WIRELESS INTERCOM SYSTEM
TW7000

TECHNICAL MANUAL
TW7000D01

Version 1.21
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0. HISTORICAL REVISON

This literature modifies and improves the previous version “Preliminar” in the following sections:

V1.21: It modifies previous version V1.01.

[New subscription Mode that combines the “Mute” button and the number keys]

V1.01: It modifies the “Preliminary” version.

[It adds to the mode subscription of beltpacks under Network Ethernet by means of protocol IP]

[It modifies the configuration of the keys by means of Software Indico and through protocol IP]

[It adds the information of the state of beltpacks through LAN]

1. DESCRIPTION OF THE SYSTEM

Digital Wireless Intercom based on standard technology DECT. It has four independent channels, which allows up to four individual communications between the portable equipments. It has a small matrix of 4x4 crosspoints whose map is configurated by the user via software.

The number of beltpacks in the system can increase over four if associations in the subscription take place or on the connection with other base stations as a coverage way. Each fixed module (up to 4 in the base station) is able to subscribe until with 5 portable modules (beltpacks), and as well, a beltpack is able to subscribe until with 4 fixed modules.

There is also possibility of subscribing any other standard terminal DECT with protocol GAP as if a beltpack were, using the numeric keyboard as crosspoint key mode.

A passive antenna is integrated inside the equipments. Coverage of 300 meters in open spaces (TV Studios and OB Vans) and 30 meters through material structures that screen RF transmission (concrete walls).

The system employs TDMA, with frequencies in the range 1880,064 Mhz to 1898,208 Mhz, and guard bands of 1,728 Mhz. Modulation is standard GFSK with BxT=0.5 and m=288 KHz, Frequency Offset of +/- 50 Khz.

1.1. OPERATION WAYS:

The system has three different ways of operation depending on integration with another type of intercoms: working with a Digital Intercom System Indico TB7000, working with an Analog Intercom System TB6000 or independent operation without interconnection to any other intercom.
The characteristics of each way of operation are:

a) **Independent System** ➔ It is an independent system, it consist of a Base Station and Wireless Beltpacks. The communication settles down among different beltpacks from the system, assigning the configuration of each key, by means of the connection to network Ethernet through a navigator with a IP direction assigned.

b) **System connected to TB7000** ➔ The Wireless Intercom is connected to the Digital Intercom by means of 4 independent ports, being totally integrated at level of audio and data. The configuration of the keys in the Wireless Beltpacks is done directly by the user with the Indico Software, registering the ports where they are associated in the digital matrix.

c) **System connected to TB6000** ➔ The Wireless Intercom is connected to the Analog Intercom by means of 4 independent ports, being totally integrated at level of audio and data. The configuration of the keys in the Wireless Beltpacks is made directly by the user with the configuration software of the matrix Map6000.

1.2. FIXED BASE STATION

This equipment is provided with up to 4 internal fixed modules for the individual connection of up to 4 beltpacks, allowing to have up to 4 simultaneous and independent conversations. It is built-in a small modular 4x4 matrix so that the different crosspoints can be made that the user demands according to the combination of pressed keys.

It is possible to be interconnected to the Indico Digital Intercom System TB7000 via RJ45, with 4 independent ports per each beltpack. The configuration is direct from the Indico software. The Analog Intercom System TB6000 can be interconnected via SUBD-9, settling down in this case the configuration of keys by means of the software of the own analog matrix.

In case the system is configurated as independent, the configuration of the keys and the subscription of beltpacks are made through local area network by means of IP addressing.

In order to obtain the maximum possible coverage the base station must be located within the area of the work perimeter, with which an aerial fixation is due to make or in front panel, when the antenna is integrated inside the equipments.

The base station is powered by an isolated power supply of +15v, with an option for redundant power supply, that can be located in a lateral receptacle that arranges the equipment. It has a weight of 3,2 kg with standard dimension of rack, in case of front positioning 3 UR width height and 19” rack mounting.

1.3. PORTABLE BELTPACK

It is a wireless beltpack with technology DECT for the connection with its corresponding fixed module DECT of the base station . It is possible to be subscribed to four different fixed modules or another fixed module where there were another beltpack subscribed, but only can be operative simultaneously in only one of them.

The passive antenna is integrated inside, and the coverage will depend on the distance to the fixed base station. The 'ACTV' led in the front panel informs about the coverage level. In its normal state it will be off, but when the coverage begins to diminish, this LED flickers until the minimum level of work recovers again, or it light permanently informing that there is no coverage at all and that it has lost the connection with its fixed module from the base station.

It has four keys of crosspoints configurable by the user via software, with the functionality of Talk, Listen or Talk&Listen. For each key there are two associated leds for signaling of the commands. The local volume control is made by the control from the front, with mute button integrated in this control. A short keystroke conducts the battle of mic mute illuminating the LED associated to the control.

A long keystroke (6 seconds) in this key *'mic mute', followed by the pressing of "0", "1", "2" and "3" keys, makes* the beltpack to be in a subscription mode, remaining totally non-operative until again it is registered in the system.

The audio input and output is via Tiny Q-C connector located at the rear back. The microphone input is electrect type with polarization of +3v at a level of –30dBu. The headset output is of differential type, with 600Ω impedance.

The beltpack is powered by three batteries of 1800 mAh, type AA1.2v, including in the equipment, with an average operating time of 16 hours of use, continuous working hours. The time of recharge is three hours, with full load indicator.

