AR2300 BLACK-BOX RECEIVER

OPERATING MANUAL
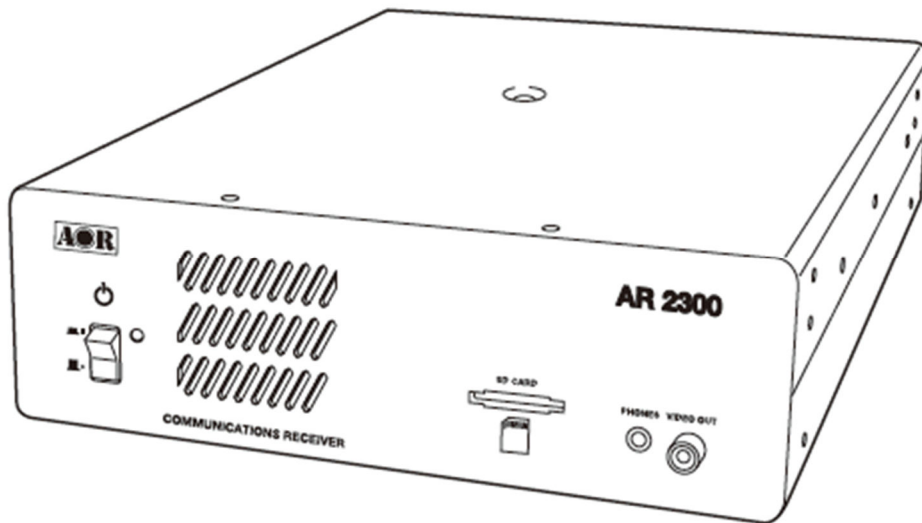
INTRODUCTION

Thank you for purchasing the AR2300.

AR2300 is a high-end black-box type receiver with wide band coverage between 40kHz and 3.15GHz. Some of its outstanding features are:

1) **Digital signal processing:**
   Input signals after the 45.05MHz IF are converted from analog to digital by a DSP processor. There is no AGC in the analog processing unit, as all processing, including AGC, is done by DSP.

2) **High-performance analog front-end:**
   Analog signal processing is performed by a computer simulated, high-performance distribution constant filter.

3) **DDS local oscillator:**
   Instead of the conventional PLL method, the first local frequency is produced by direct digital synthesis. That method allows frequency switching at high speed.

4) **IF output:**
   An analog IF of 15MHz (+/-7.5MHz) bandwidth is output.

5) **Optional digital I/Q output:**
   A digital I/Q signal of 0.9MHz is output via a USB 2.0 interface.

6) **High precision frequency reference:**
   0.01ppm frequency stability of the 10MHz internal master oscillator is achieved when using the optional GPS receiver unit.

7) **FFT analyzer:**
   Thanks to the onboard FFT processor, 10MHz wide spectrum data can be output at high speed via serial.

8) **Optional APCO25 Phase 1 digital voice demodulation**

9) **Video demodulation**
   By connecting and external TV monitor, it is possible to demodulate the signal of FM modulation security cameras and analog TV broadcasts. When you connect the TV monitor, you can check the demodulated video. Not compatible with digital terrestrial television.

10) **Simultaneous monitoring**
    2 band reception, offset reception, triple reception (restrictions apply).

11) **SD card slot**
    You can record the received audio on SD, as well as backing up receiver settings and memory data.

12) **12kHz analog I/Q output**
    Allows DRM broadcasts decoding via a PC and dedicated 3rd party software.

13) **HF direct sampling**
    When receiving HF signals, the signals are converted directly to digital without entering the mixer. This allows very good linearity characteristics.

14) **Control via LAN/Internet with optional ARL2300 Ethernet Controller**

Please read this operating manual carefully. This information will allow you to enjoy maximum performance from your receiver. Due to continuous developments of the receiver, firmware and software, we acknowledge that there might be some changes, errors or omissions.

We sincerely hope that the AR2300 will be your monitoring companion for many years to come.

SAFETY PRECAUTIONS

DO NOT operate the receiver near unshielded electrical blasting caps or in an explosive atmosphere. This could cause an explosion and death.

DO NOT operate the receiver with a headset or other audio accessories at high volume levels. If you experience a ringing in your ears, reduce the volume or discontinue use.

DO NOT directly apply AC power to the DC socket on the receiver rear panel. This could cause a fire or damage the receiver.

DO NOT apply more than 16 V to the DC socket on the receiver rear panel. This could cause a fire or damage the receiver.

DO NOT reverse the DC power cable polarity. This could cause a fire or damage the receiver.

