



TRX Krzysztof Kryński

Digital recorders KSRC series

# USER MANUAL

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TRX  
ul. Garibaldiego 4  
04-078 Warsaw  
POLAND  
Phone +48 22 871 33 33  
Fax +48 22 871 57 30  
[www.trx.com.pl](http://www.trx.com.pl)

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# 1: Introduction

## 1.1 About the recorder

KSRC series recorders are stand-alone devices, operating continuously (24 hours a day). They has been designed to record calls from a variety of phone lines, two-way radios and other devices, from which user wants to record audio signal (faxes, tone signals).

The devices can be attached to any one of the following type of phone line:

- analogue,
- ISDN BRI (S/T or U interface),
- ISDN PRI (except KSRC 308 and KSRC 316<sup>1</sup> models),
- proprietary digital lines for the most popular PABX manufacturers.

TRX recorders can also record audio signals from other acoustic signal sources like microphones.

KSRC 332, KSRC 5128 and KSRC 2U models has been implemented functionality for VoIP calls recording and CTI integration for several telecommunication systems.

TRX recorders operating system (based on Linux kernel) is installed on a dedicated flash drive. The hard disk or RAID 1 array is intended exclusively for storing recorded calls and system logs.

In this embodiment a HDD failure does not stop working device at all. Replacing the hard disk drive causes that calls will be still recording. The design of HDD enclosure does not require opening the recorder case. After installing a new disk the operating system automatically prepare a new medium to work.

Built-in keypad, LCD display and speaker make up the local user interface that allows you to:

- provide access to basic functions (monitoring or playback of recordings),
- present information about the status of the device (alerts, channels occupancy),
- network configuration (IP address, mask, gateway).

---

<sup>1</sup> KSRC 316 models support only half E1 trunk board – 15 x B channels.

By default, the recorder is operated and managed remotely through TCP network. Our dedicated remote access software (most important is *Konsola 2*) runs under Window operating system.

The executable files and user manuals for TRX programs are available on our web page [www.trx.com.pl](http://www.trx.com.pl).

## 1.2 Functional parameters

TRX call recorders are constructed based on a modular design. This solution allows for customize the recording system for current client's needs, as well as its scalability in the future. At present the following models of recorders of KSRC series are produced:

	KSRC models				
	308	316	2U	332	5128
<b>Power supply voltage</b>	230 V AC (+/- 10 %)				
<b>Power input [W]</b>	40		60 - 100		80 - 120
<b>Input voltage range for analogue interface</b>	50 mV - 2 V, AGC implemented				
<b>Dimensions *</b>	400 x 115 x 380 mm	19" 2 U		19" 3 U or 4 U	
<b>Display</b>	LCD 4 x 20				
<b>Max voice channels</b>	8	16	24**	32	128
<b>Local operation</b>	6 buttons keypad + access key + LCD display				
<b>Remote operation</b>	LAN/ WAN				
<b>Recording buffer capacity</b>	depend on HDD (8 kB for 1s. recording) eg for HDD 500 GB - 15 000 hours				
<b>Local playback</b>	+				

\* 19" housing suitable for mounting in 19" RACK cabinets (1 U = 1 $\frac{3}{4}$ " = 4,445 cm).

\*\* In configurations with VoIP channels, it is possible to achieve value of 32 channels

## 1.3 TRX's recorder's features

- Recorders are stand-alone devices, they can be handled either locally or remotely via a computer network and the software supplied by TRX.

- Network connection between PC workstation and the recorder may be encrypted (SSL).
- Recordings have precise timestamps.
- Independent recording criterion for each channel (keying, VOX, etc.).
- Channel activity signalling.
- Checking the hard drive is full - automatically create space for new recordings by erasing the oldest ones when the disk is close to full capacity.
- Automated daylight saving time feature included.
- Playback and monitoring recordings with no recording interruption.
- Archive building out of recordings, all recordings may be stored in one huge file, or each recording may be saved as a *wav* or *mp3* file.
- Phone numbers related to the recorded call are also stored.
- For digital system phones: content of phone display is also recorded (some systems).
- Internal recorder's clock may be synchronized with external time base devices or computer network (NTP protocol).
- English and Polish GUI interface.
- Simultaneous support for multiple users' access via computer network.
- Call number detection in ISDN, VoIP and analogue FSK lines.
- Recording calls from digital proprietary system phones with most popular manufacturers of telecommunications systems.

## 1.4 Additional options:

- RAID 1 array for increased protection of the recordings against HDD failure
  - hardware or software mirroring - KSRC 5128 (standard) and KSRC 332 (optional),
  - software mirroring - all models (optional),
- Exchange of broken HDD while normal recorder's operation.

**Important:** requires "Hot Swap" rack.

- Doubled power system, recorder may be powered from two independent power sources, which makes it invulnerable to single power loss - KSRC 5128 (standard) and KSRC 332 (optional).
- Detection of power loss or power failure for recorders with doubled power system - (models above).

## 2: Recorder's connections and start up

### 2.1 Package contents

Inside the recorder's package, there shall be the following items:

- the recorder
- the power cord (230 V)
- recorder access key
- HDD enclosure key lock

### 2.2 Conditions of exploitation

Recorders can be used exclusively indoors. The device must be protected from liquid and moisture ingress, as well as from excessive heat, dust and vibration.

Border acceptable storing temperature range	-30 ... +60 °C
Recommended storing temperature range	+5 ... +40 °C
Admissible ambient temperature range during the work	+10 ... +25 °C
Relative humidity (without condensation)	20 ... 80 %
Air pressure	84 ... 107 kPa
Ingress Protection Rating	IP 20
Strokes during operation	not permitted

Recorder shall be connected to the properly grounded power outlet. Power cord plug shall be removed (plugged out) from power outlet in order to permanently turn the recorder off and proceed with any actions related to recorder's maintenance (i.e. HDD replacement).

For recorders with built-mirror system, power supply, each of the cables should be plugged into an independent circuit.

**CAUTION:** *In order to fulfill IEC 950 user safety laws (i.e. including PN-93/T-42107) a person that installs the recorder is obliged to install additional short-circuit protection of power line (10 A fuse on live wire) from which the recorder will be powered. It is recommended to bring the recorder to TRX service for maintenance (hard drive, battery and fan checkout, and dusting) just before warranty period expires.*

Consecutive maintenance checkouts shall be done once every 12 months.

<p>TRX Service ul. Miedzoborska 48 04-041 Warsaw POLAND tel. +48 22 870 63 23</p>
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TRX IS NOT RESPONSIBLE FOR DATA LOSS IN CASE OF  
HARD DISK FAILURE

## 2.3 Installing the Call Recorder

TRX recorders are designed for installation as a stand-alone device (KSRC 308 and KSRC 316 models), or 19" telecom RACK cabinets (KSRC 332, KSRC 5128 and KSRC 2U models).

Elements of the local operation of the recorder as well as the HDD rack are situated on the front panel of the device. All connector: power, recording interfaces input sockets, Ethernet socket, or optional alarm connector are located on the back panel of recorder. For this reason, it is recommended to install the device in such a way to allow access to both the front and rear.

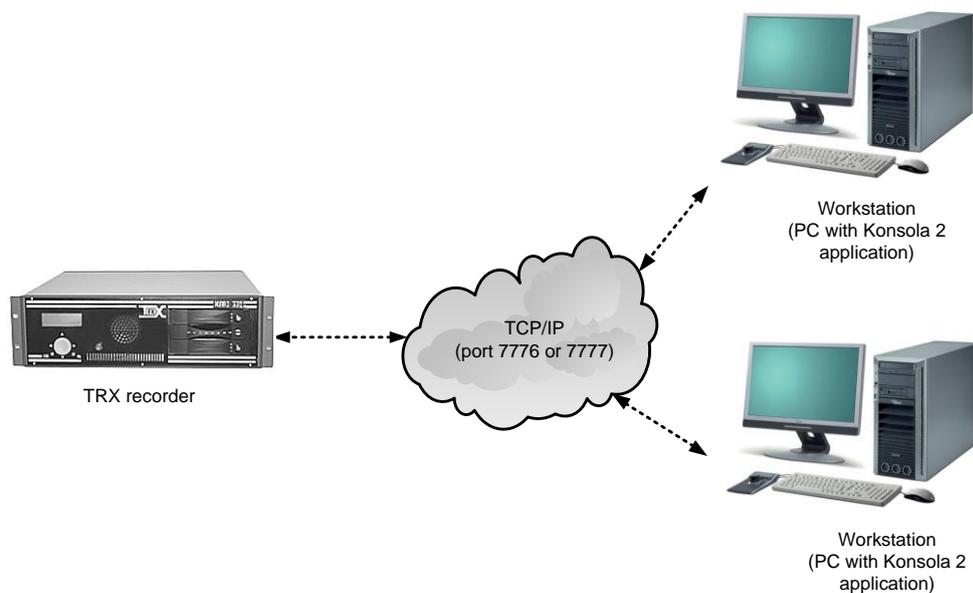
After installation the recorder in telecom RACK cabinets, you should connect the power adapter to a power source, plug LAN 1 connector to the computer network, and then bring the phone lines to the recording interface slots.

**Warning:** *Keep other object at least 10 cm away from the recorder to ensure adequate ventilation. Covering the air vents is forbidden.*

## 2.4 Connecting to TCP/IP network

Workstation stands for a personal computer, where bundled software that allows controlling of recorder's operation is run. In order to utilize all recorders' features, it is necessary to connect at least one workstation into it. The recorder can be connected to many workstations at a time.

In order to connect device to TCP/IP network use Ethernet 10/100/1000 Mb/s interface with RJ45 connector located on the rear panel. In recorders equipped with two network interfaces (*eth0* and *eth1*), the LAN 1 socket (*eth0* interface) is usually used for management and operation of the device.



Connection via TCP/IP environment

To communicate with workstations recorder uses the following ports:

- 7777 - for connections without encryption,
- 7776 - for SSL encoded connections.

To ensure proper communication with the recorder via firewall and/or NAT it is necessary to open ports mentioned above.

## 2.5 Recorder's start up

Before recorder's start up – please make sure that a hard drive is properly installed in the device. After the check is done – the recorder may be powered up. HDD LEDs go on; LCD display backlight is being turned on, too. Initialisation of all internal hardware and settings takes about one minute of time. Brief information about consecutive start-up stages appears on the display. If everything works fine, all information ends with “OK”. After the proper initialisation the device automatically starts up and is ready to record.

**Important:** *If recorder's last turn off was improper (power loss, etc.) – generally when recorder was not shut down with „Halt” option in administrative menu available on the recorder's local control panel – the system will check out hard drive for errors while device starts up.*

Time amount required for this operation varies dependent upon the HDD size. It may take up to several minutes. Please be patient. While disk test is being performed, the following information is being displayed on the display:

```
Checking disk... OK
Database...     OK
```

## 2.5.1 The first start up

At the very first start up recorder is necessary to verify and modify (if needed) network settings. Use the local keyboard on the front panel. First user shall switch into authorized mode by turning left the key in the main recorder's switch, then select "Net" line with the „v” and „^” buttons and press "OK".

```
Network conf.
>Interfaces
  Routing
  Firewall *
```

After selecting „Interfaces” and for approval with „OK” key a screen of the configuration of the eth0 (LAN 1) interface appears.

```
eth0 [up]
>IP: 172.016.000.013
  NM: 255.255.000.000
  HW: 0040-63da-571c
  Mode : Static
```

In order to change the IP address, select the second line and press „OK”.

```
eth0 [up]
>IP: █72.016.000.013
  NM: 255.255.000.000
  HW: 0040-63da-571c
  Mode : Static
```

It is possible to move among address digit fields with „>” and „<”. buttons. Digits can be changed with „v” and „^”.buttons. All changes are accepted and permanently remembered after „OK.” button has been pushed. "ESC" button cancels the changes.

More detail about local recorder operation by means of buttons on the front panel is presented in chapter 3: *Manual recorder's operation*.

Initial settings allow you to connect to the recorder by means of *Konsola 2*, where all other recorder's options may be verified and changed if needed. *Konsola 2* application has been described in the user manual of this program.

## 2.6 Phone line connections

A set of RJ12 sockets on the rear side of the recorder or RJ45 socket on the front side of the expansion module (only for KSRC 5128) allows connecting phone lines, from which the audio signal is about to be recorded.

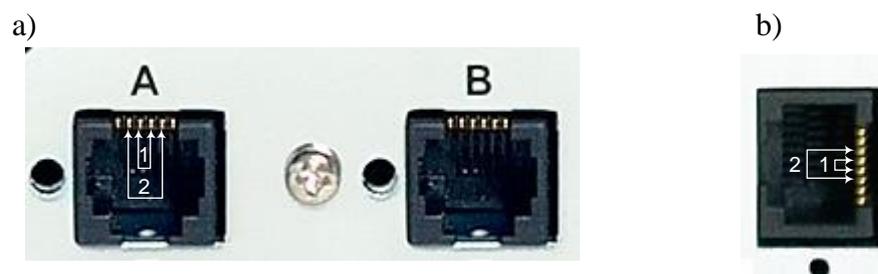
Each recorder is equipped with an individual set of interface boards, which allow recording information from different sources. Attached port specification allows do distinguish particular interface types and allows the user to connect them to the proper signal sources. The following subchapters present information about the pin out of each kind of socket on different kinds of interfaces. Information about how user shall connect a particular interface to the related phone line is also presented.

### 2.6.1 Analogue socket

Analogue interface socket allows connecting the recorder with any device (eg. phones or two-way radios) that is a source of analogue audio signal. There is possible two ways of connection: either in parallel or in series.

#### 2.6.1.1 In series connection

It is standard 6-pin RJ12 (a) or RJ45 for KSRC 5128 expansion module (b) socket. Socket's pin out description for in series connection is shown below.



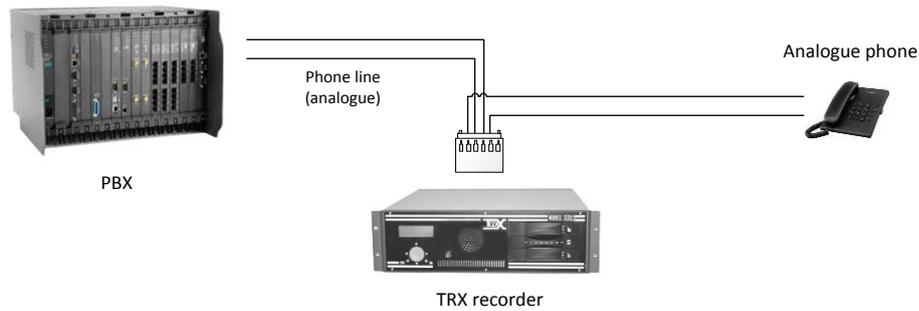
RJ12 socket legend:

- 1 - signal input (pins 3, 4),
- 2 - signal output (pins 2, 5).

RJ45 socket legend (EUROCARD type boards):

- 1 - signal input (pins 4, 5),
- 2 - signal output (pins 3, 6).

The cable pairs 1 and 2 are **interchangeable** (only in this case). In series connection is **recommended** for recording calls with analogue phones.



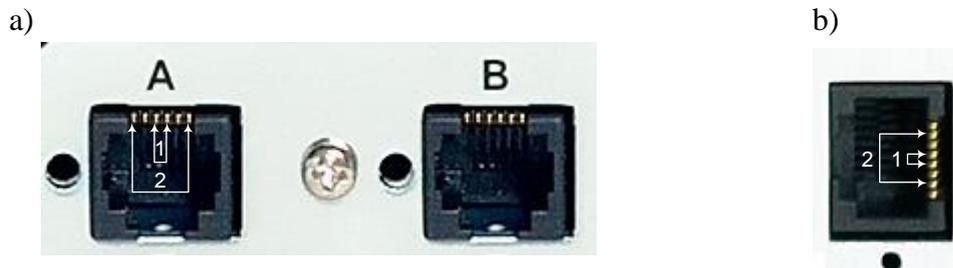
In series connection.

In this case of connection, recording begins at the moment when user picks up the handset (PBX starts to supply current to the phone). At the moment when user puts down the handset, the recording stops (PBX stops to supply current to the phone). Since this recording mechanism is very robust (there is no doubt if the recording shall start or stop).

**Attention:** In order to use keying signal input it is necessary to configure recording criterion of particular channels in the recorders. Please read *Konsola 2 user manual* for more details.