The weight is 400 gr., its external dimensions are 11,5 cm height, 8 cm width and 3cm depth.

2. TW7000R01 BASE STATION

It is the equipment where DECT fixed modules are located, responsible to provide coverage to the different beltpacks that they hang from the system. Each fixed module establishes a digital channel of connection with each beltpack, which determines that the communications of audio settle down of individual form.

The number of fixed DECT modules in the base station is configured by the user at the moment of the purchase, being expandable the system any other moment. The configurations can vary from 1 fixed module to 4 modules in the base station, which will respectively determine the use from 1 beltpack (portable module) up to 4 beltpacks.

Although the system is thought to associate a fixed module to a portable beltpack, another type of configurations also are possible. For example two beltpacks to a same fixed module can be subscribed, establishing crossed audio between them. The disadvantage is that the audio one is not independent and both beltpacks are in communication at the same time, in a same port in the system. Also standard DECT telephones can be subscribed, that incorporate protocol GAP as if a beltpack it were.

The control and state of the system is made via software that will depend on the system mode of configuration, according to the commented previously in section 1.1. In the case of connection to the Indico system (TB7000) or to the analog intercom system(TB6000), it is used the own software of crosspoint of the matrix. Only in the case of independent way of operation it is configurated via local IP network.

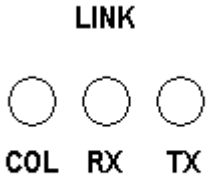
If the system is operated in digital or independent mode, each analog port of the rear back of the station is associate to the fixed module of that number of port, passing to be an auxiliary input/output of analog audio, so, it can be used to sent/receive audio from each beltpack.

The location of this station bases on its place of work, will have to give coverage to the portable modules (beltpacks). The area is 300 meters in open spaces (TV Studios and OB Vans) and 30 meters through material structures that screen RF transmission (concrete walls). For TV studies it is advisable to locate the base station on the central part of the ceiling, or on an angle of corner of the wall.

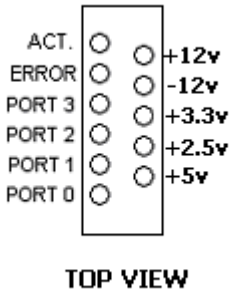
The base station is powered by an external power supply +15v, with an option for redundant power supply. In addition, there are two positioning for placing both power supplies.

The system has some indicative leds that inform to the user about the different devices real state:

- Ethernet ➔ Set of 3 green leds located at the rear back, informing:
    - TX → Transmission from the base station towards ethernet network.
    - RX → Data Reception from network to the base station.
    - COL → Collision between RX and TX at level of ethernet frame.



- POWER ➔ Set of 5 green leds that visualize the different existing voltages in the motherboard. In correct operation all of them must be illuminated/lighting. (+12v, -12v, +3.3v, +2.5v, +5v).



- Control signing Diodes and ports. ➔ They are located in the front of the equipment, next to those of power, such as is showed in the previous figure.
    - ACT→ Green Led indicating that the microcontroller has started and is operative. In its correct state it must flicker to constant frequency.
    - ERROR→ Red Led of error of initial configuration.It informs that there is an initialize error and the equipment become nonoperative.It is recommended to switch off and switch off in case the error was temporaty. In normal operation this led is off.
    - PORT[3..0] ➔ Red Leds associated to each one of the 4 available ports, with different functions:

- Off -> It Informs that the port is connected to the Digital matrix and the beltpack is not subscribed.
- Normal Flicker -> It Informs that the port is connected to the Digital matrix and the beltpack is subscribed.
- Fast Flicker -> It Informs that the port is not connected to the Digital matrix and the beltpack is subscribed.
- On -> It Informs that the port is not connected to the Digital matrix and the beltpack is not subscribed.

At the rear back of the base station are the connectors for access to other system and control. Below we can see a picture:

The analog connection is via SUBD9 male connector existing by each fixed module DECT, a port (numbered connector). Through this one, also could be used as integration of Kroma analog intercom TB6000, using audio and data. The Pinout of this connector is the following one:

SUBD9 MALE	AUDIO TW7000
1	DataControl-
2	DataControl+
3	GND
4	OUT analog audio -
5	OUT analog audio +
6	GND
7	IN analog audio -
8	IN analog audio +
9	GND

For the connection with a Digital intercom TB7000, there are 4 available digital links via RJ45 (maximum 300m), corresponding each port to a fixed DECT module, with the numeration that shows the figure. If the user wants to have the 4 DECT links (configuration of 4 beltpacks in the system), it is due to

take four cables to the base station (one per port). In the Indico software will be register per each port, configuring each beltpack of individual form.

