Signalling Converter
IDTMF / E&M

DOCUMENTATION
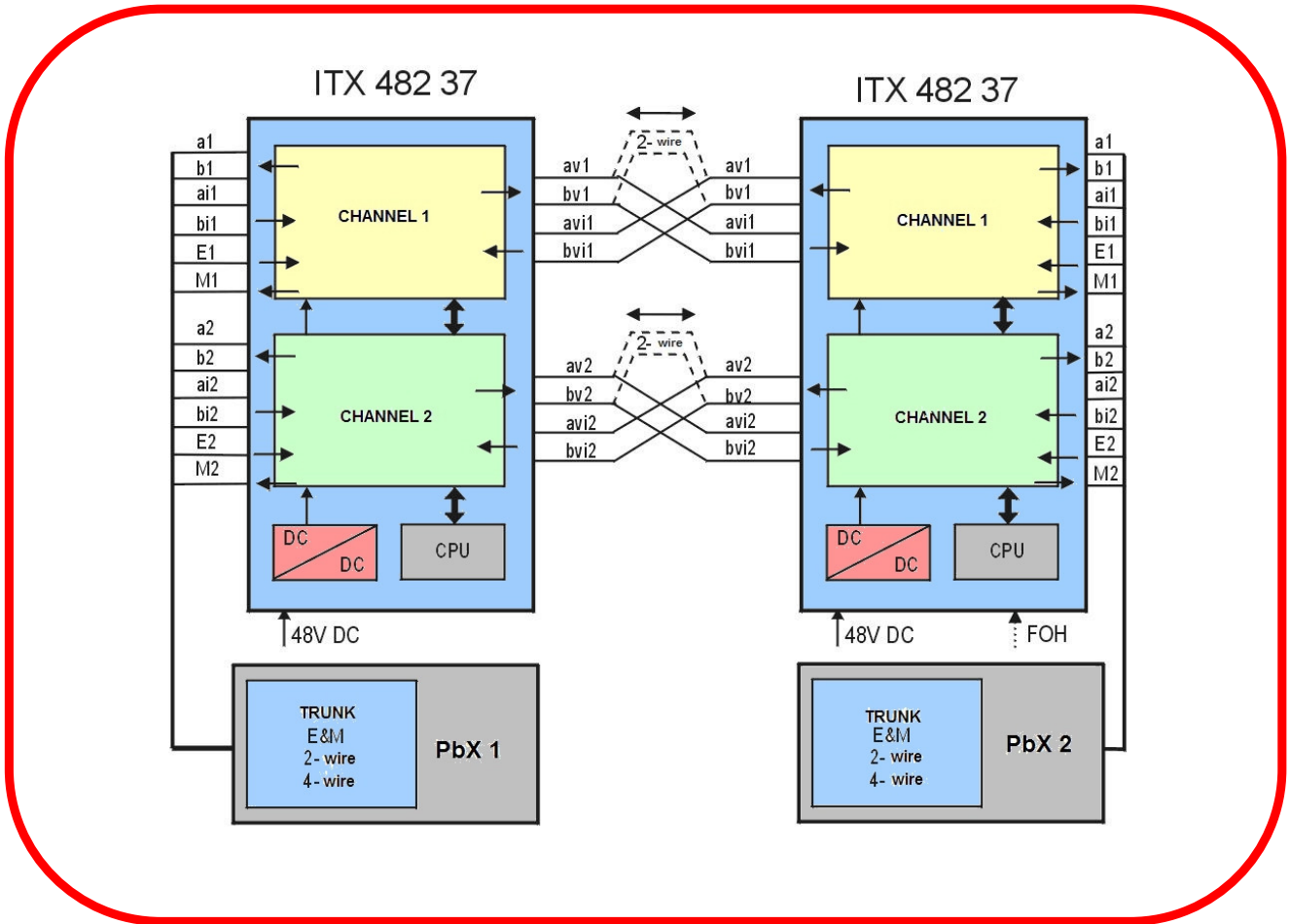
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1. GENERAL DESCRIPTION