DO NOT let metal, wire or other objects contact the inside of the receiver, or make incorrect contact with connectors on the rear panel. This could cause an electric shock or damage the receiver.

DO NOT operate or touch the receiver with wet hands. This could cause an electric shock or damage to the receiver.

Immediately turn OFF the receiver power and remove the power cable from the receiver if it emits an abnormal odor, sound or smoke. Contact your AOR dealer or distributor for advice.

DO NOT put the receiver on an unstable place where the receiver may suddenly move or fall. This could cause an injury or damage the receiver.

DO NOT operate the receiver during a lightning storm. It may result in an electric shock, cause a fire or damage the receiver. Always disconnect the power source and antenna before a storm.

DO NOT expose the receiver to rain, snow or any liquids.

DO NOT change the internal settings of the receiver. This could reduce receiver performance and / or damage the receiver. The receiver warranty does not cover any problems caused by unauthorized internal adjustments.

DO NOT install or place the receiver in a place without adequate ventilation.

DO NOT use harsh solvents such as Benzine or alcohol when cleaning, as they will damage the receiver surfaces.

DO NOT leave the receiver in areas with temperatures below 0°C or above +50°C.

DO NOT place the receiver in excessively dusty environments. This could damage the receiver.

DO NOT place the receiver against walls or put anything on top of the receiver. This may overheat the receiver. The receiver will become hot when operating the receiver continuously for long periods of time.

Turn OFF the receiver's power and / or disconnect the DC power cable when you will not use the receiver for a long period of time.

The AR2300 may receive its own oscillated frequency, resulting in no reception or only noise reception including on the spectrum displayed by control software, on some frequencies.

TABLE OF CONTENTS

1. SUPPLIED ITEMS

- AR2300 receiver _____ 1
- AC power adapter _____ 1
- Printed user manual_____ 1
- SD card _____ 1
- USB cable _____ 1
- CD with control software and drivers _____ 1

A list of optional accessories is available at:

http://www.aorja.com/accessories/receiver_accessories.html
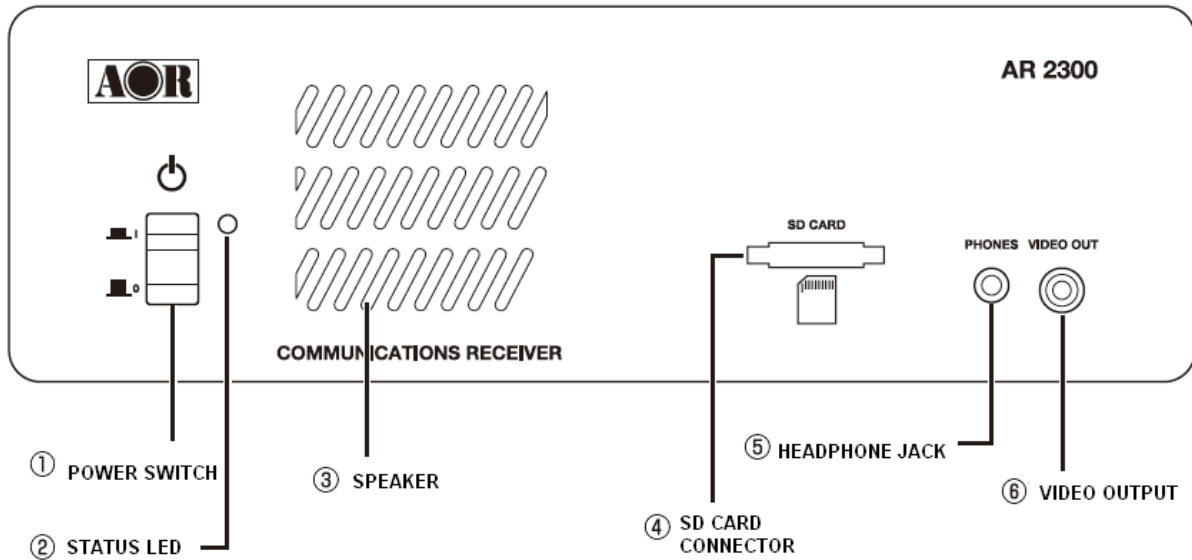
AOR software and utilities are listed at:

http://www.aorja.com/support/software.html

A list of 3rd party software solutions is available at:

http://www.aorja.com/support/third_party_sw.html

2. FRONT/REAR PANEL DESCRIPTION
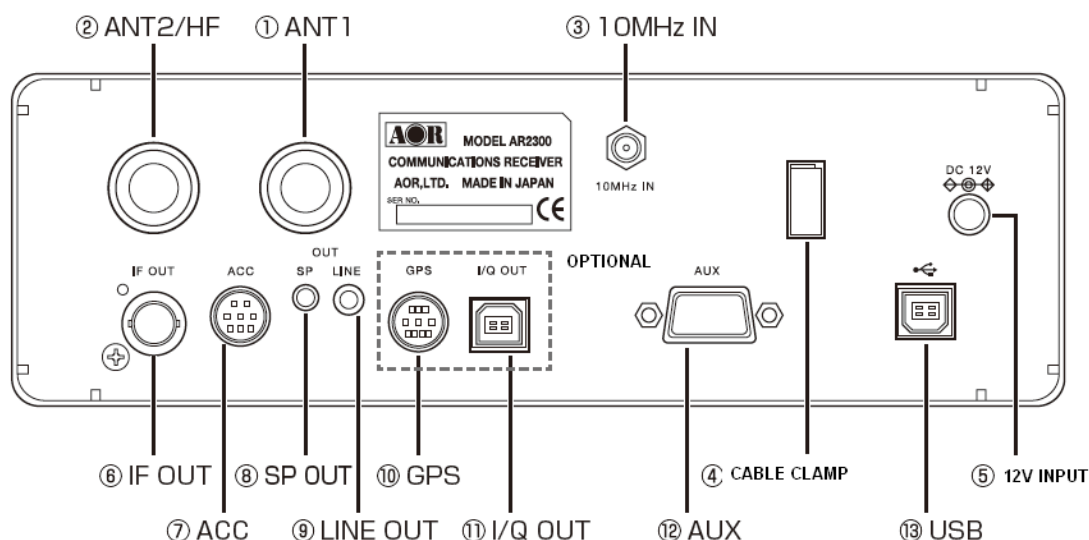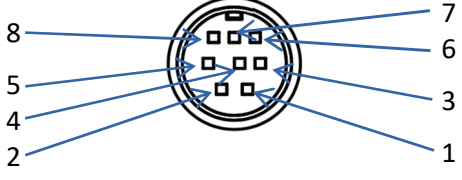
2.1. Front panel

①	Power switch	If you need to disconnect the AC power adapter, make sure that the receiver is shut down before.
②	Status LED	Green: Power on and receiving, Orange/yellow: Stand-by, Not lit: Off
③	Speaker	To mute the speaker audio while setting up the receiver and control software, simply plug in a headphone.
④	SD card connector	Standard size SD Card Connector You can record and playback received audio, backup and restore memory data and receiver settings. Insert the SD card face down. For microSD cards, use an SD card adapter.
⑤	Headphone jack	Three pin 3.5mm, stereo output. For stereo broadcasts, use the FMST receive mode with 100kHz or 200kHz bandwidth. In dual-band reception, the main frequency is audible on the right channel, and the sub-frequency on the left channel.
⑥	Video output	RCA type socket (75Ω 1 V p-p) to output the image of a demodulated analog video signal.

2.2. Rear panel

①	ANT 1	Type N socket (50Ω) for frequencies over 25MHz only.
②	ANT2/HF	Type N socket (50Ω) for all frequencies, including HF.
③	10MHz IN	SMA type socket (50Ω) External reference clock input of 10MHz (2dBm±2dB). When a valid 10MHz is entered, it automatically switches to that external input.
④	CABLE CLAMP	Secure the DC cable with this clamp to avoid the DC connector to be pulled out accidentally.
⑤	12V INPUT	DC barrel socket (5.5/2.1mm), center positive, for power input. DC10.7V～16V (2.0A@12V).
⑥	IF OUT	BNC type socket (50Ω) Outputs analog IF at 45.05MHz with a bandwidth of +/- 7.5MHz. (Output level is +10dBm relative to antenna input)
⑦	ACC	Mini-DIN-8 socket pinout description:

1	12V DC output. No current limitation. Both voltage and amperage depend on power supply DC input.
2	Discriminator output Unfiltered audio limited to the NFM receive mode. 0.78V p-pEMF 10kΩ (NFM deviation 3kHz, audio 1kHz)
3	External mute input. Short this terminal to the ground to mute the receiver's audio output. Remember that this function does not protect the high frequency circuitry from strong nearby transmissions.
4,5	Control 1,2 When busy (squelch is open) the control closes between 1 and 2 terminals. Uses non-polar photo MOS relays. Up to 350mA on-resistance 2Ω or less, load voltage 40V)
6	GPS time pulse input
7	Low level audio output (2.5mV@600Ω) Not affected by changes in AF GAIN.
8	Ground