### 2.6.1.2 In parallel connection

It is standard 6-pin RJ12 (a) or RJ45 for an expansion module (b) socket. Socket's pin out description for in parallel connection follows.



RJ12 socket legend:

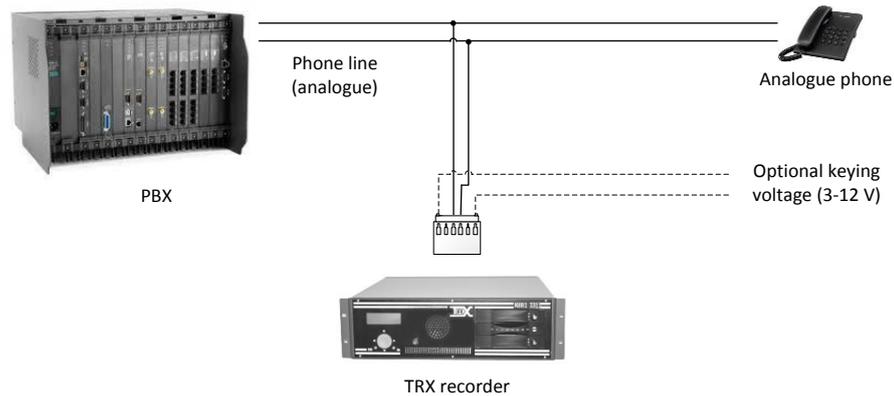
- 1 - signal input (pins 3, 4),
- 2 - keying signal input 3 - 12 V (pins 1, 6).

RJ45 socket legend (EURO type boards):

- 1 - signal input (pins 4, 5),
- 2 - keying signal input 3 - 12 V (pins 2, 7).

The second pair may be used for supplying the keying signal to the interface. If DC voltage level of keying signal exceeds about 2V, the recording process starts. Therefore, the second pair in the analogue connector may be considered as an input of electronic switch for any control signals that can be obtained from different sources like buttons, sensors, etc.

In parallel connection is designed for recording calls with two-way radios. It can also be used for recording phone as an alternative to the in series connection.



In parallel connection.

**Important:** Setting criteria for registration is performed remotely by using *Konsola 2* application. Detailed information about the configuration of recording criterion may be found in *Konsola 2* user manual.

In case of in parallel connection, automatic control of the start of recording is possible only through listening to the sound levels on the line (VOX). In this case, recording starts when audio signal level exceeds level previously set by user level. It is possible to configure the recorder for manual recording with keying voltage on the outside pair.

## 2.6.2 ISDN BRI socket

This RJ12 socket allows connecting in parallel to 2B+D (BRI, S/T) ISDN line. Input must be connected in parallel to an ISDN line, according to the following description. This socket is easy to recognize, because there are two switches and a LED next to it (see picture below).



RJ12 legend:

- 1 - phone transmit pair (pins 3, 4),
- 2 - phone receive pair (pins 2, 5),
- 3 - switches for line terminators (attaching/detaching 100  $\Omega$  resistance),
- 4 - control LED (lack of synchronization).



RJ45 socket legend (EUROCARD type boards):

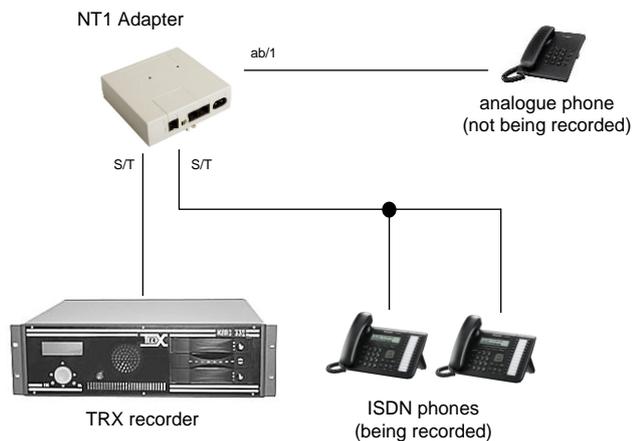
- 1 - phone transmit pair (pins 4, 5),
- 2 - phone receive pair (pins 3, 6).

DIP switches near the socket allow adding additional impedance to the line. It is necessary to add this impedance in case of long connection lines. There is a separate switch for both transmit and receive pair in line (should be in the same position). Switch in upper position means that there is no additional impedance connected to the line (short line position). Lower position of switch means that additional impedance is connected to the line (long line position).

Red control LED, when lights, stands for lack of synchronization of the recorder with data in the line. If the line is not in idle state and the LED lights, it means that connection has been done improperly.

**Important:** *In case where phones are connected to NT1 terminal, this LED will light if the line is in idle state longer than 20 s.*

For ISDN 2B+D lines the recorder may be connected directly to one of S/T sockets in NT1 terminal or (in case when both these sockets are already occupied) in parallel to one of digital phones. Phone calls from both B channels will be recorded. Wiring diagram is as follows.



Recorder connected directly to the S/T socket in NT1 device

In the case presented above the connection between the recorder and the NT1 device must be done with “rollover” cable:

- RJ12 – RJ45 (2 ↔ 6, 3 ↔ 5, 4 ↔ 4, 5 ↔ 3) - for inner type boards,
- RJ45 – RJ45 (3 ↔ 6, 4 ↔ 5, 5 ↔ 4, 6 ↔ 3) - for EUROCARD type boards.

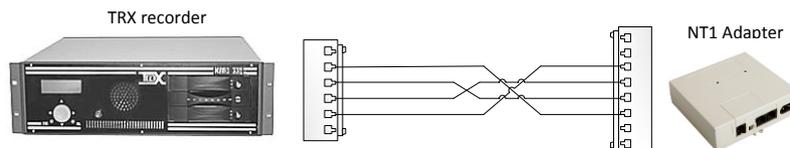
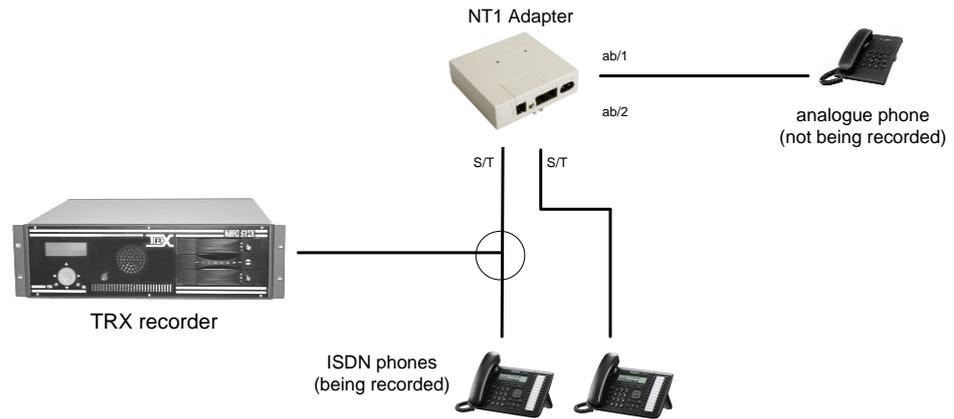
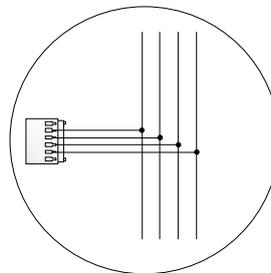


Diagram of wiring between the recorder (RJ12) and S/T (RJ45) NT1 socket



Recorder connected directly to the phone line

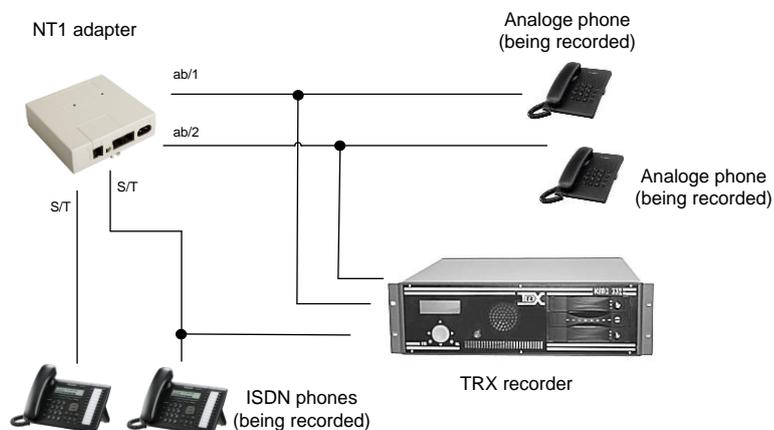
The figure below shows a diagram of individual wires of cables in the tie-recorder (the area marked on the diagram above, circle).



In parallel connection

**Important:** If there are any analogue phones connected to NT1 via ab1 and/or ab2 sockets – calls from these phones will not be recorded. Analogue phones require additional connection to the analogue interface board.

The following scheme presents a situation where all calls from all phones connected to NT1 device are recorded.



Recorder connections, where all calls are recorded (from analogue phones too).

For analogue phones, connections please follow the rules presented in sub-chapter *Analogue socket*.

Please note, that one ISDN line provides two audio channels, and therefore each connection of ISDN line to the recorder will occupy two channels in it. In case of connecting performed according to the last scheme, four channels are entertained (2 channels from the ISDN phones and two from analogue phones).

### 2.6.3 ISDN PRI socket

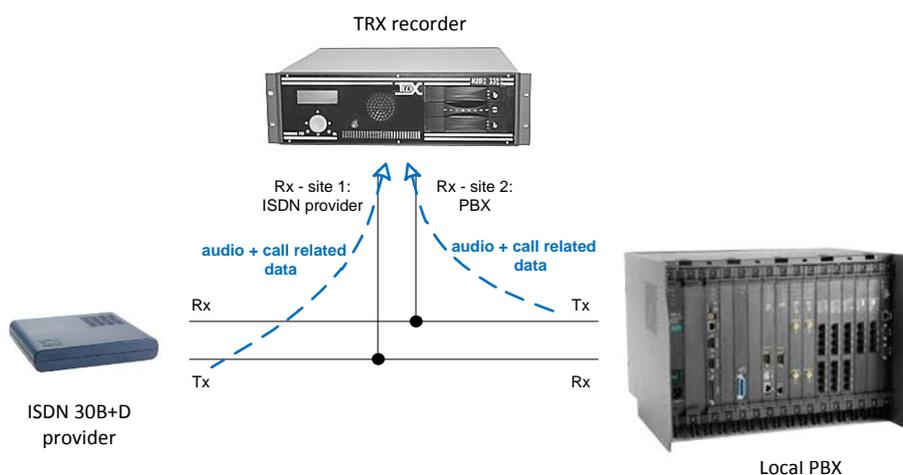
ISDN PRI line provides 32 or 16 (half-board) audio channels. Due to the nature ISDN trunk, for the call recording is used respectively 30 or 15 channels. ISDN PRI socket (G.703 interface) is presented on the following picture. The interfaces are not present in the expansion modules and are terminated RJ12 socket. The two control LEDs in the adjacent hole are characteristic of this board.



Legend for ISDN PRI interface:

- 1 - transmit pair (Tx) from PBX side (pins 3, 4),
- 2 - transmit pair (Tx) from the ISDN provider side (pins 2, 5),
- 3 - control LEDs for PBX and ISDN provider side.

Control LEDs indicate connection error of line and lack of synchronization. Left of them means the lack of the synchronization for the first pair (pins 3, 4), right - for the second pair (pins 2, 5).



Connection of TRX recorder to an ISDN PRI line

For ISDN PRI lines, the recorder shall be connected in parallel to the cable between teletransmission (eg. HDSL modem) and local PBX.

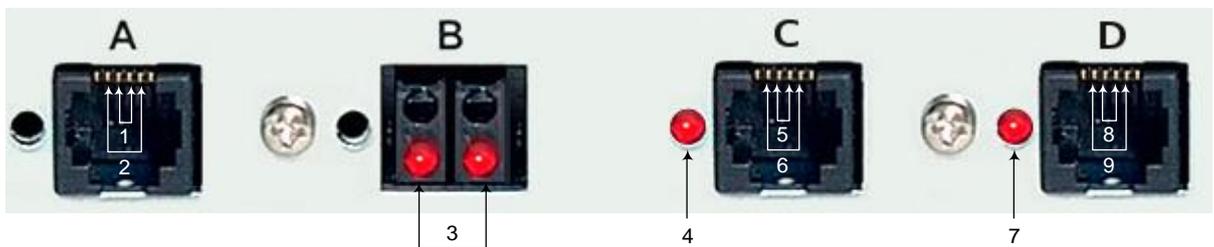
Calls from ISDN PRI lines can also be recorded with TRX active PRI interfaces equipped with 3 x RJ12 sockets (section 2.6.4). ISDN line should be connected only to the **left edge socket** (placed next control LEDs).

**Important:** *In older ISDN PRI board version confusion between transmit and receive pair will result in incorrect information about calls' direction (incoming/outgoing) in Konsola 2 call report.*

## 2.6.4 ISDN PRI active socket

PRI active interfaces are designed mainly for CTI integration TRX recorders with recorded telephone systems, but can also be used to record calls from ISDN PRI trunk lines.

Pin outs and the LEDs description on PRI\_active board are shown in the figure below.



Legend for ISDN PRI active interface:

**A - passive port** (two G.703 receivers)

1 - input the receiver 1 (pins: 3, 4) ← transmission (Tx) from PBX cite

2 - input the receiver 2 (pins: 2, 5) ← transmission (Tx) from provider cite

3 - control LED (dla strony PBX, oraz dostawcy ISDN)

**C - active 1 port** (G.703 transmitter + receiver)

4 - control LED for active 1 port

5 - output the transmitter **Tx** for active 1 port (pins: 3, 4)

6 - input the receiver **Rx** for active 2 port (pins: 2, 5)

**D - active 2 port** (G.703 transmitter + receiver)

7 - control LED for active 2 port

8 - output the transmitter **Tx** for active 2 port (pins: 3, 4)

9 - input the receiver **Rx** for active 2 port (pins: 2, 5)

The red control LED indicates lack of sync (incorrect PRI line connection) for each socket on the board. The green control LED (located next to the latch inside the socket), signaling the correct connection to the line.

Depending on the use of active PRI card (type of recording configuration) you should use appropriate socket on the board:

- most left edging (on the figure indicated by A letter) - used to record calls from ISDN PRI trunk lines. (in parallel connection)

- middle and most right edging (on the figure indicated by C and D letters) – used to receive audio stream from dedicated PRI boards applied in solutions based on active CTI integration (terminal connection).

Characteristic feature of the PRI active board is possibility of software setting the number of audio channels (in range from 2 to 30). This feature allows for allocation of unused recorder’s resources (channels) to other TDM interface or VoIP channels.

The diagram attached below showing the usage of recorder’s channels for two PRI active boards – where the number of channels was set to values 30 and 10. It is appropriate:

- 32 channels (0 - 14, 16 - 30 and 15, 31),
- 12 channels (0 - 9 and 15, 31).

Port card number	0				1				2				3				4				5				6				7			
Channel number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Channel indication	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
<b>PORT 0</b> 30 chan.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
<b>PORT 1</b> 10 chan.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2 chan.													12	13																		
4 chan.																	16	17	18	19												

Reducing the number of audio channels up to 10 on the second PRI active board (PORT 1) allows installation additional boards for addresses:

- 3, 7 (2 channels interface boards),
- 4, 5, 6 (2 or 4 channels interface boards).

### 2.6.5 System phone interface socket, parallel connection.

The board input slots are based on sockets RJ12 (two- or four-socket boards) or RJ45 (extension module - only four socket boards). For operation only the first pair is used. Boards are used to record calls from system telephones working with proprietary Up0 standard most popular manufacturers of PABX.



RJ12 legend:

1 - in parallel connection to the system line (pins 3, 4).