Product name: Signalling Converter IDTMF / E&M

Type nomenclature: **ITX 482 37, ITX 422 37**

Dimensions: 43.5 x 237 x 220 mm (HxWxD)

Placement: protected areas

Operating conditions: 0 $^\circ$ C to 55 $^\circ$ C, 20% to 75% relative atmospheric humidity

Storage: -10 $^\circ$ C to 60 $^\circ$ C, 20% to 75 relative atmospheric humidity

Basic parameters:

◆ 2 - fold signalling converter IDTMF / E&M

◆ input / output - IDTMF signalling

- 2-wire

- 4-wire

◆ input / output - E&M signalling – continuous or pulse

- 2 - wire

- 4 - wire

◆ PbX power supply - 42 to 65 V DC, current Imax = 1A

Note: When turning the device on, starting current is higher.

◆ Connecting the wires with connector

◆ Optional placement - wall or desk

◆   Optional placement to 19" rack 6U

◆ Impact of alternate signalling - in line with the resistance max. 3000 Ohm

  (Or attenuation of 22 db)

2. FUNCTION AND DIAGNOSTIC

Signalling converter IDTMF / E&M is used to connect the device with IDTMF signaling device to device with E&M signaling (vice versa).

ITX 482 37 (ITX 422 37) is connected also to PbX trunks with E&M signalling, line connection 2-wire or 4-wire.

There are protective components against overvoltage on tip and ring wires placed on the board. Voice cicuits are formed by active cradle which does not bring the attenuation into voice path. The device contains a DC / DC converter which generates the input voltage -48V into $\pm$ 12V, +5 V.
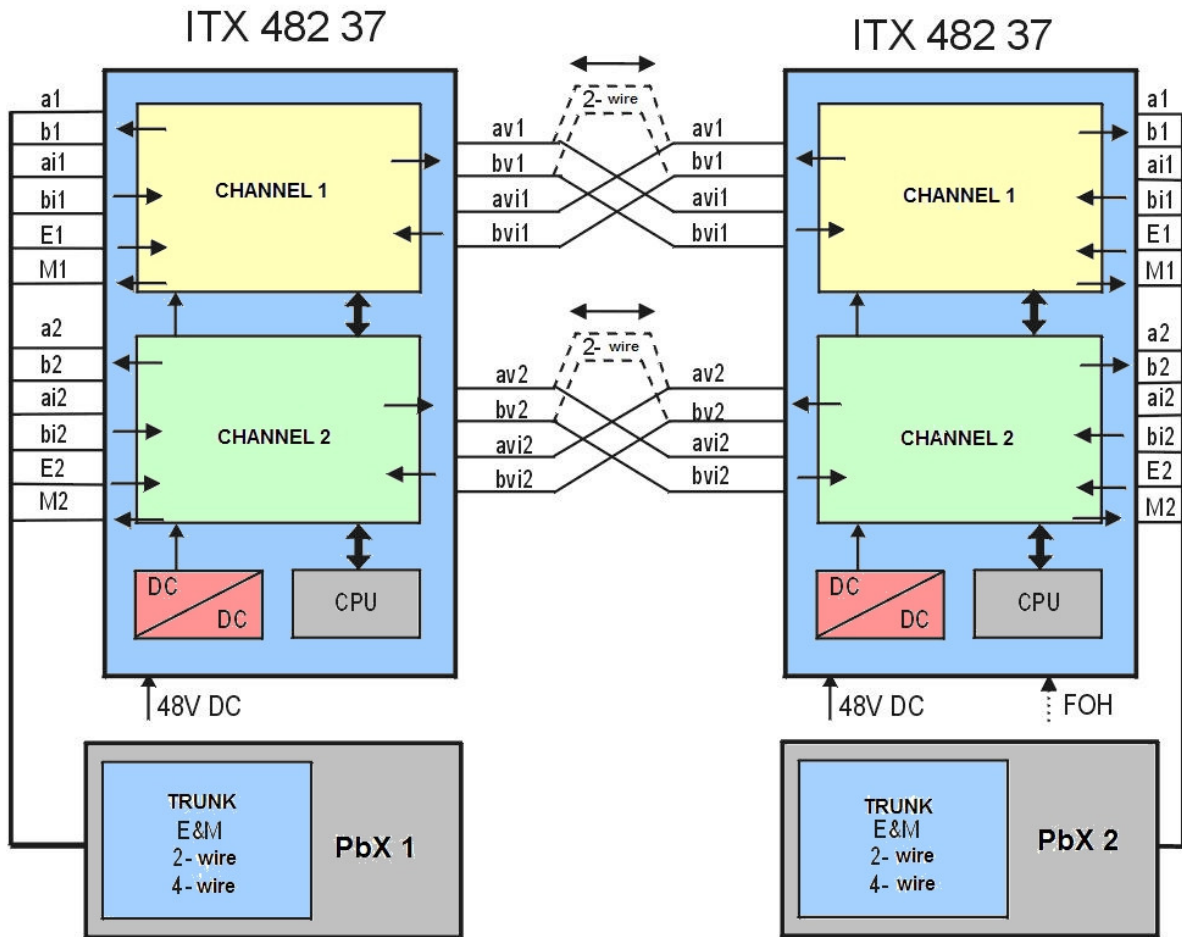