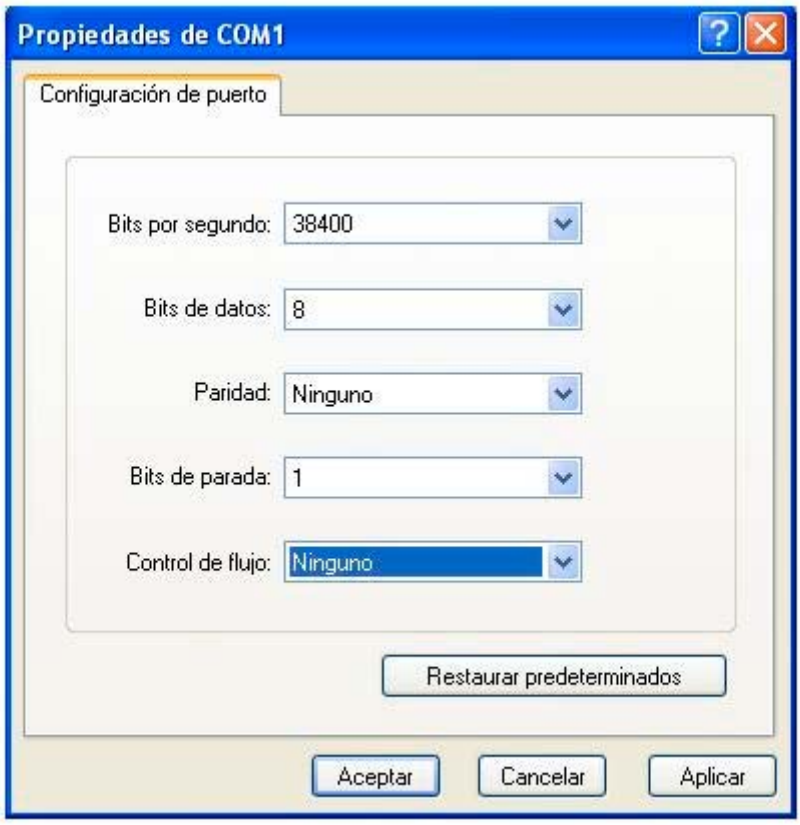
For special functions of software engineering, a port of control for the connection to PC by means of RS232 has been qualified. The connector is a SUBD9 female with connection, with following pinout:

SUBD9 FEMALE	RS232 TW7000
1	-
2	TX data
3	RX data
4	-
5	GND
6	-
7	-
8	-
9	-

The wire that connects the serial port of the PC (COM) to the serial port of the equipment TW7000 is of pin-to-pin type.

For the control and supervision of the system, it must be connected a cable of network Ethernet in the female RJ45 at the rear back, labeled ‘net’. The system supports a connection to 10Mb/s by means of IP addressing. The IP address of the fixed base station is provided by defect with the equipment **(192.168.8.222)** and will depend on the user to modify in his network LAN, the mask of subnet necessary to be able to give visibility to him.

This IP address may be modified through the connection with the control port RS232 via Windows hiperterminal. A new connection should be opened via the serial port (e.g. COM1), assigning the following values:



After configuring the port with the abovementioned valued, we can open the connection. Then press Enter so as a menu appears, showing the different options of TW7000. Shouldn´t this menu appear, please check the wire and hiperterminal connection.

Once the menu is onscreen, we will choose Option 4 (Boot Mode), typing the password (3210). Then we choose Option 9 (IP Change). Once the new IP address has been introduced **and without switching off the equipment**, we should pass to the Option 5 (User Mode) so as it can work with the new assigned IP.

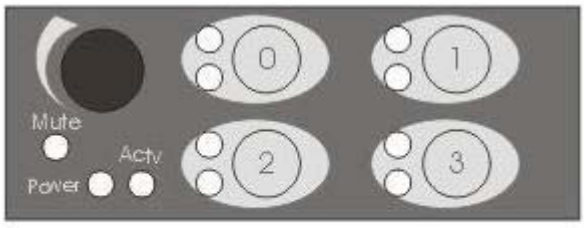
3. TW7000R02 BELTPACK

It is a portable wireless beltpack with DECT technology able to subscribe any standard base with protocol GAP. It admits configuration of keys of its front panel, having a total integration with the Analog and Digital Kroma intercom systems.

The subscription is made of simple form, with a sequence of pulsation made in the 'mic mute' key of its front, which allows to do fast modifications without any type of external controller.

A Beltpack can be subscribed until with four fixed modules of a base station, which can be used to give it of discharge in different systems and to make it work as a coverage, with brief times of establishment of the new assigned channel.

In its front part it has four configurables keys that they allow a direct selection of up to four interlocutors, with leds multifunction of state of the communication (talk or listen), mute key and volume control of the outputs headset. In addition it has LED of power and coverage state.



FRONT VIEW

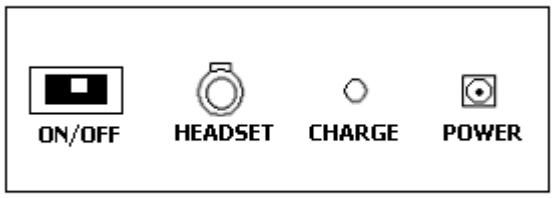
The functionality of the keys is similar to the Kroma Intercom panels, allowing of this form a greater flexibility at the time of directing the communications between users.

The beltpack is powered by three baterries NimH to 1.2v, that they are loaded through an external source of 15v, having in the front part a LED of low battery, that warns the user with its flickering.

Average operating time of 16 hours of use, the total time of load is 3 hours approximately. In addition the beltpack has the possibility of being operative while the batteries are being loaded (selection by hardware).

In the following figure we can see the the beltpack with the different connection elements from connection, commented from left to right:

- The beltpack power switch.
- Headset Connector.
- Red Led of load that it is switched on durind the load. If the led is switched off during the charge, the external source must be unpluged. The total load is 3 hours.
- Power Jack for batteries load.



