activating times will be affected. Therefore, when planning such project, it must be decided upon as to which lines are to be taken into use.

Description of CP680-2004/01 (see D401.404)

CP/01 is employed as the control panel for a single-channel transmitter, type CTF6XY-2004.

The modulation signal from the telephone line is applied, via line transformer RP6820, to the line amplifier, LA681.

A strapping arrangement in the line amplifier sets the proper modulation level, as required by the transmitter input. In addition, strapping links can be inserted to emphasize the frequency response at 3 kHz by 3, 6 or 9 dB to compensate for the characteristics of the particular telephone line.

The DA/02 unit, employing an optically coupled input for electrical isolation between the line and the transmitter power supply, is used to key the transmitter.

During standby the DA/02 receives a line current of 1.8 mA from TE680-2004 via the telephone line and the primary winding of RP6820. The direction of current is of no importance since the DA/02 input is equipped with a diode bridge rectifier circuit.

When occupying a radio channel 7.0 mA is obtained from TE to key the base station transmitter. As soon as the line current becomes greater than 2.2 mA a transistor at the output of DA/02 keys the transmitter.

By switching the line current from 1.8 mA to 7.0 mA quick activating of the transmitter is achieved, which is a requirement of the system. Dependent upon the length of the line, activating time will be from 6 to 10 ms. RF output from the transmitter appears approx. 11 ms

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after DA/02 sends the keying signal.

Description of CP680-2004/02 (see D401.405)

CP/02 is employed as the control panel for a single-channel receiver, type CRF6XY-2004.

In standby with no mobile carrier wave being received, a loud noise is present at the receiver output as the receiver's normal squelch unit, SQ601a, is held constantly open by a 0 V potential at terminal U of P2.

The receiver's output signal is applied to the RP/01 unit whose input impedance is approx. 600 Ω , independent of the impedance of the telephone line that is connected to the CP.

DA/02, DV/01 and PS/01 act as the squelch circuit.

Power supply PS/01 ensures electrical isolation between the receiver power supply and the circuits which are connected to the line. PS/01 also supplies 50 V to DV/01.

DV/01 converts the noise signal from the receiver discriminator output to a direct current between 0 and 13 mA. The amount of current rectified from the received mobile carrier is a measurement of receiver quieting sensitivity and thus also an indication of the field strength of the received carrier wave.

The diversity unit DV682-2004/01 is set to produce 2 mA at 12 dB quieting and 13 mA for reception of field strengths that give approx. 30 dB quieting.

Current from DV/01 is fed via DA/02 and the RP6820 secondary winding out to the line.

Control panel CP/02 is designed for use directly in systems employing DC diversity, e.g. CAF680-2007. In systems not having a diversity panel inserted ahead of the terminal unit the line current ($I = \geq 2$ mA) is used to indicate squelch signal in TE680-2004.

Upon reception of a signal from a mobile unit DA/02's output activates relay R in RP/01 as line current increases beyond 1.8 mA. The receiver output signal then becomes connected to the line via RP/01's emitter follower, relay contacts and the line transformer.