Fig.1 Converting of IDTMF signalling to E&M.

FUNCTION

This device can be used as a converter from the DTMF signalling to E&M signalling. It can only cooperate with another ITX 482 37 or with any other Inoteska device supporting IDTMF signaling. The converter function is chosen by connecting and switching the particular switched on main card. Detailed meaning of switches is described below. E&M signalling can be continuous or pulse, dial can be DTMF or pulse E&M. Release can be done without acknowledgment, with acknowledgment or with self-acknowledgment for cooperation e.g. with UPN trunk.

Used DTMF signals:

C1, C2 – seizure from E&M to line

A1, A2 – release from E&M to line

B – answer from E&M to line

The device controller senses the status of E&M wires or DTMF receiver each 5ms. After seizure from E&M side, it transmits DTMF signal "C" and digit 1 or 2 (according to the trunk position). Upon dial receipt and evaluation, this is transmitted either as DTMF signal with a length of 100ms or as pulse in the rate of 60/40 by keying on M-wire. Release from E&M side is transmitted to the line as DTMF signal "A" and digit 1 or 2 (according to the trunk position). If acknowledge and self-acknowledge mode is set, then release acknowledgment pulse is transmitted right after release receipt. Release from line side is transmitted by M-wire as 600ms pulse or permanent change of status.

After seizure from the line side (meaning the receipt of DTMF mark "C"), seizing pulse with length 100 ms is sent on M-wire or it is signified as permanent change of status (meaning the connection of 0V on M-wire in continuous E&M signaling). Received and evaluated dial is transmitted on M-wire by pulse in the rate of 60/40 or if DTMF dial was received and particular switches are switched, then this is by-passed further without being repated by pulse. The release is the same as for outgoing connection. Connecting pulse (after called party answers) is transmitted as DTMF mark "B". Pulse length (for pulse signalling) as well as exceptions from regular E&M signalling can be adjusted upon request.

DIAGNOSTIC

When connecting two converters ITX 482 37 diagnostic functions can be used for the supervision of line or cooperating device. It is necessary to set one ITX 482 37 as (MASTER) and the second as (SLAVE).

Used DTMF marks:

* - Diagnostic mark direction M - S

* - Diagnostic mark answer S - M

- Diagnostic mark block announcement M into S

When diagnostic is activated (appropriate switches are switched on the main board), converters are testing reciprocally each other during inactivity. (note: the proper function of diagnostics is only guaranteed for proper switch settings on both sides of cooperating devices.) Approximately every 30 seconds DTMF symbol * is transmitted from the control side (MASTER) and waits for answer from cooperating device.