REAR VIEW

In the front there are some keys and some informative command leds for the user:

- Multi-turn for the headset local volume control.
- Mic mute key incorporated in the previous control. With a short keystroke “the microphone is in mute mode” and the yellow led is illuminated, informing about this state. If this control stays pressed during 6 seconds followed by the pressing of “0”, “1”, “2” and “3” keys in that order, the beltpack become in subscriptions mode and start to be in a nonoperative state, until it is register again.
- Green Led of power. In its normal state, it is on, and when there is low battery detection, it begins to flicker.
- Red Led for coverage information. Three states:

- To be off → Beltpack subscribed and with coverage.
- To be on → Beltpack no subscribed.
- Flickering → Beltpack subscribed but without coverage.

Four assignable keys to crosspoint, with signing of the state of the communication by means of two leds.

- Fixed Illuminated Green ➔ Command achieve indication. The keystroke has been recognized.

- Fixed Illuminated Red ➔ Established channel associated to the Talk command indication. (It is possible to talk).

- Green Flickering ➔ Call establishment indication.

- Red Flickering ➔ Incoming call indication (Listen).

When the green LED 'Power' (located in the front) is flickering, it must be connected the power supply to recharge the batteries, since the equipment can begin to have badly operation and to cause cuts in the audio.

Once connected the external power, the equipment automatic becomes disconnected and starts it in recharge mode (configuration by defect). The red LED 'Charge' (located at the rear back) will remains illuminated while this situation lasts. When the LED is off, the cycle of load will have finalized and is advisable to disconnect the beltpack from the external power.

4. SUBSCRIPTION MODE

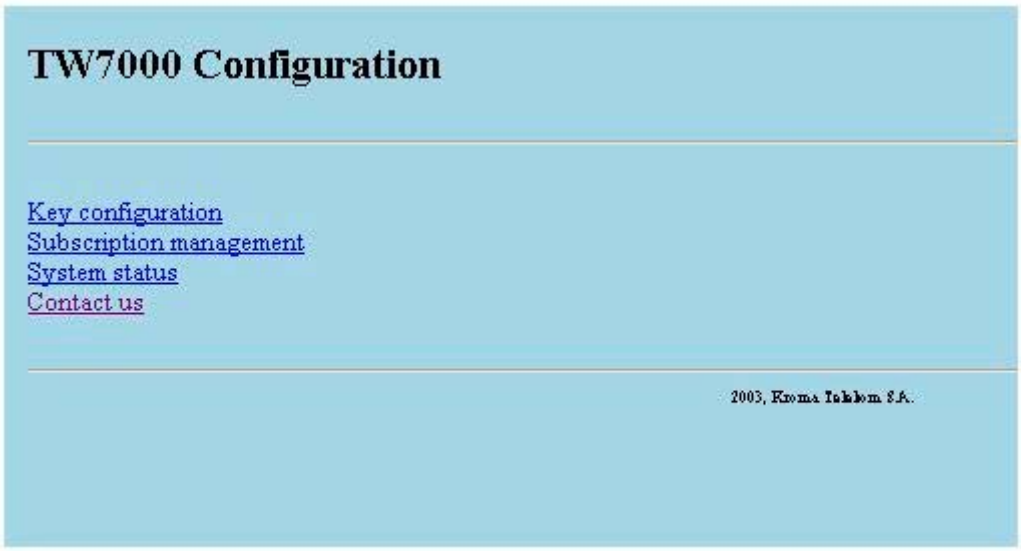
So that the portable modules (beltpacks) can be used in the system, previously they have to be registered, making an univocal correspondence between a fixed module and a portable module. This association is denominated subscription and will have to be carried out when the user wants to do new subscriptions or to cancel some subscriptions in the system.

NOTE: Beltpacks go out of KROMA already being subscribed and are therefore operative when they are delivered to the clients.

When a beltpack is switched on (Switch “ON”), begins a search process and a channel identification with the base station. This situation is visualized in beltpack with the activity red LED (ACTV) and flickering at constant form.

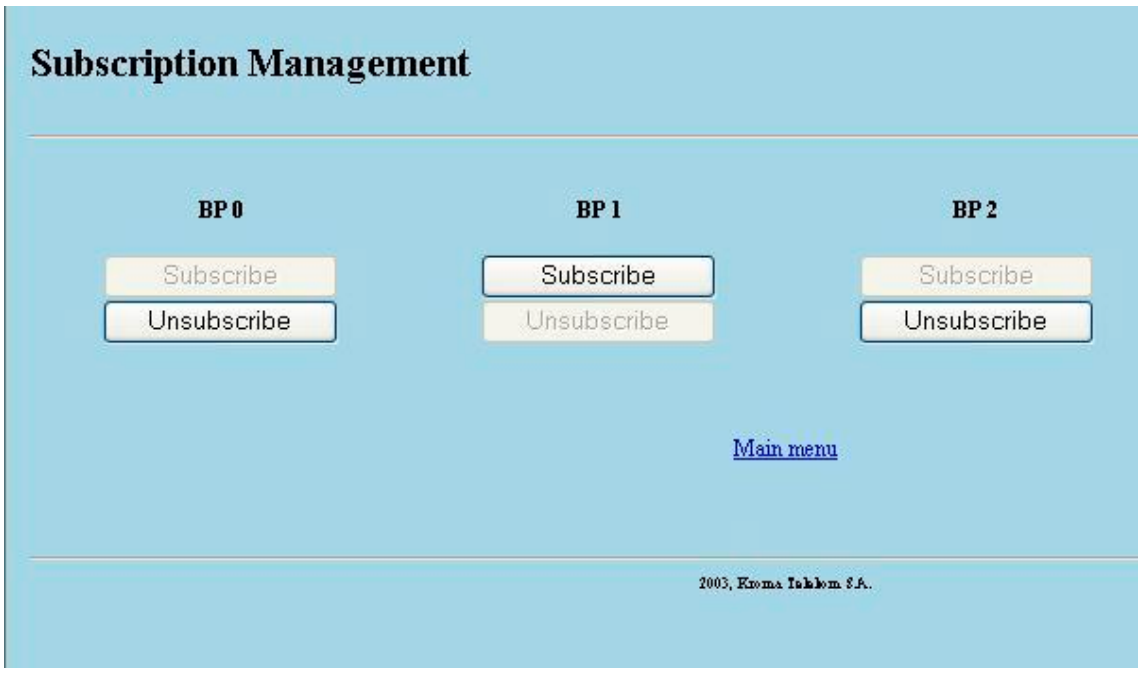
If the beltpack previously were subscribed with some fixed module of the base station and is within the coverage radius, this LED will be OFF and the beltpack would be ready to operate. If it were not subscribed previously, this LED would constantly remain ON and the beltpack would not be operative. If beltpack were subscribed but it did not have coverage, the activity LED would flicker and the beltpack would be nonoperative, waiting to reach some coverage.