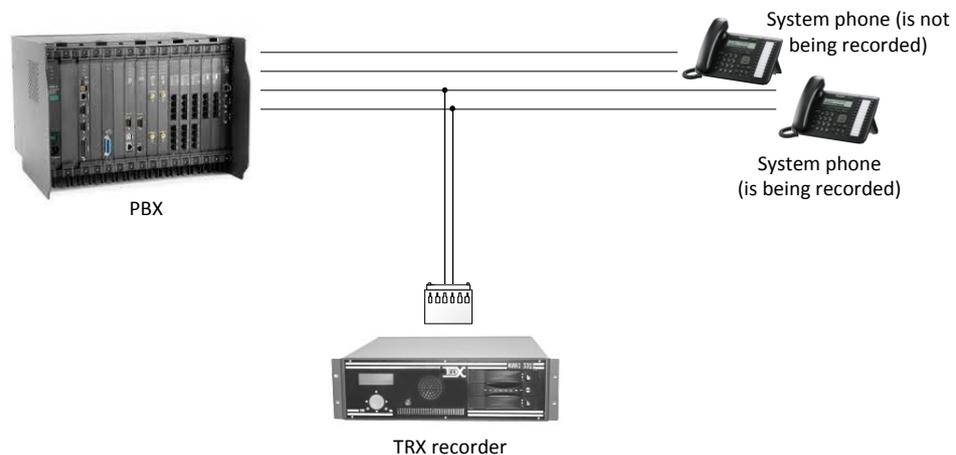


RJ45 legend (EUROCARD type boards):

1 - in parallel connection to the system line (pins 4, 5).

The interfaces allow recording calls on system phone most popular manufacturers of PBX (among others Alcatel, Avaya, Coral, DGT, Ericsson, Kapsch, Matra, Siemens and Panasonic. Interfaces for different proprietary system phones are **not interchangeable**.

This type boards should be connected in parallel with the system telephone lines as shown in the diagram above (the middle pair of pins in the socket).



In parallel connection to the system line

Each system line socket is equipped with two LEDs: green one and red one. Illuminating red LED stands for the loss of synchronization between channel on board and information on the line. It means that there is no proper signal delivered to the interface on a particular channel. Illuminating green LED stands for valid connection of line to the recorder. Flashing LEDs stand for incorrect phone connection to the line.

## 2.6.6 TENOVIS (BOSCH) interface socket

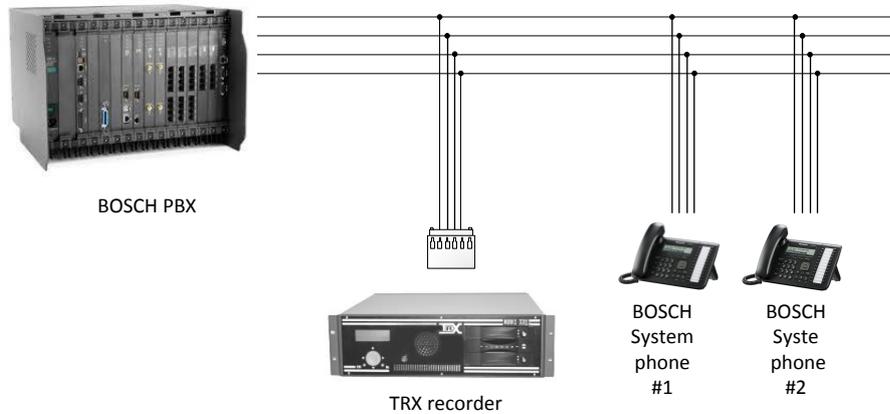
TENOVIS (BOSH) interface socket is very similar to ISDN BRI socket. Switches and LED are present and stand for the same functions, too. Socket pin out is the same; however, connection scheme is a bit different and follows.



RJ12 legend:

- 1 - transmit pair (pins 3, 4),
- 2 - receive pair (pins 2, 5),
- 3 - switches for line terminators,
- 4 - control LED

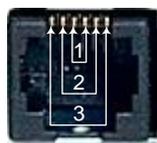
For TELENOVIS (BOSCH) system lines recorder shall be connected in parallel to all four wires in line. BOSCH standard allows for connection of two independent phones to a single line. All calls from both of these phones will be recorded.



Connection recorder to BOSCH system line

## 2.6.7 System phone interface socket, in series connection (Repeater)

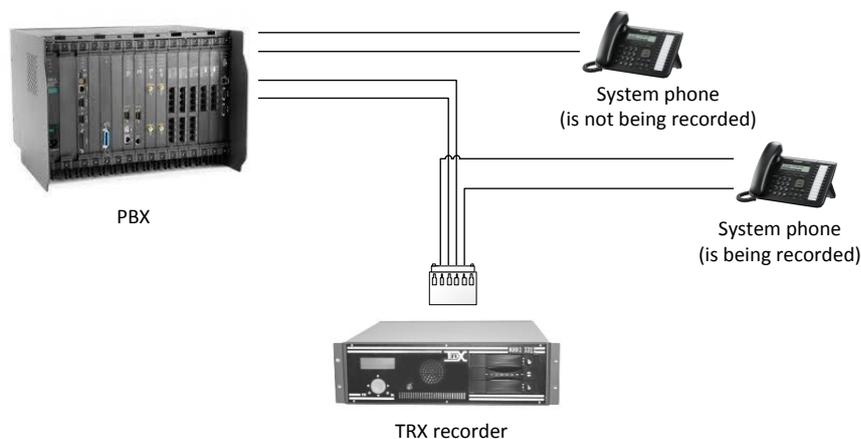
There are versions of system interface boards that shall be connected in series into the system phone line. Such boards' versions are clearly described as serial ones. Serial interface board system may be present in versions of two or four port.



### RJ12 legend

- 1 - link to the PABX (pins 3, 4),
- 2 - link to the phone (pins 2, 5),
- 3 - not used (pins 1, 6).

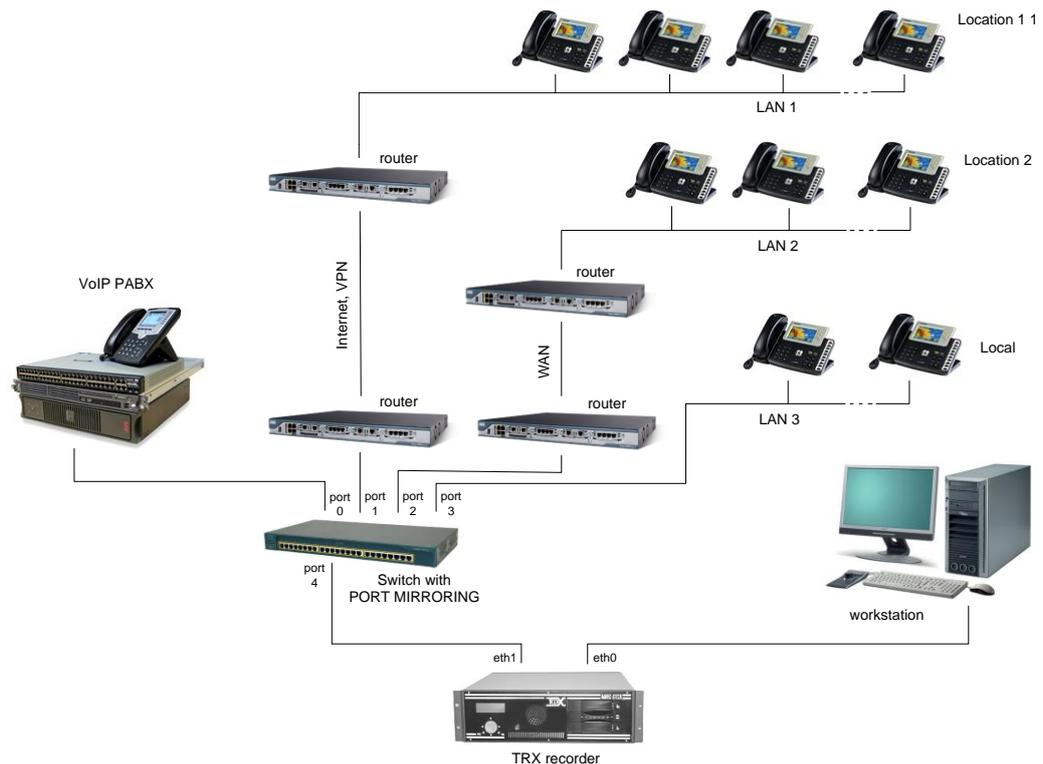
Interface boards with this kind of socket are in **series** connected between the PBX and the phone. In case of recorder's power failure for example, the board does not interrupt the connection between PBX and phone.



In series connection to the system phone line

## 2.7 Recording VoIP calls

KSRC 332 and KSRC 5128 series recorders are equipped with two Ethernet interfaces (eth0, eth1) described on the case respectively as LAN 1 and LAN 2. It is recommended to configure the first port (eth0) to communicate with the recorder with Konsola 2 software. The second port of the recorder must receive a copy of all signaling and audio stream transmitted between subscriber stations and the IP-PBX.



Recording VoIP calls based on *Port mirroring*

Customers, who intend to record calls with VoIP systems, should assure that all the network traffic generated by VoIP infrastructure components of the system reaches the recorder. This is achieved by setting a *Port mirroring* mode on one port of the switch and connects him to the TRX device.

The figure above shows an example of the interconnection TRX recorder and customer IP-PBX system. VoIP calls between stations located in several locations are being recorded. All traffic reaching ports *port 0*, *port 1*, *port 2* and *port 3* should be mirrored into *port 4* in order to allow monitoring the communication between VoIP terminals and IP-PBX.

For some VoIP systems (eg Cisco Unified Communications Manager), it is possible to use integration, ie the dedicated interface between recorder and the voice system based on CTI standard.

## 2.8 Call recording using CTI integration

Integration TRX recorders with telecommunication systems via CTI (Computer Telephony Integration) interfaces bringing the benefits as compared to traditional call recording. Advantages of CTI integration solutions are relevant in Call / Contact Center environments and for recording VoIP calls. Recorder gains access to all call-related events, such as call transfer/redirection, routing calls from ACD queues to individual agent stations. It is also possible to attach to the call list UCID (Universal Call ID) index from the CDR (Call Detail Record) database.

Sometimes is necessary using special integration platforms (eg CAP servers), whose role is to translate the messages between recorder and proprietary PBX protocols. For the communication are used industrial standards, including:

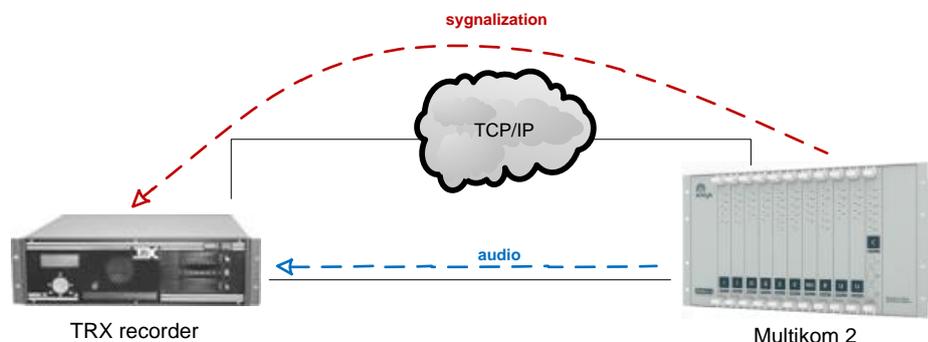
- TSAPI (Telephony Server Application Programming Interface),
- JTAPI (Java Telephony Application Programming Interface),
- CSTA (Computer-Supported Telecommunications Applications).

### 2.8.1 Passive integration

The solution does not require any additional hardware on recorded PBX side. TRX recorder is connected to each recordable station. Audio stream is being retrieved directly from telephone lines by means of additional wiring connected to the recorder interfaces. The call-related events is received not from recorded lines, but from from CTI interface.

### 2.8.2 Active integration

The active integration requires the PBX to be equipped in additional PCM 30/32 trunk boards, where the recorded system will replicate audio stream for all recordable calls. All call-related (control) data TRX recorder receives from PBX using the appropriate protocol via CTI link.

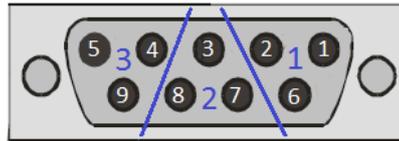


CTI integration for Multikom 2

## 2.9 Alarm connector

Optionally, recorders can be equipped with alarm connector (DB9 female), placed in the rear of the enclosure. Recorder uses it to signal to any external devices (eg buzzer, warning light) that a fault situation appeared in recorder's operation.

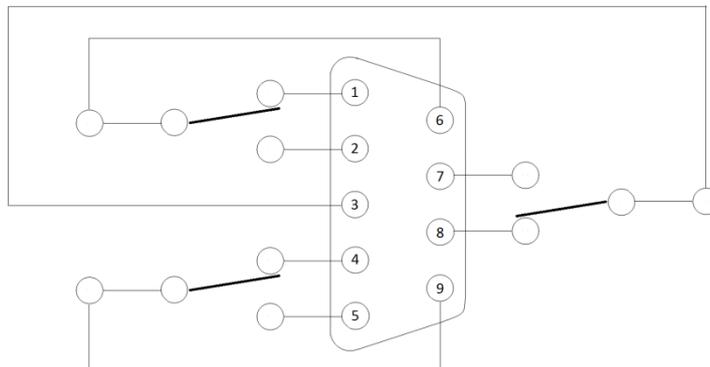
DB9 socket outputs are divided into three independent circuits; it means the ability to support up to three different events.



Alarm connector groups and pin out

Depending on the jumper settings the alarm connector can operate in passive mode (shorting / opening) or active (putting or not voltage).

Passive mode is to change the state (shorting / opening) between the selected alarm connector pins. In this mode the alarm connector works as a switch - opens or closes the circuit, which operating the device indicating occurrence of alarms.



Position of the relays for alarm active or power failure

Position of the relays in case of alarm or power failure is shown in the figure above.

If the recorder is powered and there are no declared alarms, the relay changes state to the opposite (the last column of the table below).

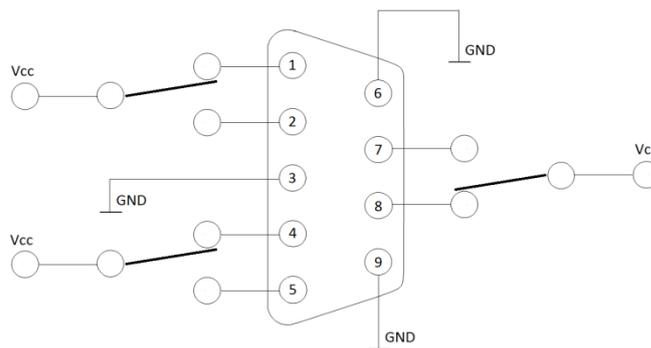
Pin numbers	Group	Alarm active or power failure.	Alarm inactive
6 - 1	1	closed	open
6 - 2		open	closed
3 - 7	2	open	closed
3 - 8		closed	open
9 - 4	3	closed	open
9 - 5		open	closed

**Attention:** Maximum rating for the connector pins are 0.5 A / 50 V DC. Stress beyond the stated limits may result in damage of the alarm connector circuit.

Active mode is to putting or not the voltage on particular connector pins. In the opposite of passive mode apart from indicate alarm, can be used to power external devices.

Voltage Vcc putting on connector pins is 5 V. Current load is about 100 mA per circuit. When using only one circuit output current, can be three times greater (ca 300 mA).

Positions of the relays in case of alarm occur is shown in the figure below.



Position of the relays for alarm active

If the recorder is powered and there are no declared alarms, the relay changes state to the opposite (the last column of the table below).

Pin numbers	Group	Alarm active	Alarm inactive
6 - 1	1	5 V (logic state "1")	0 (high impedance)
6 - 2		0 (high impedance)	5 V (logic state "1")
3 - 7	2	0 (high impedance)	5 V (logic state "1")
3 - 8		5 V (logic state "1")	0 (high impedance)
9 - 4	3	5 V (logic state "1")	0 (high impedance)
9 - 5		0 (high impedance)	5 V (logic state "1")

When the power is off, voltage levels on all pins are: 0 (high impedance).

User can configure alarms with *Monitor 2* application. Please read *Monitor 2* manual for more details.

## 2.10 External sources of time synchronization

It is possible to connect external DCF77 or GPS NMEA time base devices to USB connector put on the rear side of the recorder. This device will maintain the time setting for the recorder. Thanks to this, timestamps of recorded calls will be more accurate.

Besides the DCF, or GPS devices, it is also possible to connect time base devices via LAN or WLAN. For that purpose *NTP* (Network Time Protocol) is being used. Recorder may become a time base device for other devices in the local network, too. More details about that feature can be found in *Konsola 2* manual.