After receiving DTMF signal *, controlled side (SLAVE) responds by sending DTMF signal *. In case the control side does not receive a response to its signal within one 30s diagnostic interval, then it repeats its signal *. Error detected by diagnostic is displayed by flashing of particular LED diode on the board in 1s intervals. If there is no response until next diagnostic interval, converter is blocked and error is signalized by LED diodes flashing. Converter block means a permanent 0V connection to M-wire. After blocking the control side, this transmitts DTMF mark "#" - I am blocked. Controlled side responds only to marks *. Upon receiving #" it is automatically blocked, but transmitts the response *. This case is significant only for 4-wire lines when the direction to control side is interrupted and hence both sides are blocked. If controlled side dose not receive any mark in idle state, it does not send the response and it´s being blocked. After three diagnostic intervals it sends a release signal (if opposite side is not released because of any reason) in order to get into idle state. Controlled side can also be blocked by permanent 0V connection to M-wire. This status is displayed by flashing of particular LED diode. After blocking the controlled side, this transmitts a tone with a frequency around 770 Hz to the line.

      timing: 4s transmits

          1s does not transmit

      level: 8 db-

This way it is possible to locate the line faults easily or measure the signal level on line. After the line or opposite device repair, both sides are automatically unblocked. Another blocking option is permanent grounding of E-wire from the cooperating exchange (only for pulse E&M signaling). In this state, the corresponding side does not send a response to the diagnostic marks and the opposite side is blocked after three diagnostic intervals. After the abolition of E-wire grounding, both sides are automatically unblocked.

3. MECHANICAL ASSEMBLY

- **ITX 482 37 - desktop** – **237 x 220 x 43.5 mm** (hxdxw)
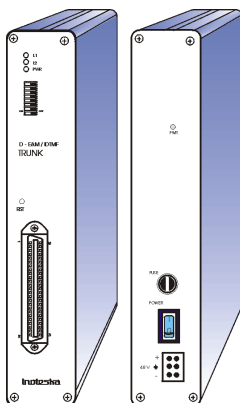
Signalling elements:

LED diodes:
L1 – 1. channel status
L2 – 2. channel status
PWR – Power supply

a) Diode permanently lights – channel is occupied
b) Diode flashes – error status (channel is not set, channel error,...)

- **ITX 422 37** – **19" rack 6U**

It is possible to insert several cards ITX 422 37 to the rack and and thereby create a multiple converter.

* Max. 17 optional cards with 4 HP (TE) width can be placed to the rack ITP 222 01.

		Multiplicity	**Width HP (TE)**
ITX 422 37	Converter E&M / IDTMF	**2 - násobná**	**4**
	Optional positions		**17x4=64**
ITX 802 01	Converter DC / DC 25, 6U	**-**	**8**
	Free last position beyond source	**-**	**8**
ITP 222 01	19", 6U	**-**	**84**

Location of cards in the rack:
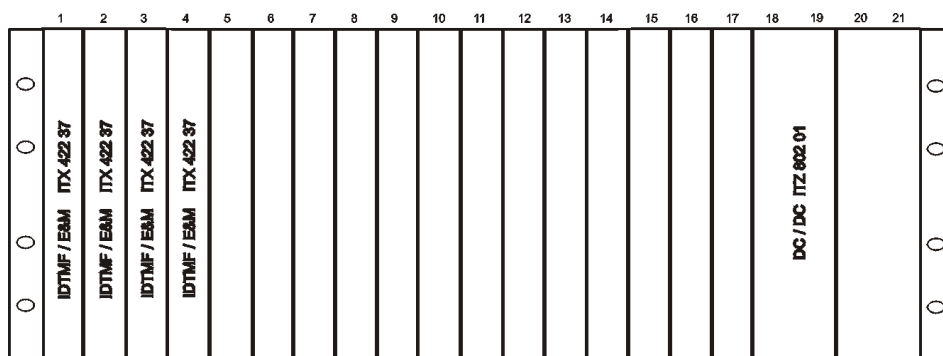
4. CONNECTING AND SETTING UP