In this way of work, the configuration of keys and the subscription of beltpacks are made via local area network Ethernet with IP address. The base station presents/displays a Web page, through a IP direction that settles down by defect from Kroma (Example: 192,168,8,221) where the user can assign the wished configuration, as it shows the following figure:



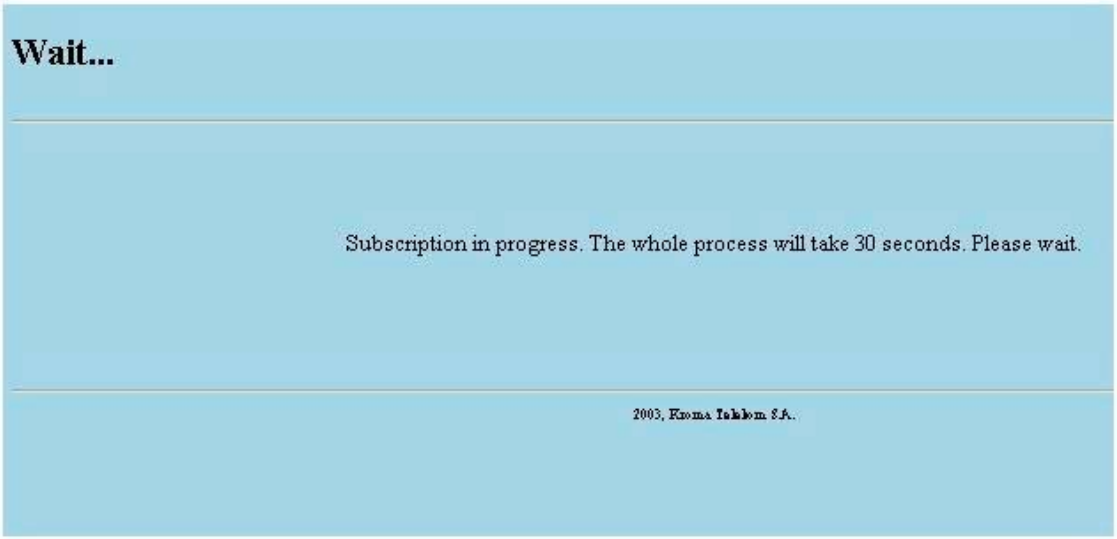
In the main page a configuration menu appears, where the user can choose the action to do, depend on how the user press the left button of the mouse on the emphasized option. In order to be able to operate in the system, one user must be identified via 'password'. By defect the user is'KROMA' and the password is '3210' that it will have to be typing in order to accede to the configuration menus, according to sample the figure:

The first submenu is the beltpack keys configuration, that will be seen in section 5.2. The second submenu does the management of subscriptions, as it is in the following figure:



Pressing in the buttons of subscribe/unsubscribe of each beltpack (BP) it is possible to be registered to them or to cancel a registration in the system. If any of the associated buttons to the beltpack is active, it means that there is not any fixed module in the base station to configure (It was not acquired in the purchase of the equipment).

In order to be able to subscribe a beltpack, previously the fixed module that is going to be associated must be available. This situation is visualized in the subscriptions management page where the " Subscribe" button must be active. Selecting this button a search begins from the fixed module of the base station associated to that channel, in order to find the portable module DECT that is desired to subscribe (to register), showing the following page:



If the beltpack is found, it is informed of such event and it is subscribed immediately. If it is not, the user is informed that it has not been subscribed after 30 seconds of search, so, a new try has to be done again updating this page.

The steps to follow to register a subscription are:

- To switch on the beltpack and to keep pressed the mute button during 6 seconds (till the yellow led begins to flicker). Then, we´ll press the following keys: “0”. “1”, “2” and “3”, in that order. The yellow led will begin to flicker more slowly informing that it is in subscription mode and the red led of activity must be switched on of constant form.

- From the subscriptions management menu, select an available beltpack and click on the `Subscription’ button. In that way a searching protocol will begin between the fixed module of the base station and the portable module (or beltpack).

- If the beltpack is found, the yellow led of mute and the red led are extinguished, informing that the subscription from the beltpack has finished (via a message on screen). If the subscription has not been possible after 30 seconds, the user will be informed with a message, having to reload the page and to repeat the previous process.

NOTE: Having to repeat the process may occur. Please do it till an available channel is assigned between the fixed module and the beltpack.