## 2.11 Power source

Recorders are powered up from standard AC power sources: 230 V, 50 Hz. Power outlet must be properly grounded. Optionally, the call recorder can be powered by 48 V DC.

### 2.11.1 Power source redundancy

Some recorders are equipped in doubled (redundant) power system, which allows connecting the recorder to two independent power sources. In such case, there are two power adapters in the recorder. This makes recorder invulnerable for power failure or power loss on one of power sources or one of power adapters.

Redundant power supply option is available only for models KSRC 332 and KSRC 5128.

#### 2.11.1.1 Power source failure signaling

For recorders with doubled power system it is possible to detect and signal to the user the power loss on the output of one of power adapters. In such case, loud audio signal can be heard and one of gauges flashes. Recording process in such case continues, as if nothing happened.

A set of LEDs on the rear side of the recorder allows determining the current state of both power adapters. Consecutive LEDs inform about the existence of the following voltages: + 5 V, +12 V and -12 V on the output of power adapter. If all these LEDs are blank, it usually means the failure of power source. If any of these LEDs remains lighted – internal power adapter failure has occurred.

#### 2.11.1.2 Power supply adaptor exchange

Broken power adaptor may be exchanged with no need to turn the recorder off if the second power adapter works fine. To do that, two mounting screws shall be removed, than power adapter shall be slid out. New power adaptor shall be slid in and then secured with two screws. Finally, it shall be connected to the power source and turned on.

## 3: Manual recorder's operation

In this chapter, detailed description of manual recorder's operation is presented. Manual operation stands for operation by means of buttons, display and a key switch that are available on the front panel of the recorder.

### 3.1 Entering characters

Entering characters can be done by means of arrow buttons. To move between characters use left and right arrow („<”, „>”). To change a character, you should use the “up” and “down” arrows („√”, „^”).

While entering passwords the only visible character is the one where cursor is placed on. All other characters are masked with “\*” character. Character set is limited to big and small letters, digits and a space.

### 3.2 Operation modes

Recorder may operate in two basic modes:

- unauthorized - no key in the switch, vertical key position in the switch,
- authorized - horizontal key position in the switch.

Both modes affect only local recorder's operation. They **do not affect the recording process** in any way, however in authorized mode it is possible either to restart and stop the recorder.

#### 3.2.1 Unauthorized mode

In this mode, recorder's operator can access only basic information about the recorder presented by default on recorder's display. There are four pages (displays) available on the display for unauthorized operator. It is possible to move between them with left and right arrow buttons.

On the following screens you can view the following details:

- Display 1:
  - The time and date according to the clock recorder.
  - Letter symbols channels that are currently recorded.
- Display 2:
  - HDD or RAID array capacity.
  - Information about the amount of free disk space (in percent).
  - Uptime, memory and CPU occupation.
- Display 3:
  - Recorder model.
  - Serial number.
  - The software version installed on the call recorder.
- Display 4:
  - Date and time of the oldest record on recorder's storage magazine.
  - Number of all recordings.

### 3.2.2 Authorized mode

Authorized mode allows browsing the confidential data stored in the recorder and modifying basic recorder's settings. This mode may be accessed after the key in the switch has been turned counter clockwise and the key is in horizontal position. Additionally it may be necessary to enter the password.

It is possible to enter this mode as a "User" or as an "Admin". For both these accounts **independent** password may be set.

The actual modes are called:

- Admin (no password).
- Admin (password).
- User (no password).
- User (password).

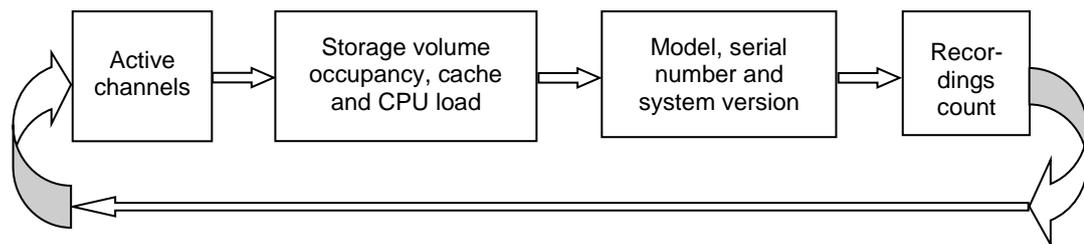
In this mode the authorized user can enter some values, such as password authentication, clock settings or an IP address.

Entering data is done through the universal arrow (<, v, >, ^) button located on the front panel of the recorder. Horizontal arrows allow you to select the right item you want edit, vertical arrows allow changing the character of the selected item.

## 3.3 Display and its contents

After correct recorder's start up – time, date and information about active channels is presented on the display. By means of „<” and „>” buttons user may switch between different displays.

With „>” button the display sequence is as follows:



And likely, with „<” button it is possible to see displays in reverse sequence.

**NOTICE:** *The appearance of the display content presented in this manual corresponds to recorders with software from 2.0.16.06/28.03.2014 version. For devices with older version of the software, the messages displayed may vary slightly.*

Since recorder’s display is capable of showing four lines of text at a time, the content of the display is periodically refreshed and vertically scrolled, one line at a time.

If any line of the display content has a length exceeding 20 characters, there is a possibility of manual shift the screen to the right or to the left, using the keys ">" or "<". In this case, the first (title) row is not shifted.

### 3.3.1 Adjusting the contrast and brightness of the LCD display

Adjust the contrast of the display characters is achieved by simultaneously pressing the "OK" and the „^” or „v” buttons.

Adjust the brightness the backlight of LCD display is achieved by simultaneously pressing the "ESC" and the „^” or „v” buttons.

### 3.3.2 „Active channels” display

This default display appears after correct recorder’s start up or after the exit from administrative menu. A date and time is presented in the first line on the display. Date and time line may blink if the device has been configured to work with an external time source (DCF77, GPS or NTP). Blinking brings information about synchronization of internal recorder’s clock with time base devices (both external and internal). Slow blinking stands for sync loss, fast blinking stands for establishing connection with time base device, and no blinking stands for full time synchronize. Clock synchronization is performed at every start-up of the recorder.

```

01.04.2014 09:35:05
Active channels:
  1:A...EF.....
 17:.....
241:          k *o
  
```

Line 3 and subsequent contains information about recorder channels. Each line displays information for 16 channels (correspond to the letters from A to P). The 33-rd and above channels is possible using the „√” and „^” buttons.

The scope of presented channels is determined by the number on the front of the line:

- 1 - physical channels from 1 to 16,
- 17 - physical channels from 17 to 32,
- 241 - physical channels from 241 to 255,

Symbol in the . (dot) shape indicates that the recorder is equipped with physical channel number indicated by given position. For channel where recording is in progress the appropriate upper case letter (A to P) in place of dot appears. If there is no dot and no letter – than this channel is inaccessible (no proper hardware installed).

The example screen presents the information that the recorder is equipped with physical channels number 1 from 20 and 25 from 32, wherein the channels 1, 5 and 6 are in recording process.

Symbol in the \* (asterisk) shape indicates the presence of (arrangement) virtual channel. For channel where recording is in progress the appropriate lower case letter (from a to p) in place of asterisk appears. If there is no asterisk and no letter – than this virtual channel has not been configured.

The example screen presents the information that for the recorder has been configured virtual channels number 251, 254 and 255, wherein the channels 251 and 255 are in recording process.

### 3.3.3 „Disk size and usage” display

This display brings information about the size and usage (in percentage) of hard drive or RAID array installed in the recorder. After some period of time free space indicator will be approach to 0 %, which means that recorder is overwriting the oldest recordings.

```
Recordings space:
  available 247.5GB
  free      50%
#####
uptime 20d 13h
cache: 0.8%
cpu: 2% core [ 0 4]
cpu: tc. max: 45°
usb: fw ver. 1.4.1
```

Subsequent rows on the display provide information about the following parameters:

- line 5 - the time elapsed since the last reboot of the recorder (uptime),
- line 6 - the cache memory occupancy,
- line 7 - the CPU load (for individual CPU cores),
- line 8 - current temperaturę for the hottest CPU core,
- line 9 – type and firmware version of the recorder base board.

### 3.3.4 System version” display”

This display gives information about recorder’s model, serial number and currently installed software version (version number with the date). A unique serial number of the recorder should be consistent with the number on the rear side.

```
Model          KSRC 332
Serial number
                2013010101
System version
2.0.16.06/28.03.2014
```

This information may be useful in case of any troubles with the recorder and it shall be provided to TRX service when failure is reported.

### 3.3.5 „Record count” display

Here user may determine the date and time of the first recording available in the recorder and the total number of available recordings.

```
First record:
2012.03.01 13:02:46
Total records:
                120875
```

## 3.4 Administrative menu

Apart from buttons next to the display there is also the access key (next to the speaker built in on the front panel) that is used for operation of the recorder. You must turn the key left in a horizontal position to go to the administration menu. Depending on the mode you have access to a restricted or a full set of features.

```
Administrator menu
>Listening
Monitoring
Alarms
Change mode
Change password
Archivization DVD
Net
Mass storage
Date & time
Language
Reboot
Halt
```

Administrative menu may be operated with „√”, „^”, „OK” and „ESC” buttons. Arrow buttons allow selecting desired options; OK button accepts selected option, ESC - allows escaping from any submenu back to the main menu.

### 3.4.1 Menu operation modes

There are four modes of administration menu:

- User (no password) – the mode provides a limited set of functions: Listening, Monitoring, Alarms and Enter password; access to the menu is not password protected.
- User (password) – the mode provides the same set of options as above, but the user password<sup>2</sup> is required in order to enter authorized mode.
- Admin (no password) – the mode gives access to all options available in administrative menu, no password required.
- Admin (password) – the mode gives access to all options available in administrative menu, but admin password<sup>3</sup> is required in order to enter authorized mode.

## 3.5 Functions

Administrative menu contains options related to recorder's configuration and local operation (without using any additional computer). Listening and monitoring functions in the models without installed the speaker, for obvious reasons, is ineffective.

### 3.5.1.1 Listening (playback)

Playback function allows to playback any recorder call from selected time range. After this option is accepted, the list of time range from which user wants to playback recordings is presented.

```
Choose range
>Recent hour
  Present day
  Present week
  Present month
  Selected day
  Free range
```

---

2). If you submit the administrator password, the system displays the menu in administrator mode. After exiting the menu (if mode is not changed) will be restored User mode (with password).

3). If is entered user (user) password the system displays the menu in user mode. After exiting the menu (if mode is not changed it) will be restored Admin mode (with password).

- Recent hour – allows to playback recordings made within last 60 minutes,
- Present day – allows to playback recordings made in time range from 00:00.00 hour till present moment.
- Present week – allows to playback recordings made in time range from 00:00.00 hour in last Monday till present moment.
- Present month – allows to playback recordings made in time range from 00:00.00 hour of the first day of current month till present moment.
- Selected day – allows to playback recordings made in time range from 00:00.00 hour till 23:59.59 hour of selected day.

```
Choose day:  <E>
█0/12/2013
```

**Important:** Black space presented in this manual stands for cursor position.

- Free range – allows specifying very precisely the time range, from which user wants to playback recordings.

```
From:
█0/12/2013  12:03.00
To:
20/03/2014  12:03.00
```

Arrow buttons allow moving within this menu. First user shall select the row in the display that he wants to edit and press “OK” button to enter edit mode. Selected line is marked with „<E>” mark (on the picture below the first line is being edited).

```
From:  <E>
█0/12/2013  12:03.00
To:
20/03/2014  12:03.00
```

While in edit mode, „Esc” button accepts changes made in a single line (edit mark disappears), „OK” button accept the all-available options. If selected time range is invalid, user will be noticed about that:

```
Wrong range!
```

and after a while he’ll be given a chance to correct his selection.

After correct time range selection it is necessary to point out channel (or channels) from which the recordings are about to be played back. To select the channel to listen, press „>” button [selection mark appears on the right side of the

channel's name], to deselect already selected channel, press "<" button [„\*” mark disappears]

```

Choose the channel:
channel 1      [ ]
>channel 2    [*]
channel 3      [ ]
  
```

After „OK” button is pressed, recorder searches for recordings with specified parameters and presents them in a list (if it finds any).

Recordings list is made of four columns, each presented on a different display:

- Date and time.
- Call duration.
- Channel name.
- Calling or called party number.

User may switch between columns with „<” and „>” buttons.

<pre> Date &gt;20/02/2014 08:45.02  20/02/2014 08:47.13  20/02/2014 09:52.24   </pre>	>	<pre> &lt; Duration time &gt; 00:01.32   00:03.03   00:05.27   </pre>	>	
<	<pre> &lt; Channel No. &gt; channel 1   office   A   </pre>	>	<pre> &lt; Phone &gt; -&gt;0600247598 &lt; -0228713333210 -&gt;211   </pre>	<

On „phone” display - arrows bring information about call direction incoming („→”) or outgoing („←”). After recording selection (with „>” cursor and „OK” button) player display appears.

Volume may be changed with „v” and „^” buttons in range -4 ... +8. „<” and „>” buttons allow for rewind and fast forward respectively (either during playback or in stop mode).

Functions of „OK” and „ECS” buttons depend on what's happening with the recording (is it played back, paused or stopped).

- „Play” mode – „OK” will pause and „ESC” will stop playback.

```

20/02/2014 08:45.02
vol:+1 ████████
Play          RW < > FF
ESC-stop     OK-pause
  
```

- „Pause” mode - „OK” starts and „ESC” stops playback.

```

20/02/2014 08:45.02
vol:+1 ████████
Pause        RW < > FF
ESC-stop     OK-play
  
```

- Stop” mode – „OK” starts playback, „ESC” exits to recording list.

```

20/02/2014 08:45.02
vol:+1 ████████
Stop
ESC-exit      OK-play
    
```

**Important:** In latest versions of the software some recordings may be encrypted by the user from the maintenance program is installed on the remote machine. If you try to play such an encrypted recordings can be heard only noise.

### 3.5.1.2 Monitoring

Monitoring option allows eavesdropping on any selected channel (it does not have to be recorded) available in the recorder. User shall select the channel on which he wants to eavesdrop.

```

Choose the channel:
◆ ■ channel 1 ( 1)
    
```

Channel selection may be done by means of „v” and „^” buttons, ”OK” approves selection, “ESC” exits into administrative menu.

The symbol on the left of the channel name is the status of the selected channel:

- - the selected channel is in idle state,
- - the selected channel is active (in recording mode)

```

20/02/2014 08:45.02
vol:+1 ████████
Mon.: channel 1
    
```

Current date and time and name of monitored channel are presented there. It is possible to set volume level with „v” and „^” buttons (like in playback display). „ESC” button will allow selecting another channel for eavesdropping.

### 3.5.1.3 Alarms

Alarm management program on the recorder is the *Monitor 2*. In the event of an alarm, the unit indicated by the beep tone and displays the alarm message on the LCD. A sample message is shown below:

```

ALARM
Recording started.
Channel 5
turn key
    
```

Disabling the alarm is possible with the actuating key the recorder authorized mode if you set it in a horizontal position. When you turn the access key, buzzer stops and the LCD displays the message containing the exact time of the alarm.

```
Lista zdarzeń:      9
>*CH 16:15:41 2014-03-11
  *TM 15:03:17 2014-03-10
  *ET 13:43:32 2014-02-15
```

An asterisk sign next to the date of the alarm means that the line indicates the new („unreaded” on the display) alert.

The two-letter symbol indicates the type of alarm message related to:

**ET** network interface (eg. LAN cable unplugged),

**SY** recorder's operating system errors,

**MD** software RAID 1 disks health,

**TM** status of the time synchronization with external sources,

**CH** recorder channel status (eg. start the recording, loss of synchronization),

**DR** hard disk health (for recorders without software RAID).

After pressing "OK" you are given full information on the type of alarm (in the figure below shows an example of an alarm).

```
ALARM
Recording started.
Channel      5
press Esc or OK
```

Pressing the "OK" button erases the asterisk (alarm is set as served), pressing the "ESC" leaves a list of events with no changes.

```
Lista zdarzeń:      9
> CH 16:15:41 2014-03-11
  *TM 15:03:17 2014-03-10
  *ET 13:43:32 2014-02-15
```

The next step you should be turning the key actuation mode the recorder authorized to vertical position. The recorder will show the first screen of information “Active channels”. Subsequent procedure depends on the type of alarm that occurred.