Connector J4 - description:
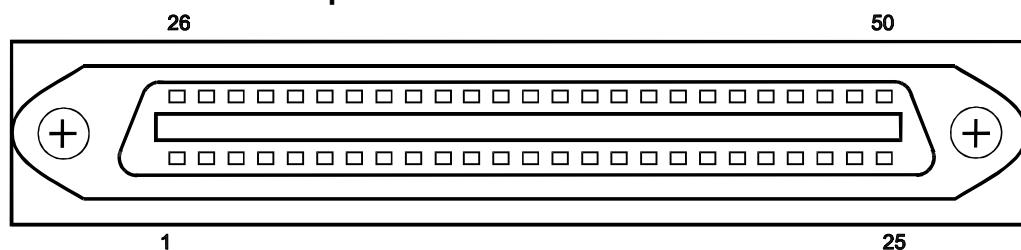
IDTMF/E&M		IDTMF/E&M	
1 -		26 -	
2 -		27 -	
3 -		28 -	
4 -		29 -	
5 -		30 -	
6 -		31 -	
7 -		32 -	
8 – E2	r	33 – M2	s(r)
9 – AVI2	r	34 – BVI2	h(r)
10 – AV2	r	35 – BV2	m(r)
11 – AX2	r	36 – BX2	o(r)
12 – AI2	r	37 – BI2	z(r)
13 –		38 –	
14 – AI1	b	39 – BI1	z(b)
15 –		40 –	
16 – E1	b	41 – M1	s(b)
17 – AVI1	b	42 – BVI1	h(b)
18 – AV1	b	43 – BV1	m(b)
19 – AX1	b	44 – BX1	o(b)
20 -		45 – FOH	
22 -		47 -	
23 -		48 -	
24 -		49 -	
25 -		50 -	

AVx, BVx, AVIx, BVIx - line - IDTMF signalling

Jumpers location on the board:
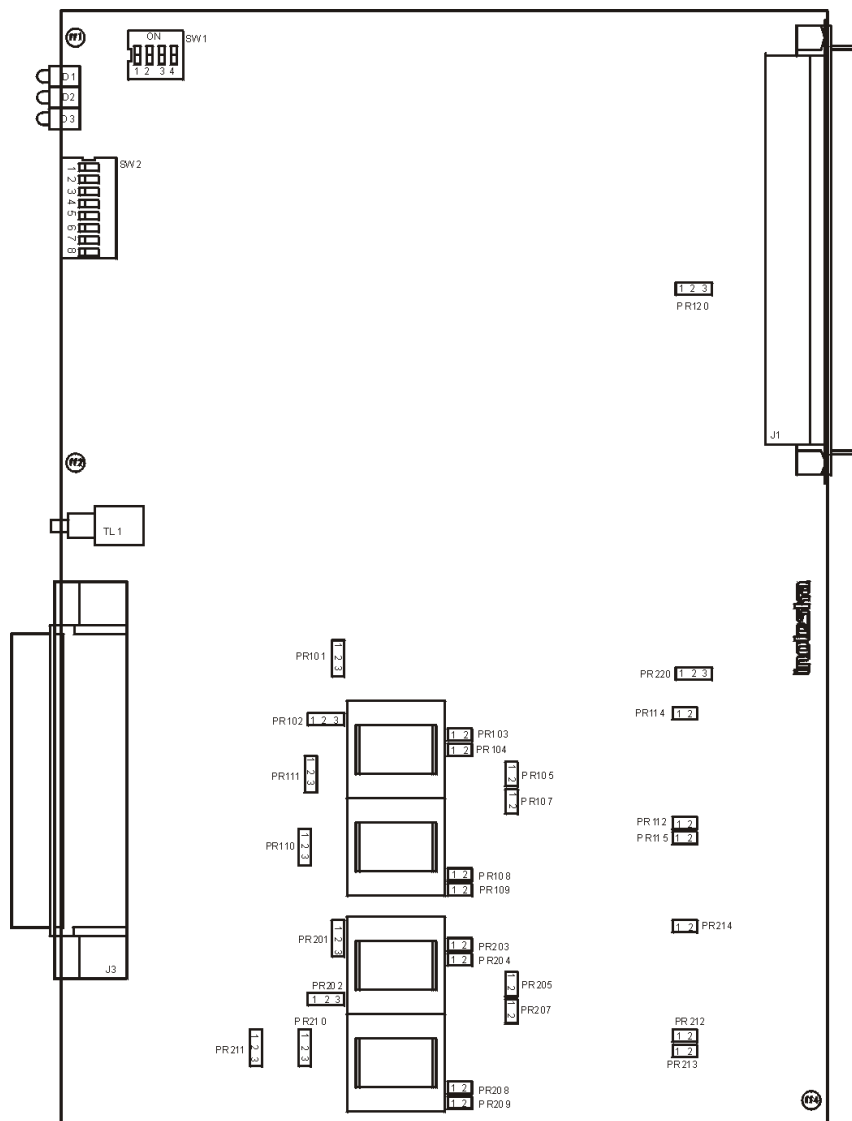
SW2 switch on the front panel