In order to cancel a ***beltpack subscription***, its subscription can be eliminated from the same previous page of management, but this time the “Unsubscribe” button is selected.

If doing this action the beltpack is switched on, immediately the red led of activity is canceled in the system, passing to be the red led of activity to constant illumination. If on the contrary it was done with the beltpack switched

off, when it is swiched on later, the red led of activity, informing that does not find its fixed module associated.

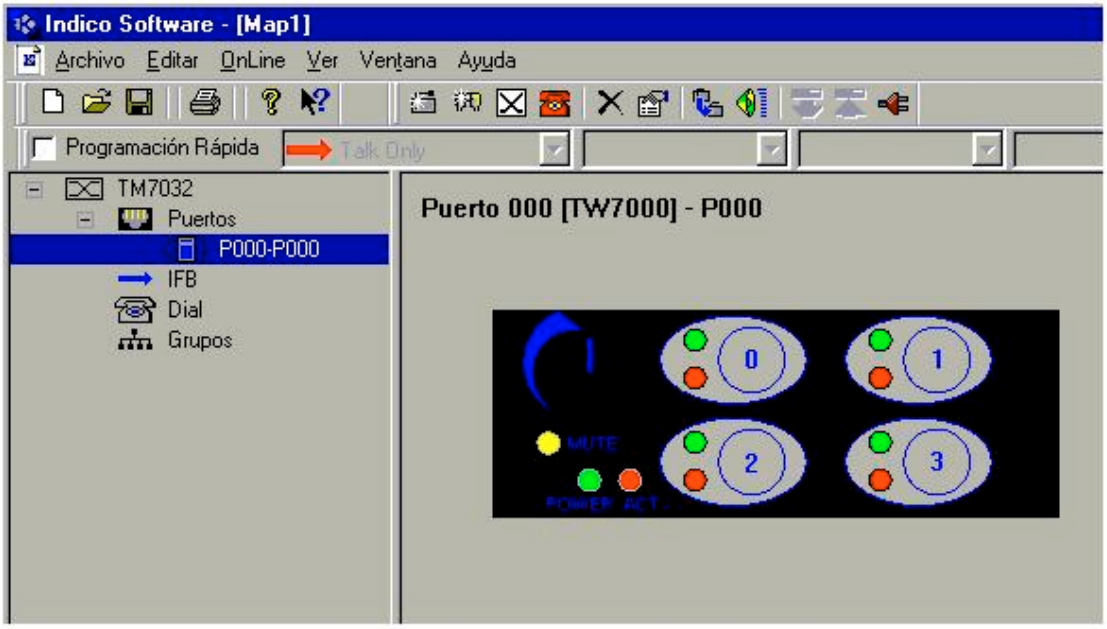
If already being subscribed a beltpack and being switching on, we keep the mute key pressed during 6 seconds and the we press the keys “0”, “1”, “2” and “3” in that same order, this will cause an automatic cancelation of subscription in the beltpack and in the base station, then the red led of activity will be illuminated of permanent form.

5. KEYS CONFIGURATION

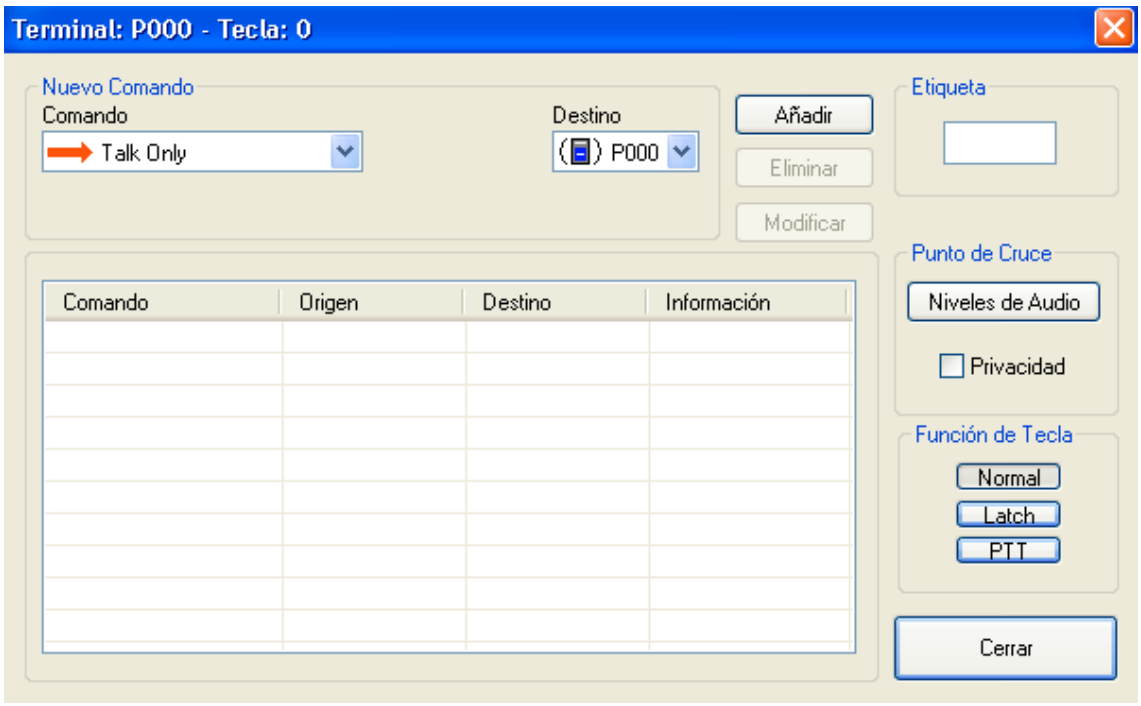
The allocation of crosspoints to the keys of beltpacks by means of the commands known as talk&listen is made of different way, depending that it is configurated as system to work with digital intercom, analog intercom or independent system.

