

# HAM RADIO WORKS

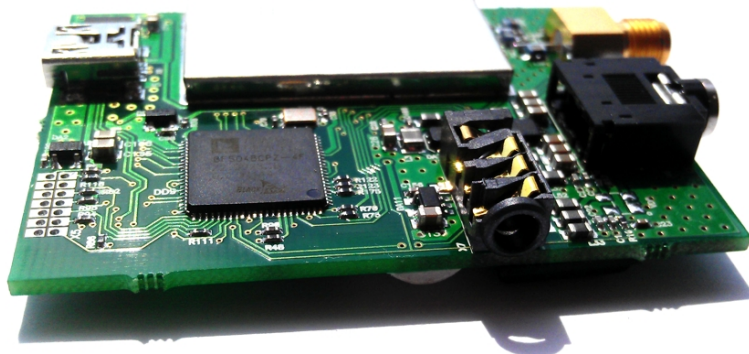
www.hrw.3dn.ru

## APCO25/DMR/NXDN/YAESU SYSTEM FUSION

*Stand alone*

Digital Voice Receiver

### ADCR25\_PRO2



Manual ver 3.5

\* the real receiver view can be different from the shown at the ad picture

## 1. Description and technical characteristics

ADCR25\_PRO2 is fully stand alone digital voice receiver from antenna to audio path. To receive digital voice only antenna, USB power and headphones needed. Its windows compatible control software can work on any PC with installed Windows XP, 7, 8 and higher. In stand alone mode it can decode digital voice, do P25 trunk tracking and memory scanning. You can use your ADCR25\_PRO2 in your vehicle for P25 trunk tracking, memory scan or conventional voice channel listening: simple plug the USB power via standard cell phone charger.

*No special requirements to PC resources because software performs control functions only. Any cheap and simple NetBook with free USB port will work with!*

Due to on-board digital voice decoder the best digital audio quality provided compared to the PC software DV decoders. All critical algorithms are performed by special Digital Signal Processor with very fast memory access and ultra fast cache.

### *Electrical specifications:*

DC power voltage from 3.5 to 5.5VDC;  
DC Current consumption 150mA max;

### *Receiver specification:*

Sensitivity better than -116dBm;  
Adjacent channel rejection -60dB;  
Blocking performance -90dB;

### *Frequency band:*

VHF version: 140-160 MHz and 164-190MHz  
UHF version: 410-480MHz  
800M version: 820-960MHz

### *I/O connections:*

Mini USB port for power and control;  
SMA female antenna connector;  
3.5mm audio stereo jack;

### *Dimensions:*

65 x 45 mm

## 2. PC connection and control software running.

Before running control software please install Microsoft .NET version 2.0. If you are running under MS Windows 7 and higher you don't need this.

Before connecting your ADCR25\_PRO2 to PC please install Virtual COM Port VCP driver (comes with ADCR25\_PRO2 software archive) from Driver\_COMPORT folder (run CP210xVCPInstaller\_x86.exe in case of WIN32 or CP210xVCPInstaller\_x64.exe otherwise). ADCR25\_PRO2 uses SiLabs CP2103 USB to COM converter. For the latest drivers and support please visit website:

<http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>

***Attention! Install VCP driver BEFORE ADCR25\_PRO2 USB connection!***

After successful driver installation run control software p25recv-v5.9.exe and connect your ADCR25\_PRO2 to any free USB port.

Your receiver is ready to work after green LINK: <serial ESN> <FW ver.> appears.



### 3. Digital standard selection and main functions



**AIR INTERFACE** – Current digital standard:

- |           |  |
|-----------|--|
| P25       | – APCO25 Phase 1 (TIA-102);  |
| DMR       | – Digital Mobile Radio (ETSI TS 102 361-1 Tier 1 and Tier 2);                              |
| DMR TS1   | – DMR time slot 1 receive only;  |
| DMR TS2   | – DMR time slot 2 receive only;  |
| NXDN4800  | – IDAS and NEXEDGE 6.25kHz ( <a href="http://www.nxdn-forum.com">www.nxdn-forum.com</a> ); |
| NXDN9600  | – KenwoodNEXEDGE 9600  |
| S. FUSION | – Yaesu C4FM Sytem Fusion ( <a href="http://www.yaesu.com">www.yaesu.com</a> );            |
| dPMR*     | – Digital Private Mobile Radio( <a href="http://www.dpmr-mou.com">www.dpmr-mou.com</a> );  |
| D-STAR*   | – Icom amateur digital two way radio standard;   |

\* *will be realized in future.*

All supported digital standards use MBE based vocoders.