Activating time for the squelch circuit in approx. 15 to 30 ms, de-

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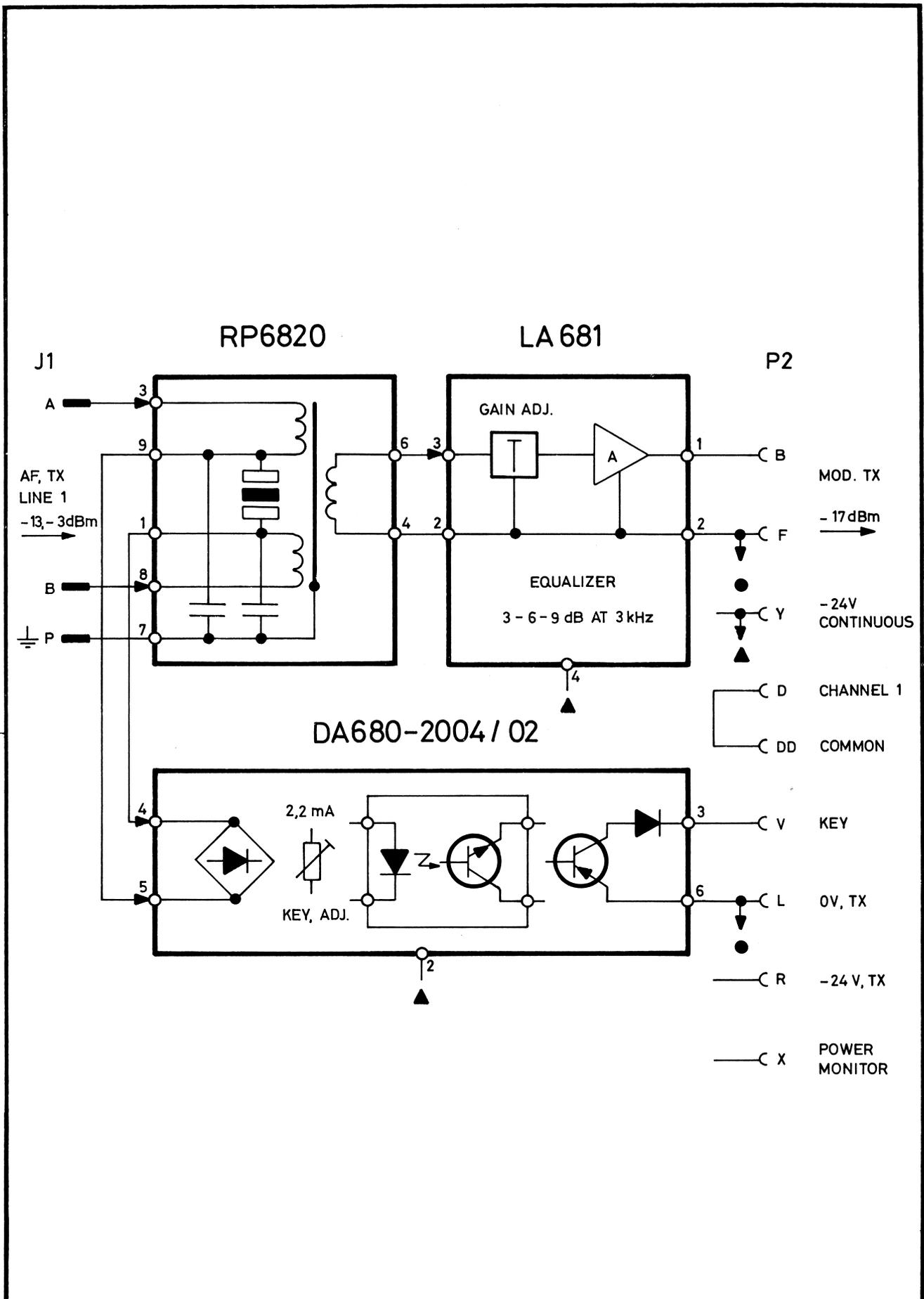
pendent upon the line that is connected to it and the reaction time of DV/01.

Description of CP680-2004/03 (see D401.406)

CP/03 is employed as the control panel in a single-channel duplex station, type CQF6XY-2004.

The panel consists of all the same units and cabling as used in CP/01 as well as in CP/02.