5.1. DIGITAL SYSTEM

In the case of interconnecting the fixed base station to the Digital Intercom system Kroma Indico, the configuration of the keys will be directly done from the own software of the matrix, registering the ports that will occupy in this system, as if a panel was.



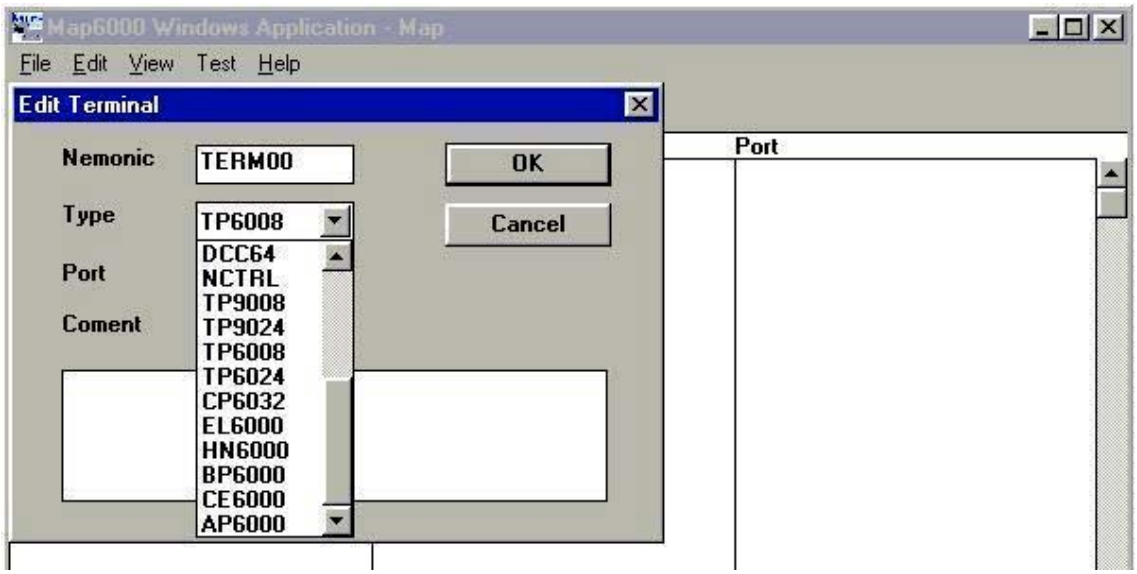
By each beltpack that registers in the digital intercom system, it will occupy a port of the matrix, where the commands of crosspoints will be able to be assigned to the keys, as it shows the following figure.



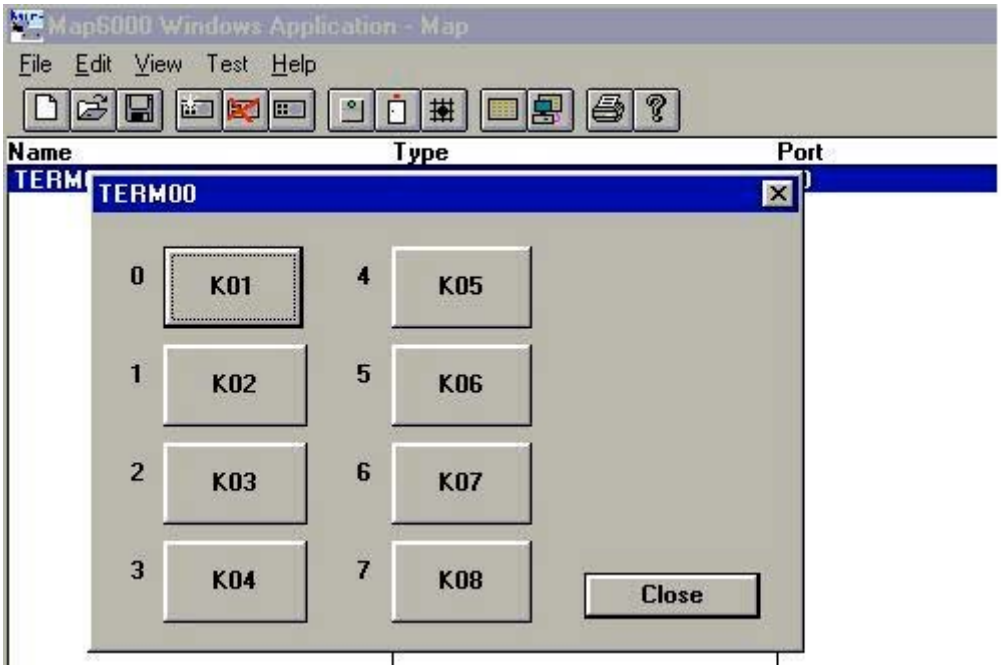
In order to determine the form of how to assign the commands to the keys, is requested to resort to the **Software Indico Manual** (Digital Intercom TB7000)

5.2. ANALOG SYSTEM

In the Analog System TB6000 there is not possibility to register the beltpack like so, since it is not defined in the list of panels available, it will have to be “emulated” as if it was another model of definable panel.