Main buttons:



- |                     |  |
|---------------------|--|
| <b>VFO</b>          | – Variable frequency mode;   |
| <b>MEMORY</b>       | – Stored memory mode;  |
| <b>LOAD</b>         | – Load receiver settings from the file;                              |
| <b>SAVE</b>         | – Save current receiver settings to the file;                        |
| <b>NAC DEC</b>      | – View NAC/RAN/COLOR CODE code in decimal (HEX otherwise);           |
| <b>IDs DEC</b>      | – View SOURCE and TARGET IDs in decimal (HEX otherwise);             |
| <b>MEM. SCAN</b>    | – Memory scanning function;  |
| <b>RECALL</b>       | – View and edit memories;  |
| <b>STORE</b>        | – Storing current frequency and mode to the specified memory number; |
| <b>SEARCH</b>       | – Search new DV channels in specified band;                          |
| <b>UPGRADE</b>      | – Firmware upgrade feature;  |
| <b>RF SET.</b>      | – RF gain and S-meter calibration settings;                          |
| <b>P25 TRUNKING</b> | – APCO25 TRUNK analyzer and tracker modes;                           |



- |                  |  |
|------------------|--|
| <b>FILTERS</b>   | – Group and NAC filter settings;       |
| <b>AUTOSCAN</b>  | – Standalone auto scan function;       |
| <b>LOG START</b> | – Start incoming calls logging to file |
| <b>?</b>         | – About this software;                 |
| <b>RESET</b>     | – Reset receiver to original settings; |

#### 4. Volume control and equalizer.

To setup decoded audio volume level change **VOLUME** parameter.



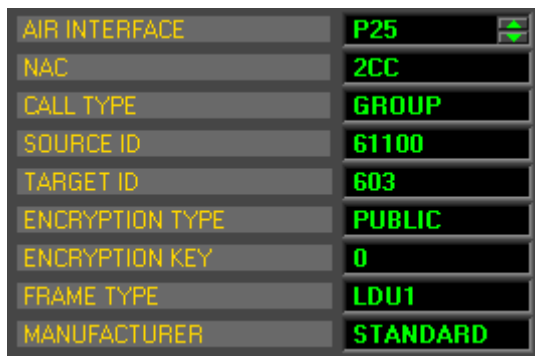
Volume level is from 0 (mute) to 15 (maximum).

Equalizer allows you to tune audio response to match to your headphones.



If you use low impedance (32 Ohm or less) headphones rise up high frequency bands: 800Hz, 1600Hz, 2400Hz and 3200Hz to ensure clear speech.

#### 5. APCO25 signal parameters.



<b>NAC</b>	– Network Access Code;
<b>CALL TYPE</b>	– GROUP or INDIVIDUAL call;
<b>SOURCE ID</b>	– Calling user ID;
<b>TARGET ID</b>	– Target group or user ID;
<b>ENCRYPTION TYPE</b>	– Encryption algorithm;
<b>ENCRYPTION KEY</b>	– Encryption key number;
<b>FRAME TYPE</b>	– Received frame type;
<b>MANUFACTURER</b>	– Special features manufacturer code;

## 6. DMR signal parameters.

AIR INTERFACE	DMR
COLOR CODE	0C
CALL TYPE	GROUP
SOURCE ID	1EDE58
TARGET ID	000016
PRIVACY INDICATOR	PUBLIC
TDMA TIME SLOT	2
ACCESS TYPE	IDLE

<b>COLOR CODE</b>	– System access code;
<b>CALL TYPE</b>	– GROUP or INDIVIDUAL call;
<b>SOURCE ID</b>	– Calling user ID;
<b>TARGET ID</b>	– Target group or user ID;
<b>PRIVACY INDICATOR</b>	– Public or encrypted channel;
<b>TDMA TIME SLOT</b>	– Repeater time slot number;
<b>ACCESS TYPE</b>	– Repeater input channel state;