The screen of alarm handling the administrative menu is shown in the figure below:

```
Alarms
>Event list
  Uncheck all
  Delete unchecked
  Signalling [OFF]
```

After selecting the *Signaling* option with the arrow keys „ $\downarrow$ ” i „ $\uparrow$ ” there is a possibility of enable (Signalling [ON ]) or disable (Signalling [OFF]) after pressing OK.

This affects only the local display of the recorder, application *Monitor 2* logs all alarms, regardless of the option above.

### 3.5.1.4 Enter password

This function is available in „User” mode only. It allows the user to gain access to all options in administrative menu. To do that knowledge of admin password is required. The following display appears:

```
Enter password:  
█*****
```

The default password is the phrase: " \_AAA" (the space and three large letter "A" - a combination of keys:  $\downarrow$ ,  $\downarrow$ ,  $\downarrow$ ,  $\downarrow$ ,  $\downarrow$ ,  $\downarrow$ , and OK). After entering the correct password, the administrator accesses the menu in administrator mode.

### 3.5.1.5 Change mode

The first four options to select the operation mode display panel (see chapter 3.4.1: *Menu operation modes*).

The last line allows you to hide (“Enable hiding”) or show (“Disable hiding”) the display when you set the access key in a horizontal position.

```
Change mode:  
>Admin (password)  
Admin (no password)  
User (password)  
User (no password)  
Enable hiding
```

### 3.5.1.6 Change password

This function allows you to change the password for the modes Admin (password) and User (password).

```
Change password:  
>Admin (password)  
User (password)
```

After selecting the appropriate mode screen with a field used to change password appears.

**Important:** By default, the password consists of the same space. If you intend to keep a password before changing the mode, you should select "yes" and enter your old password.

```
Change password?
█*****
ESC = no   OK = yes
```

If you do not want to change the password should press "ESC" if you want to change your password enter new password and press "OK".

### 3.5.1.7 Archivization DVD

This function allows you to create backup for recordings directly on recorders equipped with a DVD or CD burner. The success of this operation requires a blank, compatible disc in the drive. Otherwise, an error message is displayed:

```
Bad medium
[ESC]-exit   [OK]
```

In case of models not equipped with a CD/DVD drive after choosing "Archivization DVD" function the following display appears.

```
Function unavailable
[ESC] - go back
```

If the recorder is equipped with a CD/DVD recorder the following options are available:

```
Archivization DVD
>Record now
  History of archiv.
  Periodic archiv.
  Record not full [X]
```

- *Record now* – starting immediate archiving.
- *History of archiv.* – display history of previously created archives.
- *Periodic archiv.* – allows you to enter the time and days of the week on which you want to perform automatic backup operation.

```
Periodic archiv.
>[20:30]
M T W T F S S
  ^       ^
```

In the second line of the display as above, you should set start time of the archiving process. Changes the values of the hour (from step 1) and minute (from step 5) items can be set by using "v" and "^" buttons. Use the "OK" button to confirm the setting.

The third line shows the symbols for subsequent days of the week from Monday (M) to Sunday (S). The "^" character placed under a letter indicates that in a given day of the week (at the time specified in line no. 2) automatic archiving session will start.

After selecting line no. 3 (by means the "v" button) and confirmation using the "OK" button, you should indicate the day of the week (using the ">" or "<" buttons) and press on key:

"^" - to activate archiving (enable "^" character)

"v" - to deactivate archiving (disable "^" character)

After setting all parameters of the "Periodic archiv." option you should exit the configuration (by mean of "ESC" button). Previously entered settings will be automatically saved.

- *Record not full* - selecting this option causes the archiving process will be executed regardless of capacity the data, intended to be archived. Enabling this option allows you to record "partial" CD.

**Important:** If „Record not full” option is disabled, recording session will be started only when the volume of data to be archived is greater than or at least equal to the capacity of a CD or DVD you inserted.

### 3.5.1.8 Network

This function contains set of options related to network address setting of the recorder. It is possible to state IP address or mask for all network interfaces installed in the recorder.

```

Network conf.
>Interfaces
  Routing
  Firewall      *
    
```

It is also possible to set the network gateway and enable or disable the firewall.

The configuration screen eth0 interface (LAN 1) appears when you select "Interfaces" and press "OK".

```

eth0    [up]
>IP: 172.016.000.013
  NM: 255.255.000.000
  HW: 0040-63da-571c
  Mode : Static
    
```

The first line indicates name and status (up-active, down - inactive) of the interface.

The other lines indicate the following:

- *IP* - recorder's IP (may be set here)
- *NM* - network mask (may be set here)
- *HW* - MAC Address (read only)
- *Mode* - Static – means the independent work of the interface  
bond(0 - 3) – means operate with a network port aggregation

To change the value of the digit at the position indicated by cursor, you should use the "v" and "^" button. Changes must be to press the "OK" button, "ESC" retains the settings from before the change. To select next interface you should use the ">" or "<" button.

For other network interface ports the configuration options are similar to eth0.

"Routing" configuration display allows to set (or check) the recorder's gateway IP address.

```
Routing
>GW: 172.016.000.001
```

The "Firewall" function allows you to enable or disable the firewall rules laid down in the *Konsola 2* (ACL). This feature enables to establish communication with the recorder even when the ACL rules total block the recorder.

```
In order to disable
The firewall, hold
"UP" and press "OK"
[ESC]
```

### 3.5.1.9 Mass storage

The "Mass storage" function displays information's about block devices installed in the recorder. The screen displays information about the recorder system disk and all drives used for storage recorded calls. Depending on whether the recorder is equipped with software RAID array, the "Devices" screen may have the appearance shown in the illustrations below.

```
Devices
SATA1      1.0GB S
>SATA2     500.1GB R
```

```
Devices
RAID1      500.0GB R
SATA1      1.0GB S
SATA2      500.1GB A
>SATA3     500.1GB A
```

For each line of the display may be distinguished three component parts:

- type of device,
- disk or RAID array capacity,
- function or operation state of the block device.

The type of device field can take one of the following forms:

- *RAIDx* - presence of software RAID array, where x represents the level (eg RAID1 - means mirroring).
- *SATAx* - SATA block device (Serial ATA),
- *PATAx* - IDE/ATA block device (Parallel ATA).

The number after SATA (or PATA) description identifies the specific device.

The next part displays usable disk capacity and its function, or operation state:

*S* - device contains the recorder's operating system,

*R* - disk space is dedicated to store recorded calls and log files,

*A* - device is software RAID array member and works properly (has whole and valid data). In fact, this symbol not applicable disk as a device, but rather a SATA or IDE port to which the drive is connected.

*!* - device is software RAID array member and not working properly (is faulty or doesn't contain complete data). This symbol appears in place of the letter A.

**NOTICE:** *Drives installed in hardware RAID array are presented on "Mass storage" display as single device.*

Mass storage device selection may be done by means of „v” and „^” buttons. When you press the button "OK" the screen appears:

```
SATA 500.1GB
>Informations
SMART
Run speed test
```

After selecting the "Information" row and pressing "OK" button the subsequent display presents detailed information about chosen device.

```
SATA 500.1GB
member of RAID1 500.0GB
no 0, raid 0
00000006 as
temp 41°
size 500.0GB, 500107862016
model ST3500418AS
serial 6VM6EWZJ
fw CC46
```

Rows 2-4 are displayed only if the drive is member of RAID 1 array. For more details, see chapter 3.6.4 *Software RAID 1 array*.

Other lines indicate the following parameters of the chosen disk:

- *temp* - temperature in Celsius degrees,
- *size* - approximate and detailed (accurate to 1 byte) functional capacity,
- *model* - type/model,
- *serial* - serial number,
- *fw* - firmware version.

### 3.5.1.10 Date and time

System time may be set with this option.

```
Date & time config.
20/02/2014 15:26:32
Press [OK] to edit.
```

In order to change these settings it is necessary to press “OK” button. This will cause the cursor to appear and “Edit mode” caption will become visible. Changes can be made with up and down arrow buttons.

```
Date & time config.
█0/02/2014 15:26:32
Edit mode.
```

“OK” button will save changes in opposite to “ESC” button, which will abandon any changes and lead user to the administrative menu.

### 3.5.1.11 Language

Information on a recorder's display may be presented in one of two available languages: either Polish or English. A list of available languages will be presented after “Language” option has been selected from administrative menu.

```
>Polish
English
```

„v” and „^” buttons change the language, while “OK” accepts the selection.

```
Zmieniono jezyk:
Polski
Nacisnij [OK].
```

Once the selection is accepted, the menu will be presented in a new language.

### 3.5.1.12 Reboot

This function allows rebooting recorder. System will ask for confirmation (with “OK” button) of this action. It can be cancelled with “ESC” button.

```
Reboot ?
ESC = no    OK = yes
```

Pressing the button "ESC" causes the return to the administrative menu. After press "OK" you should decide, whether the system during next start-up has to perform a full scan of the disk (storage volume).

```
Perform disk check
after next start ?
ESC = no    OK = yes
```

Enable the scanning can cause significant increase of time to launch the recorder, and thereby increase the break in call recording. In most cases, you can skip this operation. However, sometimes a full disk scan can be very useful. For more information, see the section 3.5.1.14 *Scanning the disk of the recorder*.

After confirmation of recorder's reboot the following displays will be presented:

```
Shutdown in progress
Please wait...
```

and

```
#####
SYSTEM RESTARTING
#####
```

### 3.5.1.13 Halt

This function allows stopping recorder's operation in a safe way. Any other way of turning the recorder off (by pulling the plug out of the power outlet, switching off the main power source switch) while recorder is recording, may result in loss of all recordings. Confirmation is required.

```
Halt ?
ESC = no    OK = yes
```

Pressing the button "ESC" causes the return to the administrative menu. After press "OK" you should decide, whether the system during next start-up has to perform a full scan of the disk (storage volume).

```
Perform disk check
after next start ?
ESC = no    OK = yes
```

Enable the scanning can cause significant increase of time to launch the recorder, and thereby increase the break in call recording. In most cases, you can skip this operation. However, sometimes a full disk scan can be very useful. For more information, see the section 3.5.1.14 *Scanning the disk of the recorder*.

After confirmation of recorder's reboot the following displays will be presented:

**Important:** *It is recommended to use the "Halt" function at every attempt to shut down the recorder!!.*

After approval the system halt, you MUST wait until the display appears:

<pre>Shutdown in progress Please wait...</pre>	and	<pre>##### ## SYSTEM HALTED ## #####</pre>
--	-----	--

### 3.5.1.14 Scanning the disk of the recorder

Full scan recorder's storage volume is intended to check the integrity of data on disk or RAID drives. This operation enables you to repair unserious errors in the file structure of the drive, or if this is not possible - reformatting the volume.

<pre>Checking disk... Pass      :      2 Progress:  48.4%</pre>	and	<pre>Checking disk...OK Database      OK</pre>
---	-----	--

The specificity of recorder's operating system automatically forces full scan the storage volume after passing the specified period of time, or after exceeding the specific number of starting the device. With the ability to "manual" run full disk integrity check (during a restart or turn off the recorder), you can run this process in the moment right for oneself, such as out of work hours. Each time you perform a full scan, the recorder "refreshes" this counters. This allows you to protect yourself from forcing disk scan recorder system in times of adverse events (eg after a remote reboot associated with software upgrade).

## 3.6 Hard drive maintenance

If you wants to exchange recorder's hard drive, it is a must to turn off the recorder first, disconnect it from power source and wait for 30 seconds from the moment when recorded was powered down. This time is necessary for the hard drive spinning parts to stop.

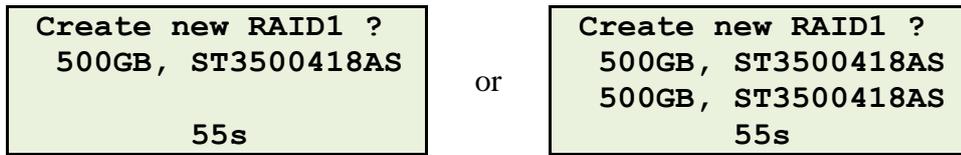
HDD rack shall be unlocked with a key and then HDD can be removed out of the recorder. Tray with new HDD shall be locked after its insertion to the recorder.

**Important:** *User must not either insert or remove the hard drive while recorder is powered on and running. Such actions will cause the loss of all data stored on this disk and may lead to drive malfunction. For security reasons user shall not open hard drive rack while recorder is up and running.*

### 3.6.1 Start up the recorder with single disk or with two hard drives.

The recorder uses hard drives with a specific partition created on it. If new hard drive does not have such partition, recorder will ask for confirmation of crea-

tion of RAID array. According to the number of drives installed in the recorder, display has suitable appearance.



Depending on, whether the new disk is supposed to work in the RAID array or as the single drive you should press the button "OK" or "ESC".

**Important:** You can create RAID 1 array on a single disk. The matrix will work in "degraded" mode, ie all recording calls will be stored, but without the possibility of data recovery. Adding in the future a second hard disk automatically attached the new drive to the previously created array.

After that you should decide whether you want to create partition with compatible file system.

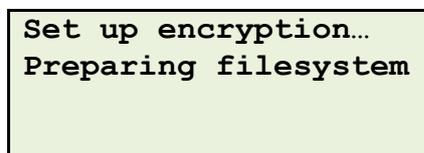


It is required to press the *OK* key to continue. Pressing the *ESC* button will cancel disk formatting and will force the recorder to work in the *RECOVERY MODE* (see chapter 3.7 *The RECOVERY MODE*).

The next step is deciding if the data on the hard drive shall be encrypted.



In order to enable the encryption, user shall set the key in the horizontal position and keep the OK key pressed for approx. 10 seconds. The recorder will notify the user about the encryption setup.



### 3.6.2 HDD rack handling

Recorder stores all recorded calls on the internal hard drive. This drive is put into the rack, which allows easy disk exchanging.

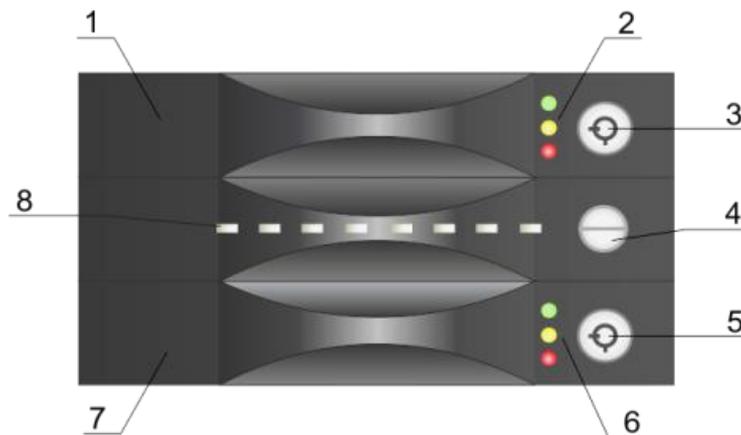
HDD drive replacement is very easy; you should take the following actions:

- turn off the recorder's power,
- wait several seconds, until the spindle motor spinning the platters stops,

- unlock HDD rack with a key,
- remove the HDD tray out of the recorder,
- remove HDD out of tray (remove top cover, remove four screws mounting the HDD in the tray, disconnect both power and signal cables)
- insert a new hard drive into the tray (connect cables, mount the drive in the tray with four screws and put on the tray's top cover)
- insert the tray into the rack,
- lock the rack with the key,
- turn the power on,
- format disk when prompted.

### 3.6.3 Hardware mirror option

Hardware mirror is available for KSRC 332 (optional) and KSRC 5128 recorders. Two hard drives are installed then instead of one and all recordings are stored simultaneously on both disks. In case of failure of one of these drives, all data are still accessible on the second drive and all new recordings are stored on a healthy disk. Since mirror option utilizes "Hot Swap" feature, it is possible to exchange broken hard drive "live" – with no interruption to the recorder's operation.



#### Legend:

1. Upper HDD tray,
2. Upper HDD condition gauges,
3. Upper tray lock,
4. HDDs status gauges.
5. Lower tray lock,
6. Lower HDD condition gauges,
7. Lower HDD tray,
8. HDDs sync level gauges.

Both hard drive trays are equipped with a set of three LEDs that inform about current drives' condition.