For that reason, it is going to be registered by each beltpack, a panel TP6008 and we are going to assign crosspoints on their first four keys, to make them coincide with the keys of the front of beltpack.

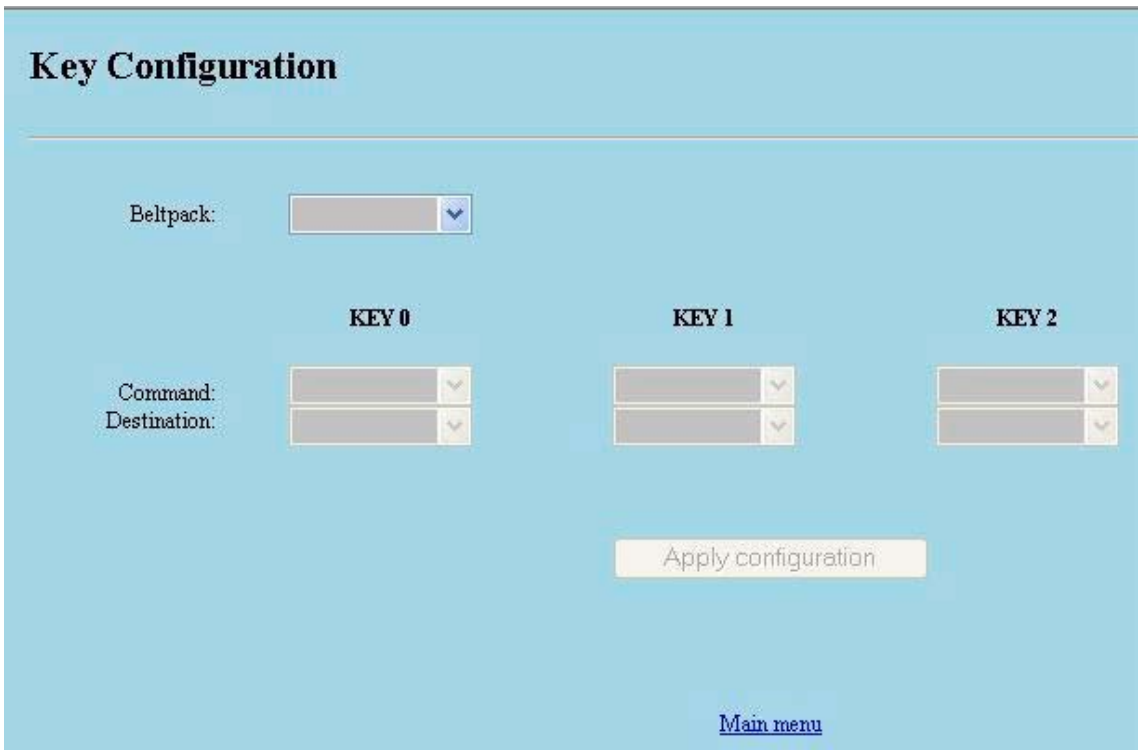


In order to determine the form of how to assign the commands to the keys, is requested and neccesary to resort to the **TB6000 Analog Intercom Software Manual**.

5.3. INDEPENDENT SYSTEM

In this type of configuration, the asignation of the crosspoints to the keys is done through network Ethernet on IP protocol. The IP Direction of the base station is fixed by defect on Kroma facilities and the customer is informed about it for giving visibility in its network LAN.

Once one we are on main menu page, it must be selected the link “Keys Configuration” introducing the user name: **“KROMA”** and the password **“3210”**. The following page of configuration must appear:



In the first place, we must select the number of beltpack to configure (from number 0 to the 3, up to 4 beltpacks the system can have) and next, and by each key, we must choose the the wished command (Talk, Listen and Talk&Listen) that it is wanted to execute in the key.

In each command, we must select the destiny of the action, since the origin always will be the beltpack that is being configurated. When finalizing the configuration of the four keys is due to store it activating the button “Apply Configuration”, appearing a message of commands stored from correct form.

6. STATUS OF THE SYSTEM

Through connection IP it is possible to visualize the state of the beltpacks which they are in the system, it is just as informative mode since actions can not be done in this submenu. In order to be able to accede we must select the “Status system” option from the main menu, appearing the following page:

Each beltpack (BP) is identified with a number (from 0 to 3), showing the present state in which it is, with its fixed module associated from the base station. The different options from their state are:

- OUT OF RANGE → Subscribed Beltpack but is not in coverage or it is switched off.
- IN RANGE → Subscribed Beltpack and it is in coverage radius (it is operative).
- NOT SUBSCRIBED → Beltpack nonsubscribed. We must go to the subscriptions menu and to register it.
- LOCKED → Blocked fixed module. It has not been acquired the “operation link/connection” option, in the system, being available for future increases.
- NOT PRESENT → Unblocked fixed module but it is not located in the base station (not physically inserted).

7. ELECTRICAL DIAGRAMS

Below you will find material lists and electrical diagrams of the TW7000:

For the TW7000R01:

-Assembly of the main board of the fixed station (TW7000P03)
-Electrical circuit of the fixed station (TW7000E03)

For the TW7000R02:

-Assembly of the main board of the beltpack (TW7000P01-02)
-Electrical circuit of the main board of the beltpack (TW7000E01-02)
-Assembly of the front keyboard of the beltpack (TW7000P02-02)
-Electrical circuit of the front keyboard of the beltpack (TW7000E02-02)