## 7. NXDN4800/NXDN9600 signal parameters.

AIR INTERFACE	NXDN 4800
RAN	01
CALL TYPE	CONFERENCE
SOURCE ID	1
TARGET ID	1
CIPHER TYPE	PUBLIC
KEY ID	0
EMERGENCY	NORMAL

<b>RAN</b>	– Radio Access Number;
<b>CALL TYPE</b>	– CONFERENCE or INDIVIDUAL call;
<b>SOURCE ID</b>	– Calling user ID;
<b>TARGET ID</b>	– Target group or user ID;
<b>CIPHER TYPE</b>	– Public or scrambled/encrypted channel;
<b>KEY ID</b>	– Scrambler key id;
<b>FRAME TYPE</b>	– Received frame type;
<b>EMERGENCY</b>	– Normal or emergency call;

## 8. Yaesu C4FM System Fusion signal parameters.

AIR INTERFACE	S.FUSION
SQUELCH CODE	00
CALL TYPE	GROUP
SOURCE CALLSIGN	RU3ANQ
TARGET CALLSIGN	*****
SQUELCH CODE ENABLED	NO
DATA TYPE	V/D MODE 2
VOIP PATH	LOCAL

- SQUELCH CODE** – Code for opening “squelch” (like DCS in analog radio);
- CALL TYPE** – Group or individual call;
- SOURCE CALLSIGN** – Calling radio callsign;
- TARGET CALLSIGN** – Called radio callsign or broadcast “\*\*\*\*\*”;
- SQUELCH CODE ENABLED** – Calling radio squelch state;
- DATA TYPE** – Type of the used protocol;
- VOIP PATH** – Internet or local call;

## 9. Conventional digital voice receiving.

Enter voice channel or repeater frequency via the keyboard or tune it with mouse wheel.

452.425000 MHz
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If received signal power is enough to decode control software will show all decoded signal parameters and pass speech to your headphones.

## 10. Memory channel storage

Press **STORE** button on the main window.

FILTERS			
MEMORY NUMBER	1		
AIR INTERFACE	DMR		
FREQUENCY, MHz	439,800000		
MEMORY SCAN/TRACK LOCK	X		
COMMENTS	0,-108 dBm,BS		
NAC/CC 1	0	NAC/CC 5	0
NAC/CC 2	0	NAC/CC 6	0
NAC/CC 3	0	NAC/CC 7	0
NAC/CC 4	0	NAC/CC 8	0
EXCLUDE	X		
ENABLE	X		
STORE	CLOSE		

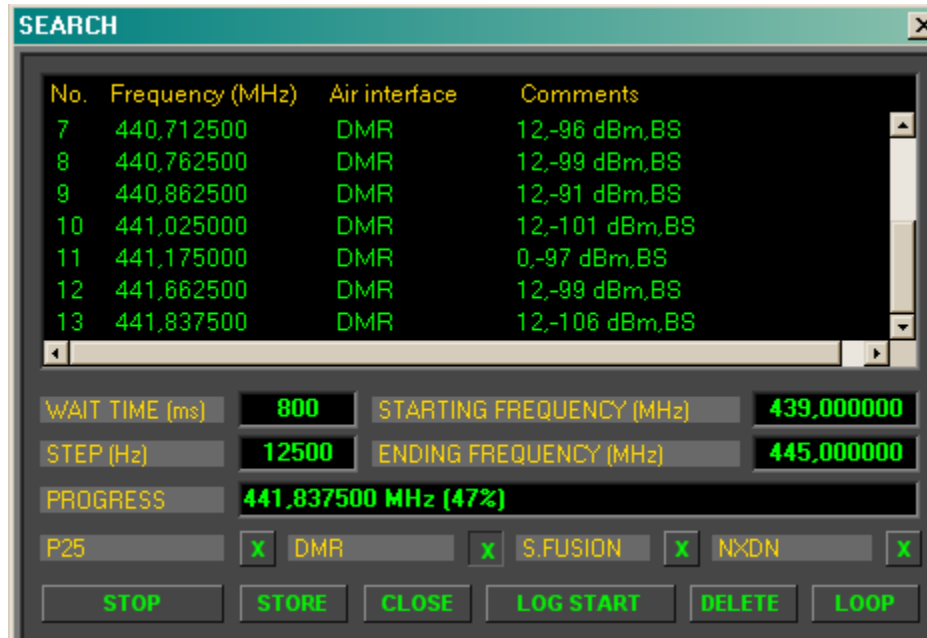
<b>MEMORY NUMBER</b>	– memory channel number;
<b>AIR INTERFACE</b>	– type of digital standard;
<b>FREQUENCY, MHz</b>	– frequency;
<b>MEMORY SCAN/TRACK LOCK</b>	– memory scan or track enable;
<b>COMMENTS</b>	– channel tag;
<b>NAC/CC&lt;x&gt;</b>	– channel filter settings;
<b>EXCLUDE</b>	– channel filter exclude mode;
<b>ENABLE</b>	– channel filter enable;

## 11. Search and store in memory.

ADCR25\_PRO2 can search for APCO25, DMR, NXDN and Yaesu C4FM System Fusion channels across the specified band limits. You can **LOOP** the search or **STOP** it and **STORE** results in the receiver memory.