1 - E&M signalling	OFF - pulse	ON - contiuous
2 – dial to PbX	OFF - DTMF	ON – pulse
3 – occupation acknowledgment	OFF – no acknowledgment	ON – with acknowledgment
4 – release acknowledgment	OFF – no acknowledgment	ON - s potvrdením
5 – reverse pulse release	OFF – none	ON - active
6 - dial	OFF - DTMF	ON - pulse
7 - diagnostic	OFF – turned off	ON – turned on
8 – diagnostic control	OFF - controlled	ON - controlling

Switches 3, 4, 5 are used only for pulse E&M signalling.

Switch **6 ON:**

       from PbX   →   DTMF signals to the line
       pulse dial   D and number of dial 1, 2, 3, ...
       DTMF   passed directly

Switch **6 OFF:**

       pulse dial   only number of dial
       DTMF   passed directly

If pulse dial is set by switch and pulse dial is received from PbX, then this is converted to frequency dial and two signals are transmitted to the line – first signal means block of voice path, second signal is a particular digit. If DTMF dial is received from PbX, then it is direclty passed to the line.

If DTMF dial is set by switch and pulse dial is received from PbX, then this is converted to frquency dial and is transmitted to the line as one signal.

Note:

It is necessary to set the switches and PbX parameters in a way to avoid the dial duplicity.

For seizure and release, the converter firmware uses a combination of two signals which increases the resistance against the influence of crosstalk on the lines (for this reason it is necessary to connect 1.trunk on the board against 1.trunk on the second board, the same is valid for 2.trunks) and there are also modifications to suppress dial duplicity when converting from DTMF to pulse.

SW 1 switches:

1 - RESET WD   - always in ON position
2 – switch of SW   - only when it is fitted with external program memory
3 - unused
4 - unused

Jumpers on board:

<u>E&M</u>

1. Pn	2-wire	4-wire	2. Pn	2-wire	4-wire
PR101	1-2	2-3	PR201	1-2	2-3
PR102	1-2	2-3	PR202	1-2	2-3
PR103	1-2	discon.	PR203	1-2	discon.
PR104	1-2	discon.	PR204	1-2	discon.