The following table contains the explanation of information presented by these LEDs when they are glowing:

LED colour	Description
Green (solid)	HDD installed properly, drive tray is locked
Yellow (blink)	Data transfer is in progress
Red (solid)	No disk, disk installed incorrectly or broken, drive tray is not locked
Red (blink)	Rebuilding data (on one disk) in progress

*Important: Red LED may glow while recorder starts. It shall stop glowing right after successful HDD detection in the recorder.*

The following table contains the explanation of information presented by these HDD status LEDs when they are glowing:

LED colour	Description
Upper (solid)	HDD installed in upper tray is faulty
Upper (blink)	Rebuilding data (on the upper disk) in progress
Lower (solid)	HDD installed in lower tray is faulty
Lower (blink)	Rebuilding data (on the lower disk) in progress

### 3.6.3.1 Mirror failure signalling

Correct mirror operation is being signalled by a set of HDD sync level gauges (8). Consecutive LEDs are cyclically flashing from the right to the left side of the mirror rack and vice versa (“sweeping” effect).

If a failure of one of drives in mirror appears, system will produce interrupted high pitch sound. One of HDD status LEDs will glow in red. Thanks to this user will obtain information which drive is broken (either upper or lower one).

After proper configuration information about “Mirror down” event may be sent to *Monitor 2* program or/and into external devices via alarm connector. More information may be found in *Monitor 2* program user manual.

### 3.6.3.2 Mirror hard drive exchange

For recorders with mirrors installed on it, it is possible to exchange one of mirror’s HDD during standard operation of the recorder. When an exchange is performed all data is being stored on a second disk.

Exchange process begins when HDD tray is unlocked. At this moment, the drive is disconnected from the recorder. User shall wait about 10 seconds, so the platters inside HDD stop spinning. After this time user may remove HDD tray out of mirror device and exchange the hard drive. It is recommended to install a new drive of **equal or bigger capacity** in compare to the drive already working in the mirror. For best results, it is recommended to install hard drives with similar parameters. After insertion of HDD tray with a new HDD in it, it shall be locked. Right after new drive is recognized by mirror, alarm signal will disappear. If it has been configured, the „mirror up” event will be sent to *Monitor 2* program and signals on alarm connector will return to their default values.

A HDD sync level gauges set (8) present all errors related to incorrect HDD installation. Error description follows.

Error signalling	Reason for error	Error solution
	New HDD is broken	Use another drive
	Capacity of new HDD is too low	Install new drive of equal or greater capacity in compare to existing one
	Cooling fan fail	Contact TRX service
	Bad sectors on new HDD	Install another drive.
	Removed or discharged backup battery.	Contact TRX service.
	Power failure for first HDD	Contact TRX service
	Power failure for second HDD	Contact TRX service

### 3.6.3.3 HDD information synchronization

Installation of new drive in mirror does not end the process of recorder's recovery. The device is carrying out further actions automatically.

All information already stored on a healthy drive must be copied into newly installed one. This may take from a few up to several hours, depending on the number of recordings to be copied. At the very beginning of synchronization process, all eight gauges glow. At the end of sync process, no gauge in the set is glowing. Finally, usual „sweeping” effect may be observed.

The level of data synchronization is presented by a set of gauges (8).

HDD sync level gauges set	Level of synchronization [%]
	0 – 12.5
	12.5 – 25.0
	25.0 – 37.5
	37.5 – 50.0
	50.0 – 62.5
	62.5 – 75.0
	75.0 – 87.5
	87.5 – 100

Symbol mean the LED is blinking.

### 3.6.4 Software RAID 1 array

Similarly as in solution with the hardware RAID, in the recorder two hard disks are installed. In this solving, the drives are mounted in “Hot Swap” HDD pockets (without RAID 1 controller), and the mirror array function is realized by means of software running on the recorder. In consequence two physical drives are recognized as one logical disk of the software RAID array.

The software RAID array can be created on disks of various types / manufacturers, including disks of different capacities. Functional storage space of array logical drive is always slightly smaller than the capacity of the **smallest member** of RAID.

As in the case of a hardware table, the best results are obtained by using drives of the same or similar parameters.

Software RAID does not differ significantly from the hardware one. All recordings are stored simultaneously on both disks. In case of failure of one of these drives, all data are still accessible on the second drive and all new recordings are stored on a healthy disk.

Information's about the existence and operating status of the array are presented on the recorder LCD display. Appropriate information screen is available after enter in administrator menu (see chapter 3.4 *Administrative menu*) and choosing the “Mass storage” function.

#### 3.6.4.1 Work of the matrix in normal mode (state: „optimal”)

The presence of software array in the recorder is indicated by displaying the string RAID1 directly under the line "Devices".

A detailed description of the “Mass storage” screen (including the meaning of each symbol in right column) has been described in chapter 3.5.1.9 *Mass storage*.

In case of normal operating mode (complete and valid data on both disks) the information screen looks like the picture below:

Devices		
>RAID1	159.9GB	R
SATA1	1.0GB	S
SATA2	160.0GB	A
SATA3	500.1GB	A

The second line on the screen "Devices" describes the RAID array as a single logical device:

- *RAID1* - existence of software array RAID of level 1 (mirroring),
- *159,9GB* - usable capacity of the logical drive is 159,9 GB,
- *R* - array space is dedicated to store recorded calls and log files,

Line 4 gives information about operation status the disk in the top HDD pocket of the recorder:

- *SATA2* - top tray (HDD pocket) supports SATA drives,
- *160,0GB* - the upper disk has capacity of 160 GB,
- *A* - the drive is RAID 1 array member and contains complete data.

Line 5 gives information about operation status the disk in the bottom HDD pocket of the recorder:

- *SATA3* - bottom tray (HDD pocket) supports SATA drives,
- *500,1GB* - the bottom disk has capacity of 500,1 GB,
- *A* - the drive is RAID 1 array member and contains complete data.

The ">" character indicates active line of the screen, which can be changed using the buttons „up” („^”) and „down” („v”).

When you select RAID1 and press "OK" button the screen appears as shown below:

```
RAID1 159.9GB
>Informations
Run speed test
```

After selecting the "Informations" row and pressing "OK" button the subsequent display presents detailed information about chosen device (RAID array).

```
RAID1 159.9GB
2013-01-22 15:25:27
total 2, raid 2
00000001 c
actv 2, work 2
fail 0, spare 0
```

The first two rows contain the parameters of array: level, capacity and creation time. The last two rows show the operating status the array members:

- *actv* - number of efficient disks with complete data,
  - during normal operation the parameter has value "2",
  - when synchronizing data or one disk failure - value "1".
- *work* - number of efficient disks regardless of the content of the data,
  - during normal operation the parameter has value "2",
  - when one disk failure - value "1".
- *fail* - counter any failures or disk disconnections during operation the array this indicator i se to 0 after every restart the recorder.
- *spare* - number of disks on which data recovery lasts,
  - during normal operation the parameter has value "0",
  - when synchronizing data - value "1".

#### 3.6.4.2 Work with failed disk of array („degraded” mode)

In case of failure one drive in the RAID 1 array, all data are still accessible on the second drive and all new recordings are stored on a healthy disk. Since mirror option utilizes "Hot Swap" feature, it is possible to exchange broken hard drive "live" – with no interruption to the recorder's operation.

In case of “degraded” mode (failure of one disk) the information screen looks like the picture below:

```

Devices
>RAID1    159.9GB  R
  SATA1    1.0GB  S
  SATA2    160.0GB  A
  SATA3           !
    
```

In line "SATA3" the field displays capacity of the disk is empty, and in place of symbol "A" appears symbol "!".

When you select RAID1 and press "OK" button the screen appears as shown below:

```

RAID1 159.9GB
>Informations
  Run speed test
    
```

After selecting the "Informations" row and pressing "OK" button the subsequent display presents detailed information about chosen device (RAID array).

```

RAID1 159.9GB
2013-01-22 15:25:27
total 2, raid 2
00000001 c
actv 1, work 1
fail 1, spare 0
    
```

The parameters "actv" and "work" (which during normal operation are set to "2") in this case, take the value "1". It means that only one drive work in the array. At the same time the error counter "fail" increased by 1.

### 3.6.4.3 Replacing the hard disk

For recorders with mirrors installed on it, it is possible to exchange one of mirror’s HDD during standard operation of the recorder. When an exchange is performed all data is being stored on a second disk.

Exchange process begins when HDD tray is unlocked. At this moment, the drive is disconnected from the recorder. User shall wait about 30 seconds, so the platters inside HDD stop spinning. After this time user may remove HDD tray out of mirror device and exchange the hard drive.

It is recommended to install a new drive of **equal or bigger capacity** in compare to the drive already working in the mirror.

For best results, it is recommended to install hard drives with similar parameters.

**Important:** Pay particular attention to the number of SECTORS on the new drive. It cannot be less than the number of sectors on the “healthy” disk.

After replacing the disk at the bottom HDD pocket (to the correct drive) the information screen looks like the figure below:

```

Devices
>RAID1    159.9GB  R
  SATA1    1.0GB  S
  SATA2    160.0GB  A
  SATA3    160.0GB  !

```

In line "SATA 3" appears the value of a new drive capacity, however, remains the symbol "!". It will be replaced by the symbol "A" in the moment when synchronizing data on both disks will end.

The "Devices" display does not include information whether a new drive is added to the RAID array. Therefore, after replacing the hard drive you should display detailed information for the "RAID1" device.

```

RAID1 159.9GB
>Informations
  Run speed test

```

After selecting the "Informations" row and pressing "OK" button the subsequent display presents detailed information about chosen device (RAID array).

If the new drive has been properly added to the RAID matrix the parameter "work" is set to "2".

```

RAID1 159.9GB
2013-01-22 15:25:27
total 2, raid 2
00000001 c
recover 10% 48 MB/s
actv 1, work 2
fail 1, spare 1

```

The parameters "actv" and "spare" in this case, take the value "1". It means that only one disk contains complete data, while the second takes rebuilding data.

When you replacing the disk at the bottom HDD pocket on the drive with too small capacity, the display "Devices" looks like in the picture below:

```

Devices
>RAID1    159.9GB  R
  SATA1    1.0GB  S
  SATA2    160.0GB  A
  SATA3    120.0GB  !

```

Unlike the previous example (with correct hard drive capacity) the parameter "work" on the details screen still is set to "1". It means that still working only one hard drive.

```
RAID1 159.9GB
2013-01-22 15:25:27
total 3, raid 2
00000001 c
actv 1, work 1
fail 1, spare 0
```

The value of parameter "spare" set to "0" also indicates that on the second drive did not start the process of rebuilding data.

Just like for RAID1 array, detailed information can be displayed for individual disks. When you select appropriate line (eg, "SATA3") and press "OK" button the screen appears as shown below:

```
SATA3 120.0GB
>Informations
SMART
Run speed test
```

After selecting the "Informations" row and pressing "OK" button the subsequent display presents detailed information about chosen device (SATA3 disk).

```
SATA3 120.0GB
member of RAID1 159.9GB
temp 27°
size 120.0GB, 120034123776
model ST3120811AS
serial 6PT09K1C
fw 3.AAE
```

Rows 2-4 are displayed only if the drive is member of RAID 1 array. For more details, see chapter 3.6.4 *Software RAID 1 array*.

Other lines indicate the following parameters of the chosen disk:

- *temp* - temperature in Celsius degrees,
- *size* - approximate and detailed (accurate to 1 byte) functional capacity,
- *model* - type/model,
- *serial* - serial number,
- *fw* - firmware version.

### 3.6.4.4 Syncing disk

Installation of new drive in mirror does not end the process of recorder's recovery. The device is carrying out further actions automatically.

All information already stored on a healthy drive must be copied into newly installed one. This may take from a few up to several hours, depending on the number of recordings to be copied.

When you select RAID1 and press "OK" button the screen appears as shown below:

```
RAID1 159.9GB
>Informations
Run speed test
```

After selecting the "Informations" row and pressing "OK" button the subsequent display presents detailed information about chosen device (RAID array).

```
RAID1 159.9GB
2013-01-22 15:25:27
total 2, raid 2
00000001 c
recover 0% 78 MB/s
actv 1, work 2
fail 1, spare 1
```

The "recover" line shows the percentage progress of the synchronization data, and the speed of data writing.

### 3.7 The RECOVERY MODE

If the recorder starts up with no hard drive installed, or if the formatting process at the time of HDD preparation has been cancelled, the device works in the recovery mode. While in this mode, the recorder does not record any calls, since there is no storage device for it.

The IP address of the recorder is temporarily set into its default value, i.e.: 172.16.0.13/16 (mask 255.255.0.0). This allows temporarily recovering the connectivity between the recorder and user's workstation in cases where the recorder's network configuration is incorrect and prevents anyone from connecting into the recorder. Recorder's configuration may be then verified and corrected.

No other functionalities of the recorder are altered in the recovery mode. Information about working the device under *Recovery Mode* appears on the LCD screen.

```
24.01.2013 08:35:05
-----
RECOVERY MODE
-----
```

## 4: Bundled software

### 4.1 Installing the software

Software for remote handling and managing recorders of KSRC series can be found on the website: [www.trx.com.pl](http://www.trx.com.pl). The primary program used to listen to stored recordings and configuring TRX device is *Konsola 2*. The full set of TRX applications contains the following programs:

1. *Konsola 2* - primary program that allows configuring and using the recorder's features.
2. *Automat 2* - allows you for automatic building archives in order to avoid information loss while recorder overwrites the oldest recordings when the hard drive is full (the application is paid).
3. *Pilot* - allows for remote control of recording (starting or stopping) on several recorders channels.
4. *Monitor 2* – ensure the possibility to configuring and receiving the events if recorder's operation is normal, or if any failures and problems occurred.
5. *VPC Agent* - allows for recording calls on virtual private channels for recorder's users based on their Windows logon.

Detailed instructions for every program are presented in corresponding user manual available in *pdf* files on [www.trx.com.pl](http://www.trx.com.pl).

The minimum computer requirements to support TRX applications:

- Processor: Pentium 300 MHz,
- RAM: 512 MB,
- HDD: 2 GB,
- Graphics card: SVGA resolution (800 x 600) with DirectX 9.0c support,
- Sound card: every nowadays available,
- Network card (NIC): 10 Mb/s,
- Operating system: Windows XP ServicePack 2,
- Drivers: DirectX 9.0c,
- Further equipment: speakers or headphones.

## 4.2 Software updates

### 4.2.1 Workstation software update

TRX applications are still under development. Latest versions of TRX remote access applications are available on TRX web page [www.trx.com.pl](http://www.trx.com.pl).

Before new version of software is installed, it is necessary to remove older one with *Add/Remove Programs* dialog available in Control Panel in Windows menu.

### 4.2.2 Recorder's software update

Recorder's software is also being developed. New features appear and found bugs are fixed. It is possible to upgrade recorder's software. Latest upgrade files may be obtained from our web page.

Downloaded upgrade file shall be stored into the recorder with *Konsola 2* program. More information is presented in *Konsola 2* user manual.

***Important:*** *Some versions of workstation software may require recorder's software update. We recommend upgrade of both workstation and recorder's software.*

## 5: Recorder's case roadmap

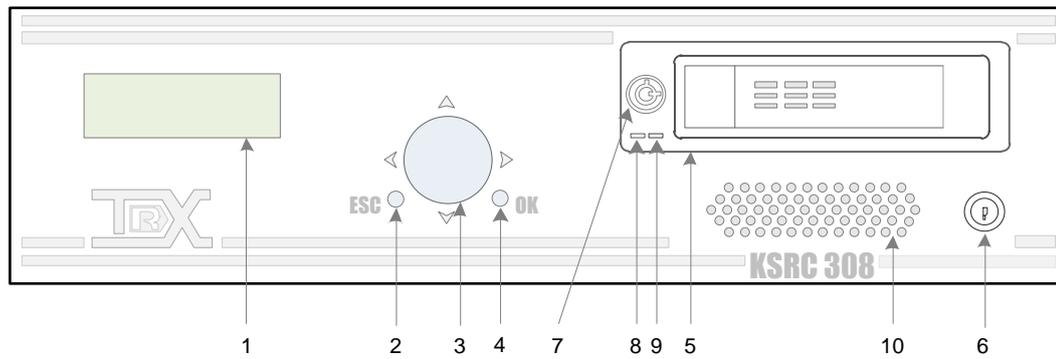
### 5.1 Legend

- 1) LCD display (4 x 20 characters).
- 2) Escape button.
- 3) Four arrow button (up, down, right, left) for manoeuvring between options on the display.
- 4) OK button, accepts option, selection, setting.
- 5) The tray with hard drive, where recordings are stored.
- 6) Key-switch, allows for an authorized access to the configuration options, cancels alarms (if set).
- 7) Key-lock, locks the HDD in the rack.
- 8) LED indicator of power of HDD. If it is off – there is no power delivered to the HDD.
- 9) LED indicator of HDD activity. If it's on – there is data transfer in progress from/to the HDD.
- 10) Internal speaker.
- 11) Power cord socket AC 230 V / 50 Hz.
- 12) Serial port socket USB or RS-232.
- 13) The set of up to 16 channel inputs made out of 6-pin RJ12 sockets.
- 14) RJ45 network connector. Recorder communicates with the PC through this connector while remote operations are performed on the recorder.
- 15) Cooling fan.
- 16) Power switch.
- 17) A LED that presents single power source condition (it lights if failure occurs).
- 18) Power connector for extension modules.