Before searching specify Noise Floor parameter. The higher Noise Floor means faster search. Also select what type of digital voices standards you want to find.

Press **SEARCH** button on the main window.



<b>WAIT TIME (ms)</b>	– waiting time, mS;
<b>STEP (Hz)</b>	– search step, Hz
<b>STARTING FREQUENCY (MHz)</b>	– start from, MHz;
<b>ENDING FREQUENCY (MHz)</b>	– end at, MHz
<b>PROGRESS</b>	– current search state and result;

To store search results in receiver memory press **STORE**.

To remove selected line from result list press **DELETE**.

To make search process infinite press **LOOP**.



## 12. Memory channels scanning.

Press **MEM. SCAN**.



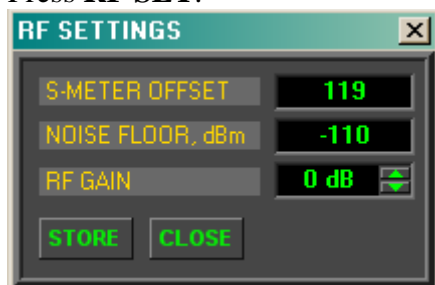
**WAIT TIME (ms)** – channel activity wait time, mS;

**HOLD TIME (ms)** – busy channel hold time, mS;

After **START** pressed receiver successively setting selected memory channels and wait for **WAIT TIME** on it. Receiver stops on busy channel and plays received speech. After the last voice transmission is done receiver waits **HOLD TIME** for any voice activity and then begin to listen next voice channel.

## 13. Noise Floor setting, S-meter calibration and RF gain set.

Press **RF SET**.



To calibrate receivers S-meter you need RF signal generator. Tune generator to the receiver frequency and set output level between -80dBm and -110dBm. Changing **S-METER OFFSET** value achieve equal S-meter reading to your generator. To store new S-meter settings press **STORE**.

To increase receiver IMD (receiver ability to work in band crowded conditions) you can change **RF GAIN** setting. Decrease RF gain to increase receiver IMD. Available values from 0 (maximum sensitivity) to -39dB (maximum IMD).

**NOISE FLOOR** – this parameter defines noise level above which receiver will search for desired signal type in **SEARCH** menu.

## 14. Filter settings.

Press **FILTERS** on the main window.

GROUP ID	Value	NAC/CC	Value
GROUP ID 1	0	NAC/CC 1	0
GROUP ID 2	0	NAC/CC 2	0
GROUP ID 3	0	NAC/CC 3	0
GROUP ID 4	0	NAC/CC 4	0
GROUP ID 5	0	NAC/CC 5	0
GROUP ID 6	0	NAC/CC 6	0
GROUP ID 7	0	NAC/CC 7	0
GROUP ID 8	0	NAC/CC 8	0

BANK # < 1 >

EXCLUDE ☒

FILTER ENABLE ☒

STORE CLOSE

Group filter defines which group numbers will be received. All group IDs are in decimal format. After group filter is programmed press **FILTER ENABLE** to activate it. Press **STORE** to store settings.

**NAC** (APCO25) or **CC** (Color Code, DMR) filter defines which systems will be received.

**EXCLUDE** defines filter mode: if enabled all IDs and NACs will be received with the exception of specified.

**FILTER ENABLE** enables filter work.

Up to 8 banks of filters settings can be stored. Choose bank by changing **BANK #**.

## 15. Stand alone memory scanning mode.

Receiver can do memory scanning mode after power up without control software. To do that press **AUTOSCAN**.