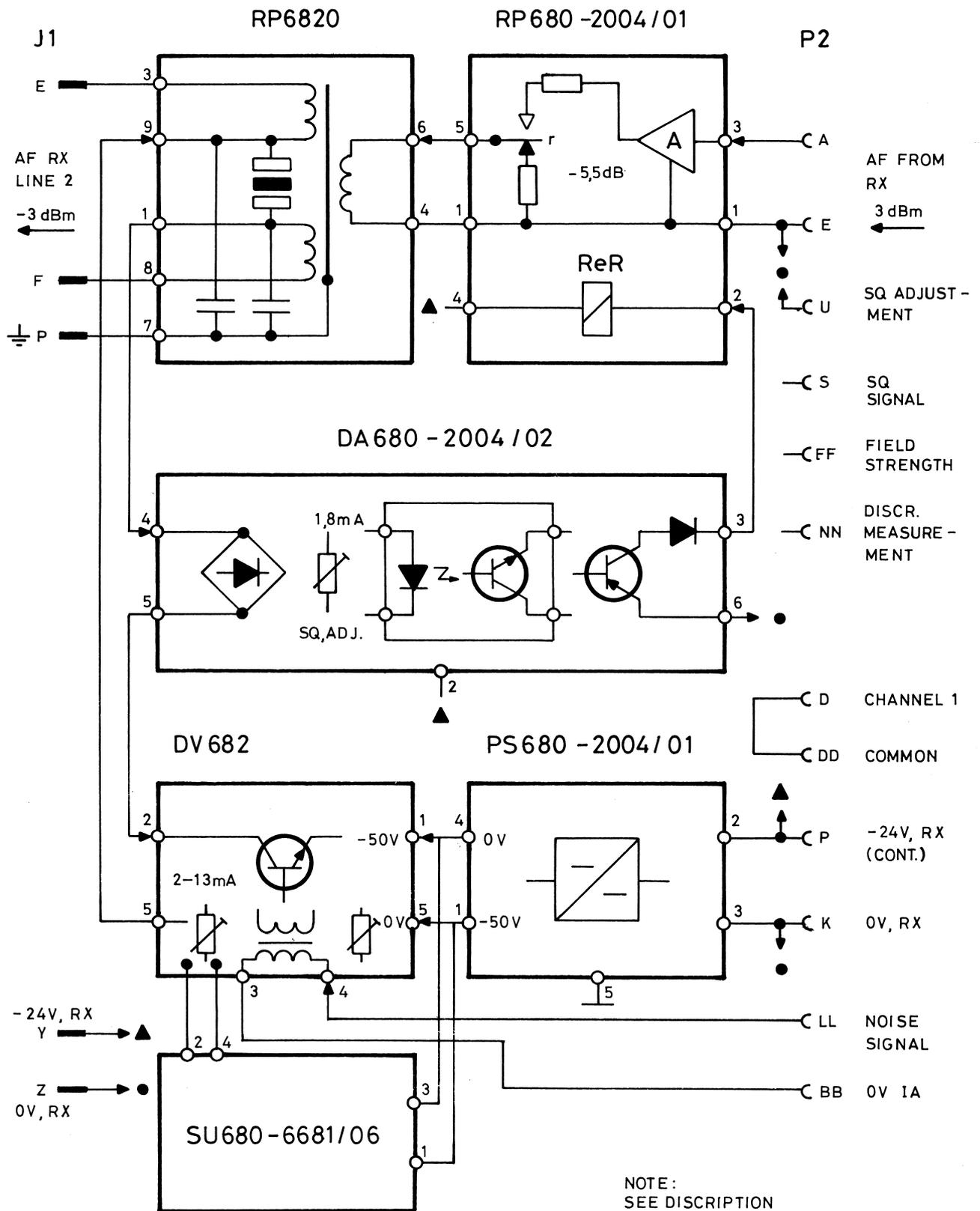
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CONTROL PANEL
FOR 1 BASE STATION TRANSMITTER
CP680-2004 / 01

TEGN. NR.
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REV	DESIGN DRAWN OG / BSO	APPR	COMP LIST	CONTROL PANEL FOR 1 BASE STATION RECEIVER CP680-2004/02 a	DATE 16.12.75
					A4 DRWG NO D401405/1

AUTOMATIC MULTICHANNEL RADIOTELEPHONE SYSTEM
CAF680-2004

System Lay-out, CAF680-2004	D401.526
System Description p. 1-2	38.070E1
Calculation of Traffic Handling Capacity	D401.697
System Description p. 3-4	38.070E1
Signalling Scheme, Call from Wired Sub- scriber to Mobile	D401.567
System Description p. 5	38.070E1
Signalling Scheme, Call from Mobile to Wired Subscriber	D401.566
System Description p. 6-8	38.070E1
System Lay-out	D401.523
System Lay-out, with Diversity Reception	D401.522
AF Level Plan, CAF680-2004	D401.781
Lay-out, Antenna Branching, 2 UHF TX	D401.777
Antenna Branching, 2 UHF TX, BF660-6644/01	D122.705
Antenna Branching, 4 UHF RX, BF660-6644/02	D122.707
System Description p. 9	38.070E1
Lay-out, Inter-cabling of Terminal Equipment	D401.525
Lay-out, TE680-2004	D401.453
Bay Lay-out, Base Station Transmitters, 2 ch.	D401.436
Bay Lay-out, Base Station Receivers, 4 ch.	D401.437
Bay Lay-out, Junction Panel, Debiting Equipment, 8 ch.	D401.438
Terminal Equipment. Diversity Panel, 1 ch.	D401.439
System Description, p. 10-11	38.070E1
Debiting and Terminal Equipment, Photo	
Installation Cabling, CAF680-2004	D401.527
Connection of TE to Exchange Interface	D401.597
Adaption of TE to Exchange Interface Units	D401.598
System Description p. 12-13	38.070E1
Mobile Station, Photo CQM/TE/CB-2004	D123.617
Control Box, Photo CB700-2004	D123.616
Lay-out, Mobile Station	D401.599
Block Diagram for TE680-2004	D401.554
Lay-out, TE600-2004	D401.590
System Description p. 14-16	38.070E1
Description, Control Panels p. 1-4	38.123E1
Control Panel (TX), CP680-2004/01	D401.404
Control Panel (RX), CP680-2004/02	D401.405