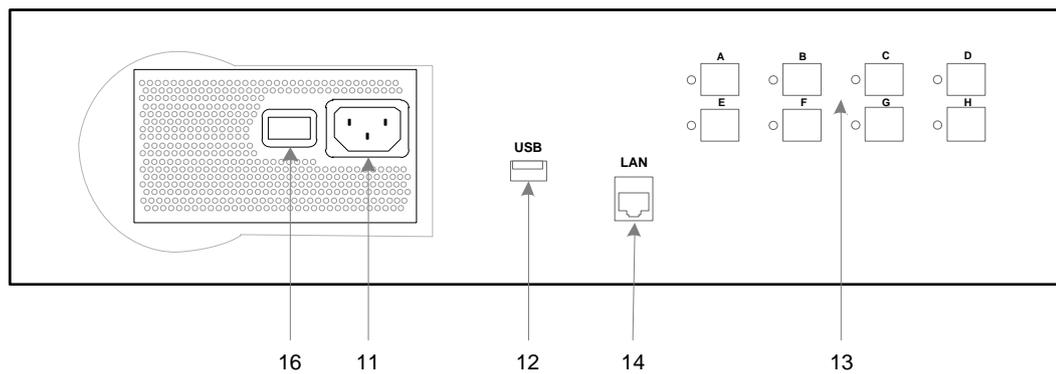
- 19) Socket for the communication with extension modules.
- 20) Green LED that indicates if the HDD has been installed in the rack properly.
- 21) Yellow LED that indicates if there is data transmission from/to the HDD.
- 22) Red LED that indicates if there is a problem with HDD.
- 23) A gauge for failure of HDD in the top tray in mirror
- 24) A gauge of HDD failure in the bottom tray in mirror
- 25) A set of eight gauges that presents the information about the level of synchronization between hard drives in the mirror
- 26) DVD recorder.

## 5.2 KSRC 308

### Front panel:

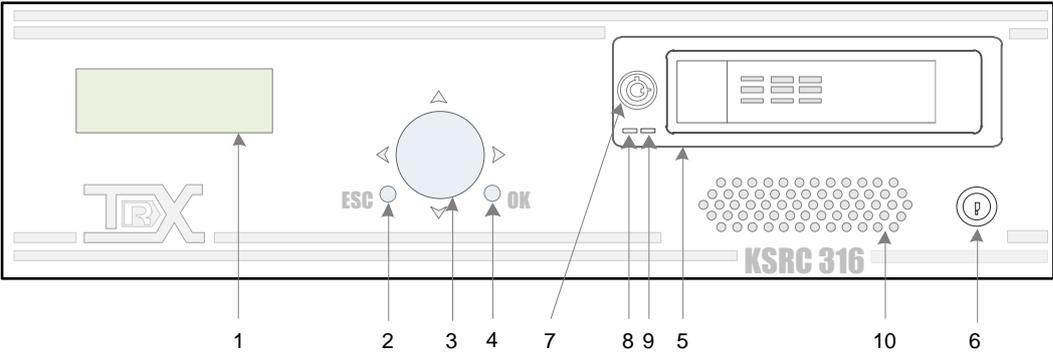


### Rear side:

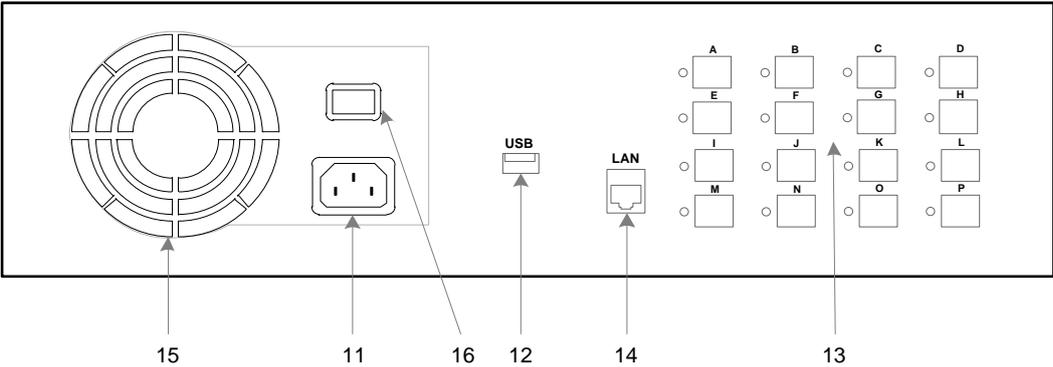


### 5.3 KSRC 316

Front panel:

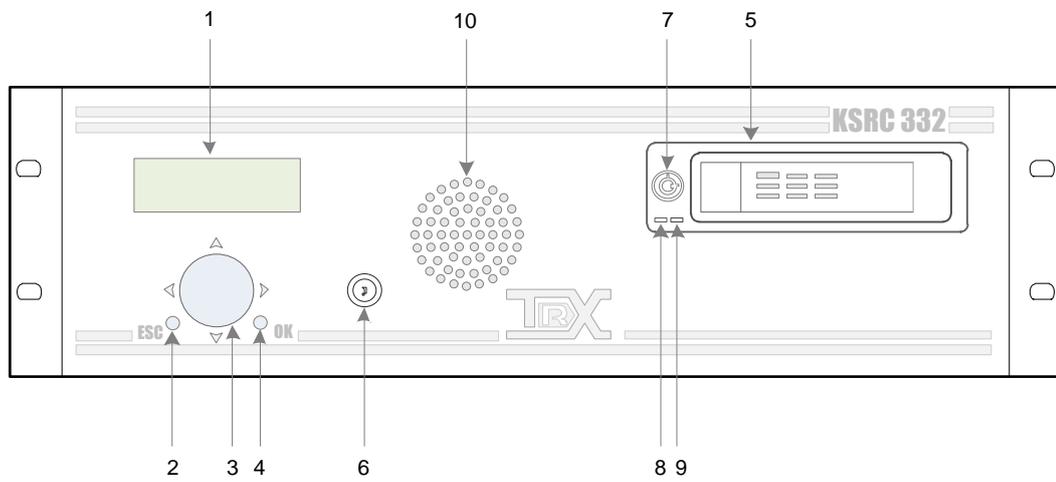


Rear side:

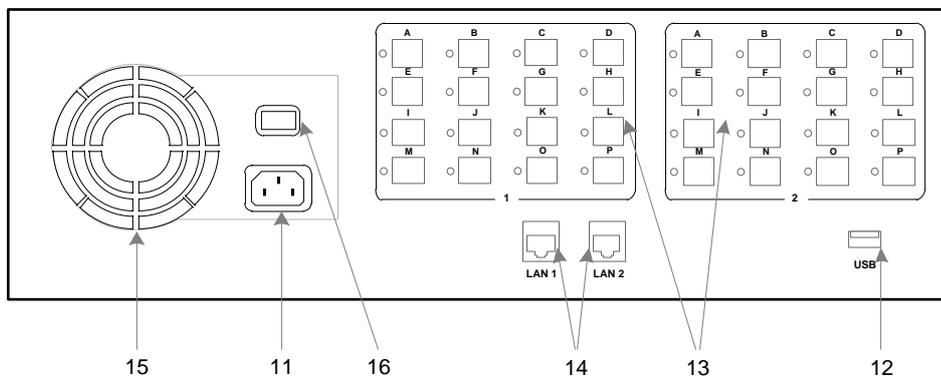


## 5.4 KSRC 332

### Front panel:

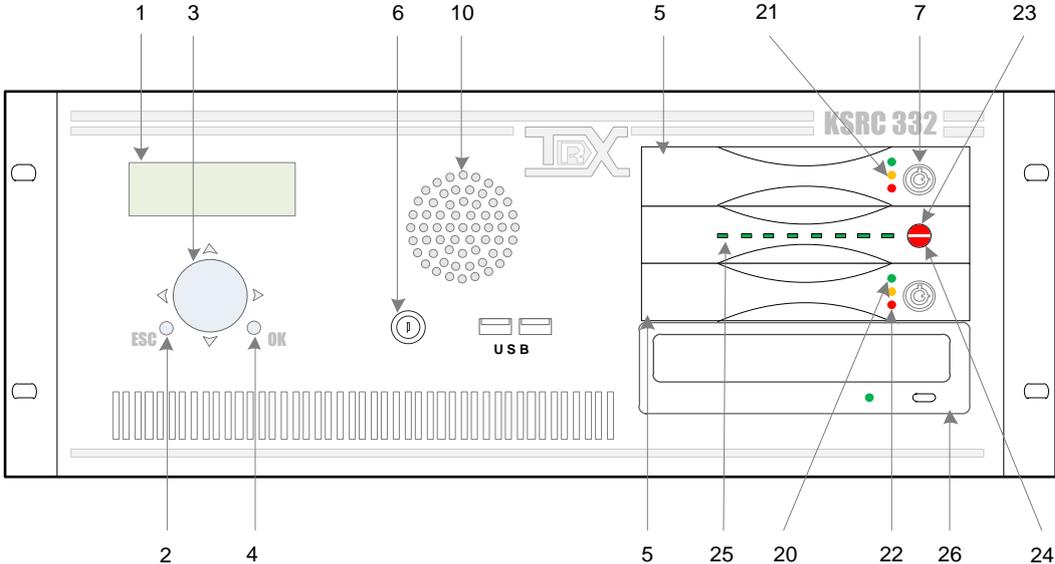


### Rear side:

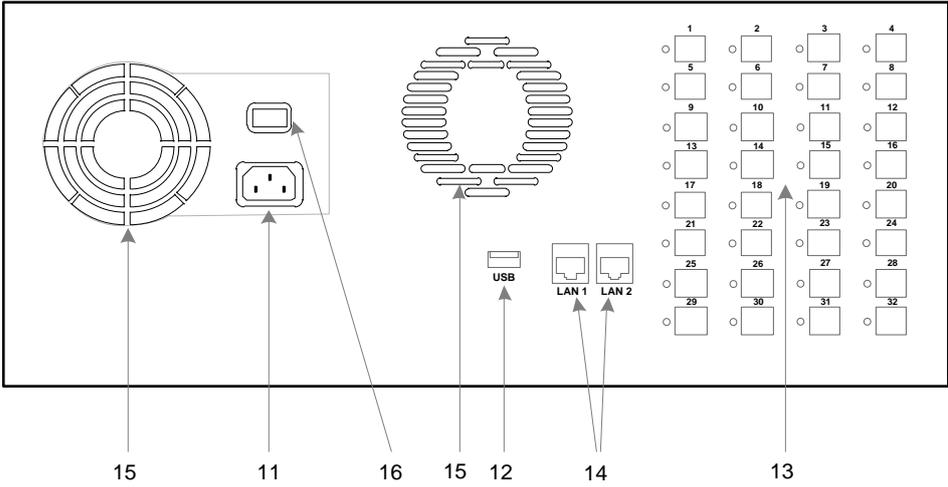


# 5.5 KSRC 332 version 4U (with RAID array and DVD recorder)

Front panel:

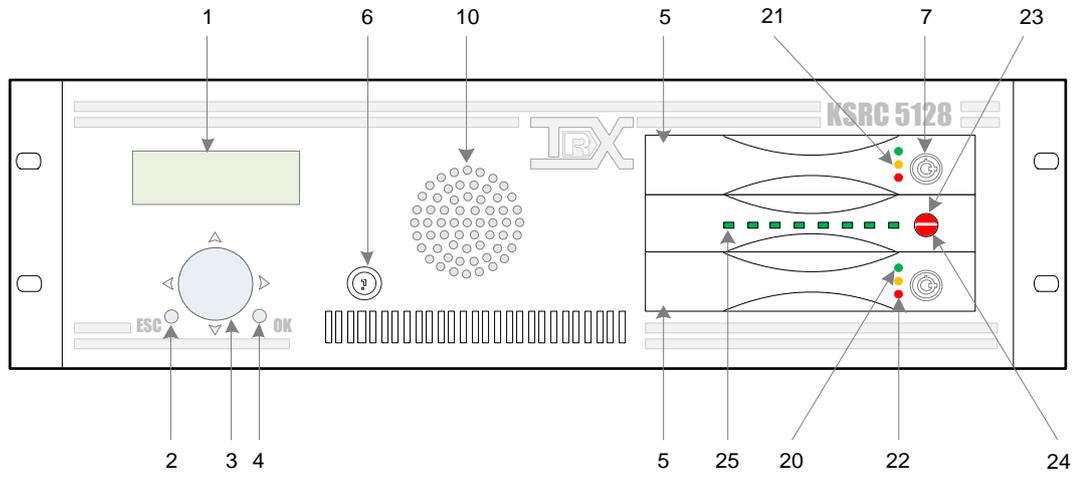


Rear side:

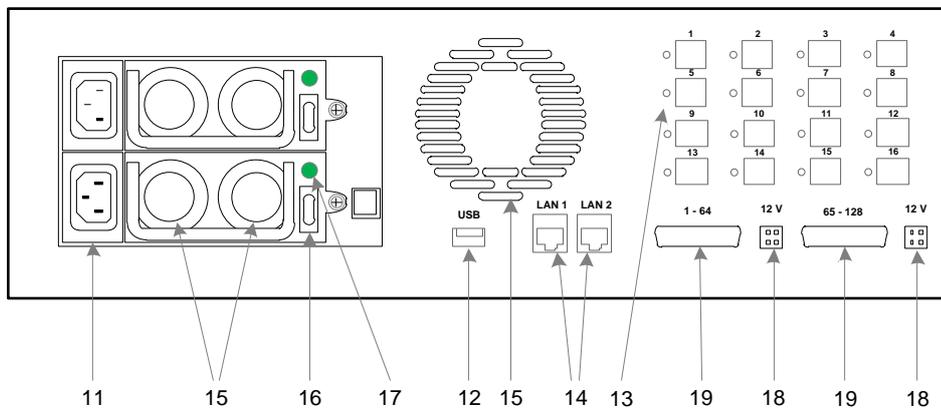


## 5.6 KSRC 5128

### Front panel:

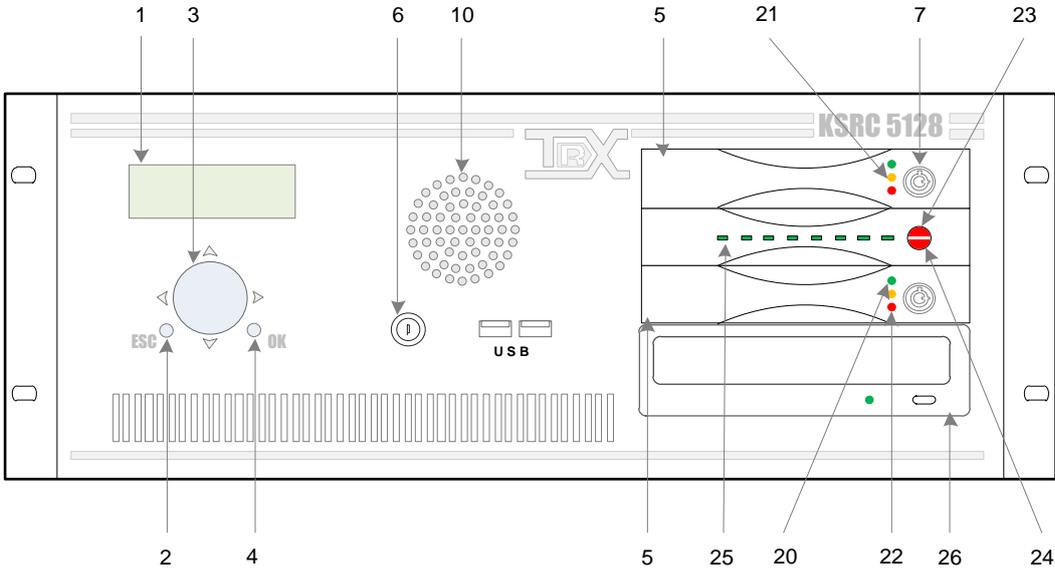


### Rear side:

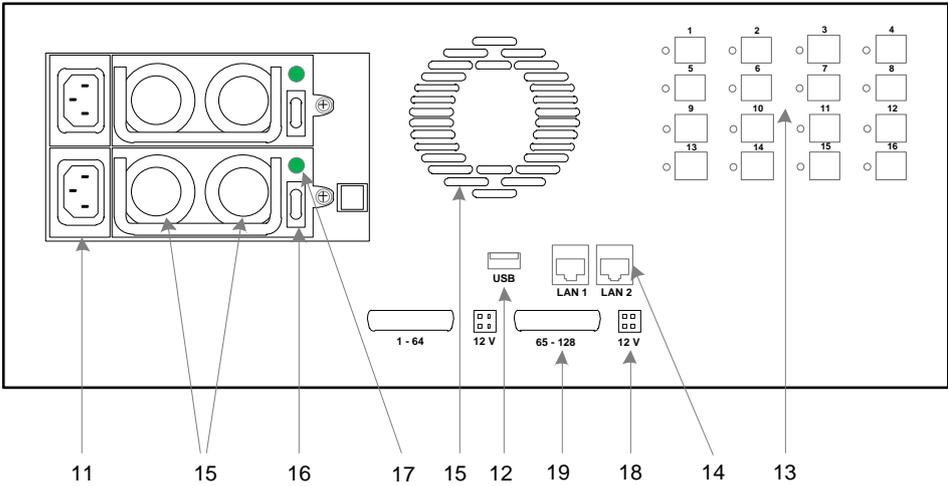


# 5.7 KSRC 5128 version 4U

## Front panel:

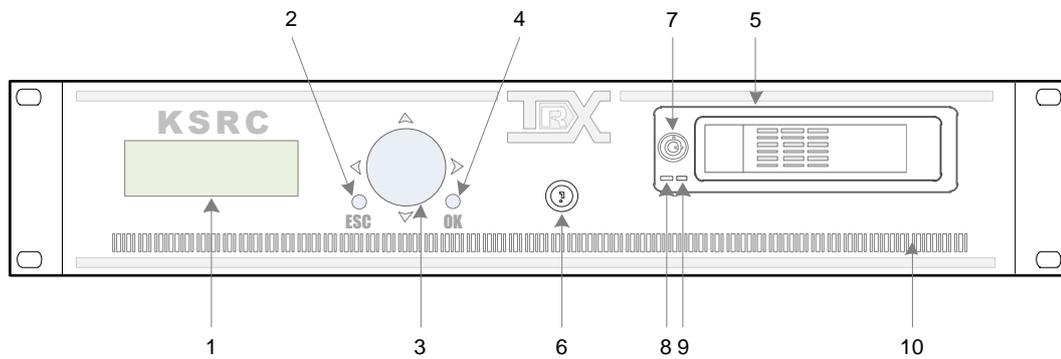


## Rear side:

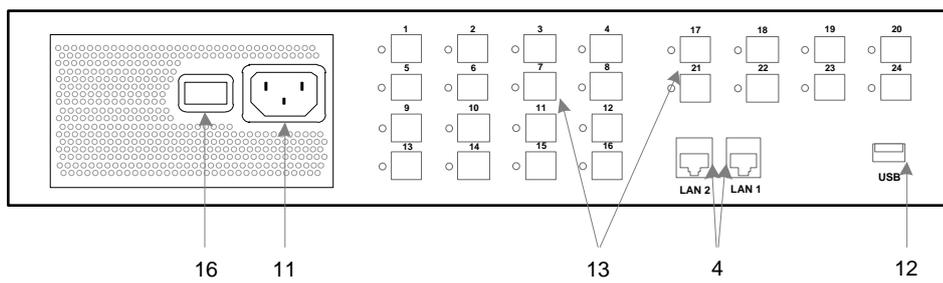


## 5.8 KSRC 2U

### Front panel:

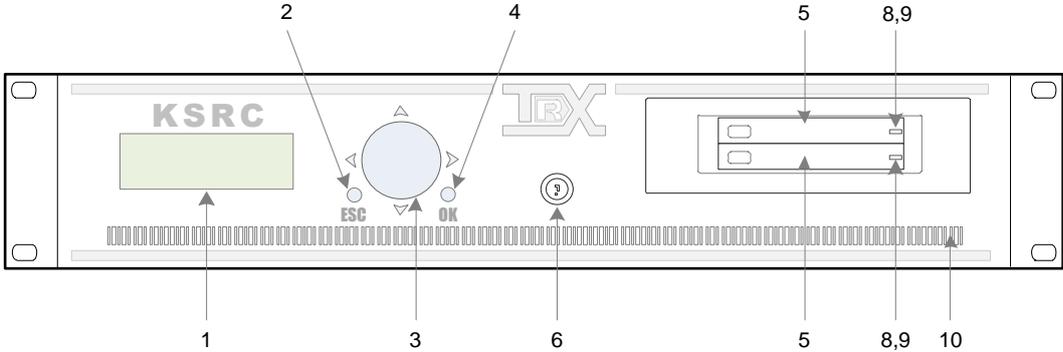


### Rear side:

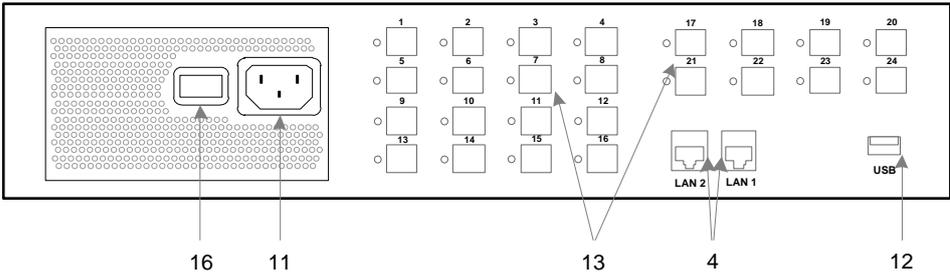


### 5.9 KSRC 2U version with software RAID matrix

Front panel:



Rear side:



## 6: Setting the board jumpers

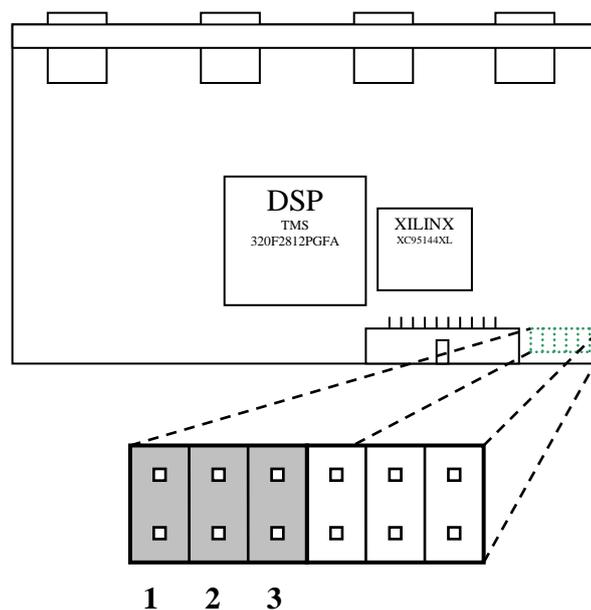
### 6.1 General considerations about board addresses

Each card in the recorder shall have its own unique address in the range from 1 to 8. If two or more boards have the same address set, the recorder will not function properly.

### 6.2 Location of address pins on different boards

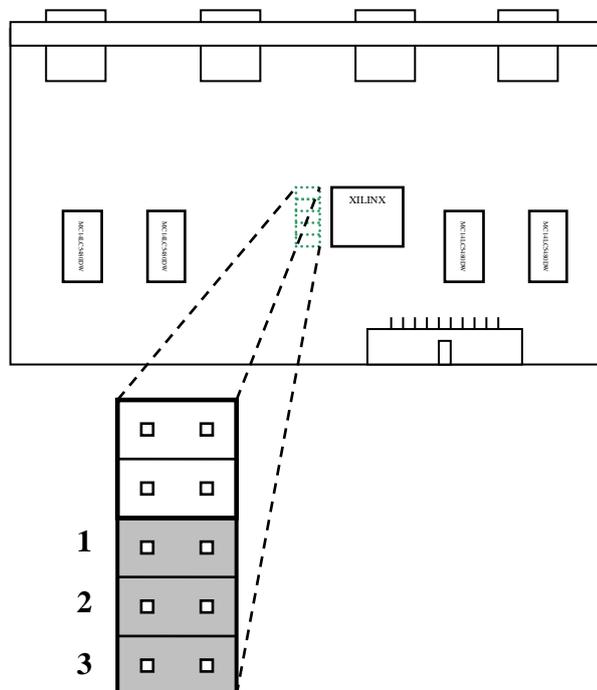
#### 6.2.1 Analog DSP board

Pairs of address pins are marked with 1-to-3 digits and greyed-out on the following picture.



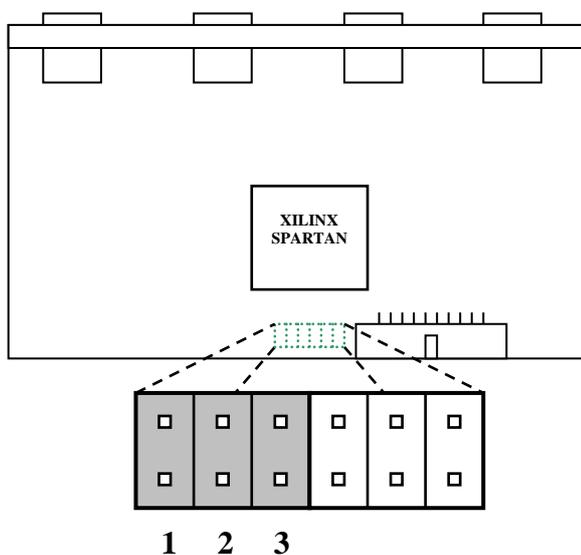
## 6.2.2 Analog board

Pairs of address pins are marked with 1-to-3 digits and greyed-out on the following picture.



## 6.2.3 ISDN and system boards

Pairs of address pins are marked with 1-to-3 digits and greyed-out on the following picture.



## 6.3 Jumper settings and the corresponding board numbers

Jumper setting	Board number	Jumper setting	Board number
 1 2 3	0	 1 2 3	4
 1 2 3	1	 1 2 3	5
 1 2 3	2	 1 2 3	6
 1 2 3	3	 1 2 3	7

 - jumper set  
 (pair of pins is short)

 - jumper removed  
 (no connection)

## 7: Licenses

Software for configure and maintenance of recorders (search, view and listen the stored call) are one piece of equipment purchased by the user. The operation of these programs is not subject to time limits, and the latest versions can be downloaded at: [www.trx.com.pl](http://www.trx.com.pl).

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## 7.1 The Linux kernel code license

The distribution of the Linux kernel code is based on the *GPL* license. The content of the license is presented below. It can be also found on the web: <http://www.gnu.org/licenses/old-licenses/gpl-2.0.txt>

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```

The following license is related to the source code of the *pcr* library.

Written by Philip Hazel  
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```

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```

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```
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##

ISC Cron - January 2004
[V4.0 was November, 2000]
[V4.0b1 was September 7, 1997]
[V3.1 was some time after 1993]
[V3.0 was December 27, 1993]
[V2.2 was some time in 1992]
[V2.1 was May 29, 1991]
[V2.0 was July 5, 1990]
[V2.0-beta was December 9, 1988]
[V1.0 was May 6, 1987]
ftp://ftp.isc.org/isc/cron/
```

This is a version of 'cron' that is known to run on most systems. It is functionally based on the SysV cron, which means that each user can have their own crontab file (all crontab files are stored in a read-protected directory, usually /var/cron/tabs). No direct support is provided for 'at'; you can continue to run 'atrun' from the crontab as you have been doing. If you don't have atrun (i.e., System V) you are in trouble.

A messages is logged each time a command is executed; also, the files "allow" and "deny" in /var/cron can be used to control access to the "crontab" command (which installs crontabs). It hasn't been tested on SysV, although some effort has gone into making the port an easy one.

To use this: Sorry, folks, there is no cutesy 'Configure' script. You'll have to go edit a couple of files... So, here's the checklist:

```
Read all the FEATURES, INSTALL, and CONVERSION files
Edit config.h
Edit Makefile
    (both of these files have instructions inside; note that
    some things in config.h are definable in Makefile and are
    therefore surrounded by #ifndef...#endif)
'make'
'su' and 'make install'
    (you may have to install the man pages by hand)
kill your existing cron process
    (actually you can run your existing cron if you want, but why?)
build new crontabs using /usr/lib/{crontab,crontab.local}
    (either put them all in "root"'s crontab, or divide it up
    and rip out all the 'su' commands, collapse the lengthy
    lists into ranges with steps -- basically, this step is
    as much work as you want to make it)
start up the new cron
    (must be done as root)
watch it. test it with 'crontab -r' and watch the daemon track your
changes.
if you like it, change your /etc/{rc,rc.local} to use it instead of
the old one.
```

```
$Id: README,v 1.6 2004/01/23 19:03:32 vixie Exp $
```

## 7.4 The OpenSSL license

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```

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lib/gssapi/generic/gssapi\_err\_generic.et  
lib/gssapi/mechglue/g\_accept\_sec\_context.c  
lib/gssapi/mechglue/g\_acquire\_cred.c  
lib/gssapi/mechglue/g\_canon\_name.c  
lib/gssapi/mechglue/g\_compare\_name.c  
lib/gssapi/mechglue/g\_context\_time.c  
lib/gssapi/mechglue/g\_delete\_sec\_context.c  
lib/gssapi/mechglue/g\_dsp\_name.c  
lib/gssapi/mechglue/g\_dsp\_status.c

```
lib/gssapi/mechglue/g_dup_name.c
lib/gssapi/mechglue/g_exp_sec_context.c
lib/gssapi/mechglue/g_export_name.c
lib/gssapi/mechglue/g_glue.c
lib/gssapi/mechglue/g_imp_name.c
lib/gssapi/mechglue/g_imp_sec_context.c
lib/gssapi/mechglue/g_init_sec_context.c
lib/gssapi/mechglue/g_initialize.c
lib/gssapi/mechglue/g_inquire_context.c
lib/gssapi/mechglue/g_inquire_cred.c
lib/gssapi/mechglue/g_inquire_names.c
lib/gssapi/mechglue/g_process_context.c
lib/gssapi/mechglue/g_rel_buffer.c
lib/gssapi/mechglue/g_rel_cred.c
lib/gssapi/mechglue/g_rel_name.c
lib/gssapi/mechglue/g_rel_oid_set.c
lib/gssapi/mechglue/g_seal.c
lib/gssapi/mechglue/g_sign.c
lib/gssapi/mechglue/g_store_cred.c
lib/gssapi/mechglue/g_unseal.c
lib/gssapi/mechglue/g_userok.c
lib/gssapi/mechglue/g_utils.c
lib/gssapi/mechglue/g_verify.c
lib/gssapi/mechglue/gssd_pname_to_uid.c
lib/gssapi/mechglue/mglueP.h
lib/gssapi/mechglue/oid_ops.c
lib/gssapi/spnego/gssapiP_spnego.h
lib/gssapi/spnego/spnego_mech.c
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TRX  
ul. Garibaldiiego 4  
04-078 Warsaw  
POLAND  
tel. +48 22 871 33 33  
fax +48 22 871 57 30  
biuro@trx.com.pl



TRX Serwis  
ul. Międzyborska 48  
04-041 Warsaw  
POLAND  
tel. +48 22 870 63 33  
tel. +48 22 871 33 34  
serwis@trx.com.pl