Parameter	Value
WAIT TIME (ms)	500
HOLD TIME (ms)	1000

AUTOSCAN ENABLE ☒

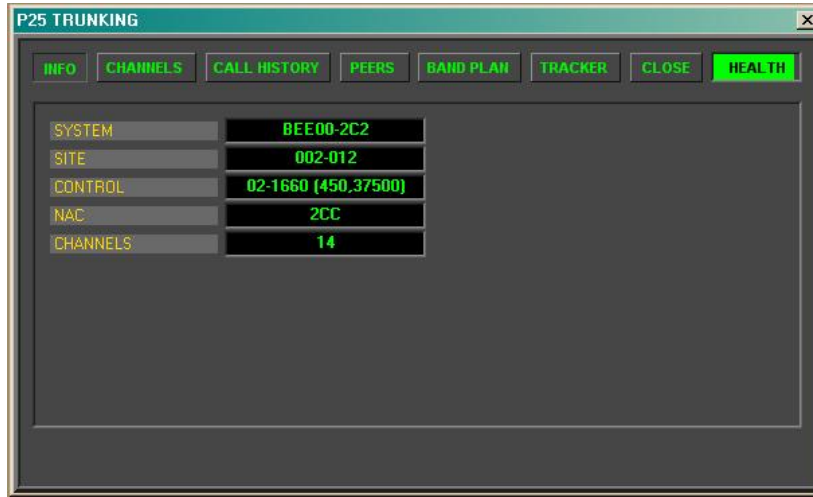
STORE CLOSE

Settings **WAIT TIME** and **HOLD TIME** work as in regular memory scanning mode. Switch on **AUTOSCAN ENABLE**, close control software and remove USB power. Apply USB power and your receiver will start memory scanning. Red led will flash every time on switching to the new memory. Once you run control software during auto scan mode scanning will stop.

## 16. APCO25 trunk analyzer.

First tune your receiver to the APCO25 Control Channel frequency. After receiver detected APCO25 Control Channel (led is become yellow) press **P25 TRUNKING**.

Press **INFO** to view main control channel info.



**HEALTH** indicates receiving quality.



## CALL HISTORY



**PEERS** indicates roaming control channels.

P25 TRUNKING

INFOCHANNELSCALL HISTORYPEERSBAND PLANTRACKERCLOSEHEALTH

System	Site	Control	Frequency	Last
00000-2C2	001-003	02-1774	451,08750	12:49:25
BEE00-2C2	002-015	02-1604	450,02500	12:49:23
BEE00-2C2	002-016	02-1688	450,55000	12:49:25
BEE00-2C2	001-007	02-1754	450,96250	12:49:21
BEE00-2C2	002-013	02-1684	450,52500	12:49:24
BEE00-2C2	001-011	02-1632	450,20000	12:49:22
BEE00-2C2	002-014	02-1612	450,07500	12:49:22
BEE00-2C2	001-009	02-1654	450,33750	12:49:22
BEE00-2C2	001-017	02-1658	450,36250	12:49:22
BEE00-2C2	001-001	02-1620	450,12500	12:49:25
BEE00-2C2	001-005	02-1646	450,28750	12:49:24

**BAND PLAN**

P25 TRUNKING

INFOCHANNELSCALL HISTORYPEERSBAND PLANTRACKERCLOSEHEALTH

ID	Base	Lo	Hi	Spacing	Bandwidth	TX offset
02	440,00000	02-0000	02-4095	6,25	12,5	6,400
03	136,00000	03-0000	03-4095	6,25	12,5	6,400
04	160,58750	04-0000	04-4095	6,25	12,5	6,400

# 17. Multi Site APCO25 TRUNK TRACKER

ADCR25 has the real innovative feature APCO25 TRUNK TRACKER. This feature allows the receiver to seek and listen group calls in trunk system. Also trunk tracker works in fully standalone mode (after power up without control software).

## How it works and talk group filter

Standing on control channel ADCR25 receives it data and analyze it. When group call grant packets is received ADCR25 moves to the group call frequency. After conversation is done ADCR25 moves back to control channel frequency and waits for the new grant packet.