IDTMF

	2-wire	4-wire
PR108	1-2	discon.
PR109	1-2	discon.
PR110	2-3	1-2
PR111	2-3	1-2
PR208	1-2	discon.
PR209	1-2	discon.
PR210	2-3	1-2
PR211	2-3	1-2

Amplification:

PR105	+3dB in direction E&M to line 1.Pn
PR107	+3dB in direction from line to E&M 1.Pn
PR205	+3dB in direction E&M to line 2.Pn
PR207	+3dB in direction from line to E&M 2.Pn

IDTMF signal transmission:

	- 6dB	0dB	+6dB
PR114	disc..	1-2	1-2
PR115	disc.	disc..	1-2
PR214	disc.	1-2	1-2
PR215	disc.	disc.	1-2

IDTMF signal receive:

	0dB	+6dB
PR112	disc.	1-2
PR212	disc.	1-2

E&M

	-48V	-12V
PR120	2-3	1-2
PR220	2-3	1-2

disc. – disconnected jumper

Change of E&M signalling parameters:

It is possible to change E&M signalling times by programming. At the end of the program, there are descriptions and two tables. After second table, there is one byte FF and then time table:

Hexadecimal	Decimal		
14	20	x 5 ms =	100 ms – length of busy pulse
14	20	x 5 ms =	100 ms – length of answer. pulse
78	120	x 5 ms =	600 ms – length of release
C8	200	x 5 ms =	1000 ms – length of release acknowledgment
0C	12	x 5 ms =	60 ms – dial pulse
08	8	x 5 ms =	40 ms – dial gap

To change the parameters, a programmer for AT 89C52 circuits is necessary.

Diagnostic:

PbX 1 Controlling	**PbX 2 Controlled**	
* →		
	← *	
After 3 intervals without mark *		Only for 4-wire line
It is blocked		
# →	it is blocked	
	← *	
After 3 intervals		
	← A1 or A2	
	← 770 Hz 4s transmits/ 1s does not transmit	

Pulse E&M signalling

Seizure | Dial | Connect | Call | Release

Seizure self-acknowledgment

Switch 3 ON, 5 ON
PbX 1 M
PbX 2 M
PbX 1 E

With seizure acknowledgment

Switch 3 ON, 5 OFF
PbX 1 M
PbX 2 M
PbX 1 E

Release self-acknowledgment

Switch 4 ON, 5 ON
PbX 1 M
PbX 2 M
PbX 1 E

With release acknowledgment

Switch 4 ON, 5 OFF
PbX 1 M
PbX 2 M
PbX 1 E

Without release acknowledgment

Switch 4 OFF, 5 OFF
PbX 1 M
PbX 2 M
PbX 1 E

Switches:
1 ON
2 OFF
3
4   no relevance
5

Continuous E&M signalling

1 M
2 M

Trasmission of DTMF marks on the line

PbX 1   C1 or C2   1, 2, 3 ...   A1 or A2

PbX 2   B

5. TECHNICAL PARAMETERS

Requirements for power supply:

- DC voltage-40V to-64V - Input current <0.3 A

Pulse E&M signalling timing:

Seizure: 150 ms resp. 70 ms

Release : 600 ms

Dial: pulse - 60 ms, gap - 40 ms

Transmission parameters

Insertion attenuation

Insertion attenuation value measured at a frequency of 800 Hz and the input signal level is 0 db 0.5 db + - 0.7 db.

Asymmetry attenuation

Asymmetry attenuation is better than the following values:

50 -   300 Hz   26 dB

300 - 600 Hz   40 dB

600 - 3400 Hz 46 dB

Reflection attenuation

Reflection attenuation is higher than 12 db in the range of 300 to 600 Hz and 18 db in the range from 600 to 3400 Hz, at the input level of 0 db.
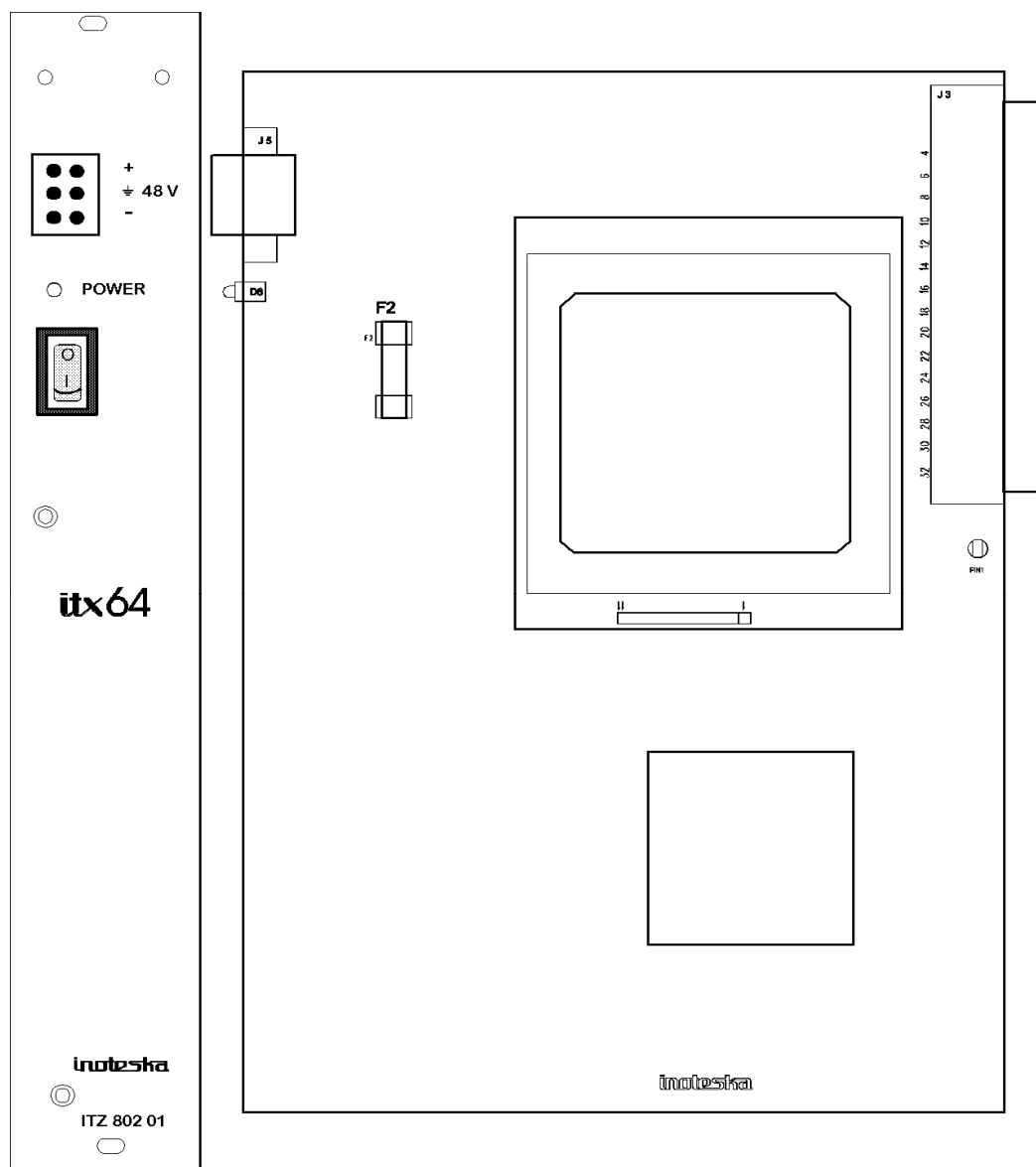
Psofometric noise

Average value of psofometric noise measured at the point of zero relative level of voice signal does not exceed -67 dB.

6. POWER SUPPLY DC/ DC

ITZ 802 01 includes two DC / DC converters:

1. DC / DC1 $\rightarrow$ - 48V / 5V, 5A

2. DC / DC2 $\rightarrow$ - 48V / +12V, 1.5 A

$\rightarrow$ - 48V / - 12V, 1.5 A $\rightarrow$ - 48V / - 12V, 1.5 A

Fuse F2: T2.5A