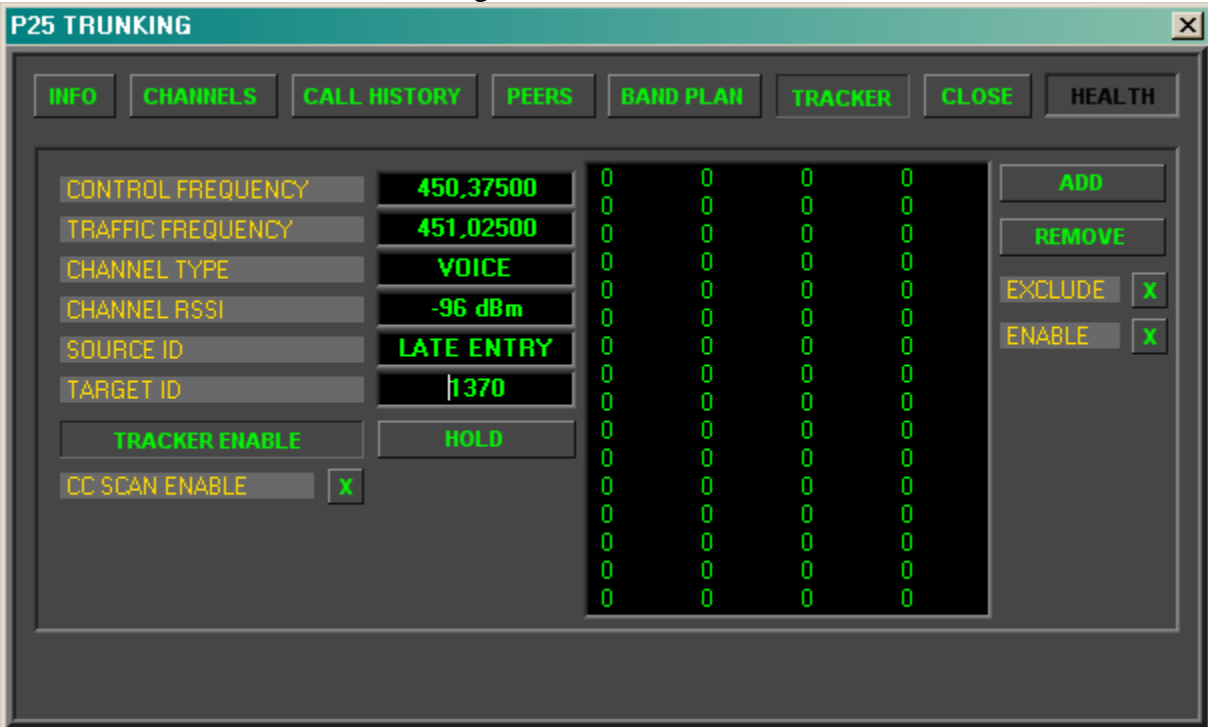
You can use **FILTERS** to set what groups will be track or use special trunking group filter in **TRACKER** window which can be enabled by pressing **ENABLE**.

Current **TARGET ID** can be added to trunking filter by pressing **ADD** button.  
Press **REMOVE** to delete selected record in trunking filter.

**EXCLUDE** option means that all talk groups will be tracked except of specified in the trunking filter.

## Multi site and Control Channel scanning

ADCR25 can track a list of control channels. It will choose the most powerful control channel from the list. The list of control channels should be stored in receiver memory. To enable stored control channel tracking set **MEMORY SCAN/TRACK LOCK**.



During group call listening press **HOLD** to stay receiver listen current group only.

**CC SCAN ENABLE** – Receiver will scan stored in memory control channels with **WAIT** time and **HOLD** time settings from AUTOSCAN menu settings. Run **CC SCAN ENABLE** before **TRACKER ENABLE**.

## 18. ADCR25\_PRO2 & UniTrunker (PRO96COM).

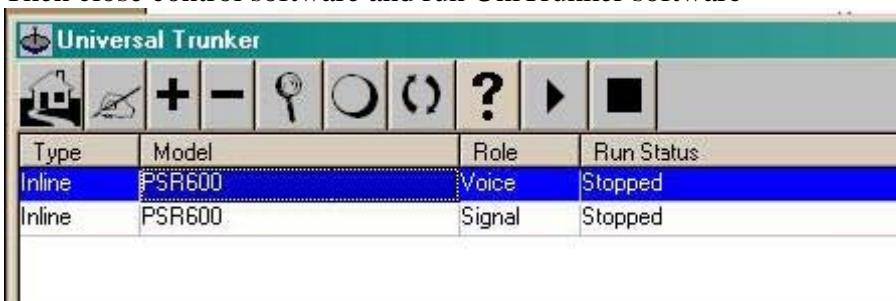
ADCR25\_PRO2 emulates GRE PSR-600 control protocol and can communicate with UniTrunker or Pro96COM software.

To download UniTrunker use this shortcut <http://www.unitrunker.com/>

First determine ADCR25\_PRO2 com port number. For that run ADCR25\_PRO2 control software and get com port number from the bottom of the main window:

LINK: COM45, S/N: 22DA29416662DC2B [v3.3]

Then close control software and run UniTrunker software



To create new receiver press “+” in the main window.

To remove selected receiver press “-” in the main window.

Each receiver connected with UniTrunker can be Signal (to receive control channel data) or Voice (to receive voice data and playback the audio). Define that in **Role** field. In the field **Type** select *Inline* for both of ADCR25\_PRO2 receivers.

ADCR25\_PRO2 com port settings for UniTrunker:

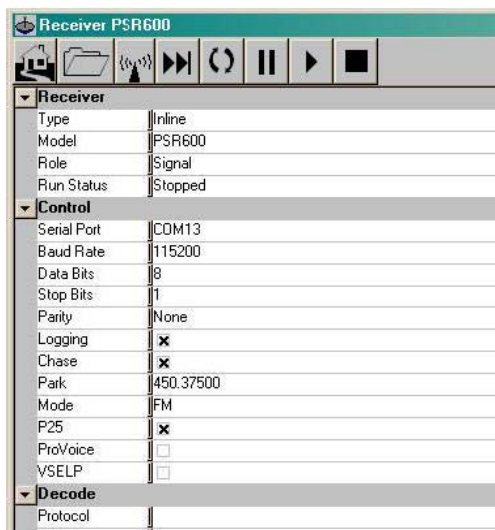
Baud Rate: 115200

Data bits: 8

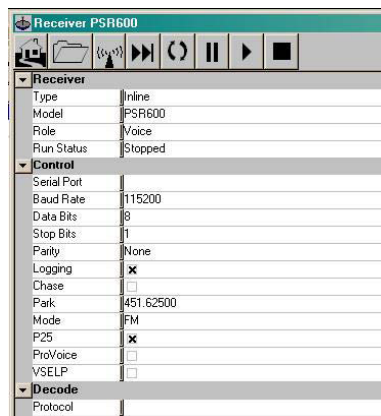
Stop bits: 1

Parity: None

ADCR25 is in Signal role:



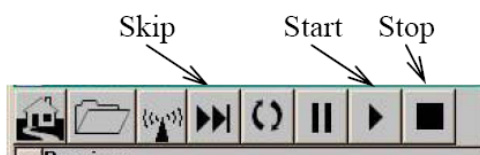
ADCR25 is in Voice role:



Before running the receivers set signal receiver to the control channel frequency:

For that type control channel frequency in **Park** field and press **Skip** button.

To run the receiver press **Start** button.



After that ADCR25\_PRO2 automatically recognize control channel and start data transmitting to its com port.

To allow trunk tracking run second ADCR25\_PRO2 which is in *Voice* role and set in the Options *Listen Enabled* setting.

The screenshot shows the 'Site 002-012' software interface. At the top, it displays 'APCO P25 BEE00-2C2'. Below this is a table of LCNs (Local Channel Numbers) with columns for LCN, Frequency, Audience, Target, T, Source, Source Label, and Svc. The table lists various LCNs and their corresponding frequencies. Below the LCN table is a 'Call History' table with columns for Stamp, Source ID, Source Label, Action, Target ID, Target Label, and Svc. The Call History table shows a list of calls with timestamps, source IDs, and target IDs. The interface also includes a toolbar with icons for Home, Folder, Signal, and other functions.

LCN	Frequency	Audience	Target	T	Source	Source Label	Svc
02-1774	451.08750						
02-1792	451.20000		1473	G	147259		4
02-1820	451.37500						
02-1832	451.45000						
02-1860	451.62500						
02-1898	451.86250						
02-1908	451.92500						
02-1912	451.95000						
02-1924	452.02500						
02-1964	452.27500						
02-1970	452.31250						
02-1988	452.42500						
02-2024	452.65000						
02-2056	452.85000		1381	G			-
02-2076	452.97500						
05-2093	0.00000						

Stamp	Source ID	Source Label	Action	Target ID	Target Label	Svc
17:53:08	138152		Call	1381		4
17:53:09	147206		Call	1472		4
17:53:09			Call	602		-
17:53:12			Call	1472		-
17:53:12			Call	1381		-
17:53:14			Call	1310		-
17:53:17	147233		Call	1472		4
17:53:17			Call	1473		-
17:53:24			Call	1310		-
17:53:30	147259		Call	1473		4
17:53:30			Call	1381		-