⑧	SP OUT	Φ3.5mm monaural jack (Up to 2W with 8Ω load) To connect to an external speaker.
⑨	LINE OUT	Φ3.5mm stereo jack (600Ω -10dBm) To connect to an external recording device, or an audio amplifier. Can be switched to output a 12kHz wide analog I/Q signal. In dual-band reception, the main frequency is audible at the right side and the sub-frequency at the left side.
⑩	GPS (not compatible with the GP5001 GPS antenna unit) For future applications.	Only populated when optional IQ5001 board is fitted. Mini-DIN-8 socket pinout description: _(connector diagram: pins 8, 5, 4, 2 on left; pins 7, 6, 3, 1 on right)_ <table><tr><td>1</td><td>GPS TXD</td></tr><tr><td>2</td><td>GPS 1Hz Pulse</td></tr><tr><td>3</td><td>12V</td></tr><tr><td>4</td><td>GND</td></tr><tr><td>5</td><td>GPS RXD</td></tr><tr><td>6</td><td>RTS</td></tr><tr><td>7</td><td>CTS</td></tr><tr><td>8</td><td>NC</td></tr></table>
⑪	I/Q OUT	Only populated when optional IQ5001 board is fitted. USB type B socket which outputs digital I/Q data (bandwidth 0.9MHz) for PC.
⑫	AUX	D-SUB 9 male socket for receiver serial control or to connect the optional Ethernet Controller unit.
⑬	USB socket	USB Type B socket for receiver control by PC.

3.   PREPARING FOR PC CONTROL

➢ The supplied AR2300 CONTROLSOFT software features complete receiver control, audio recording/playback and memory bank management for the AR2300 receiver.

3.1   PC requirements

Minimum PC system:
- Supported OS: Windows 7/8.1/10
- 2GHz Dual Core CPU
- 2 GHz RAM
- 1024 x 768 resolution monitor
- One available USB 2.0 port
- CD-ROM drive for software installation

3.2   Connecting the receiver to the PC

Connect the supplied USB cable as follows:

Receiver's USB socket (labelled with USB logo) on the back of the receiver, to PC.

- Some type of USB 3 ports can be incompatible due to the particular chipset they use. If that occurs, use a USB 2.0 port instead.

3.3   Installing the driver

Providing that your PC is connected to the Internet, you do not need to manually install the supplied USB driver.

(All following instructions and screenshots are based on the Windows 10 operating system)

1. Make sure the USB cable is connected.

2. To check the driver status, open WINDOWS DEVICE MANAGER (press simultaneously the Windows key and the X key, then select "Device Manager")

3. Windows will first detect the USB connection as pictured:
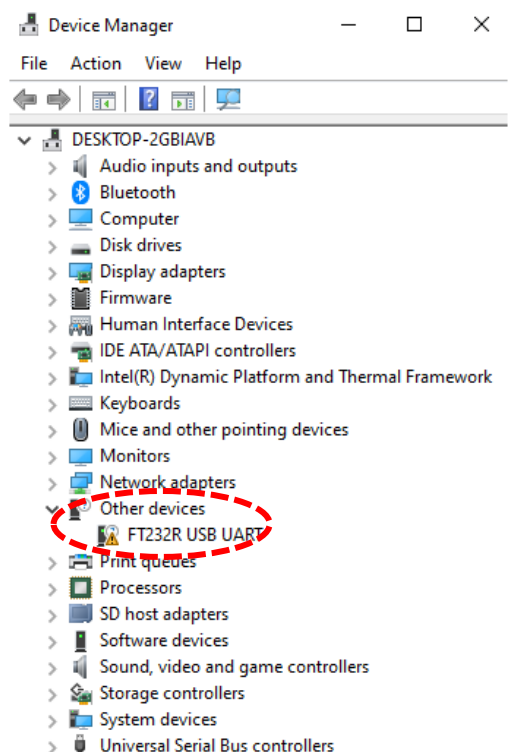
4. After Windows has automatically downloaded and installed the driver, Device Manager will list it as pictured:

The auto-assigned COM number depends on your PC configuration.

4. CONTROL SOFTWARE OPERATION

4.1 Connecting power

Connect the supplied AC power adapter. If using another power supply, make sure it provides DC10.7V～16V with at least 2 A of power.

4.2 Power on

Push the power switch on the receiver's front panel. The LED will turn orange/yellow, indicating the stand-by mode.

4.3 Starting the control software

- Copy the folder "AR2300 CONTROL SOFT" from inside the CD to any folder on your PC. The software does not need to be installed; it can be run as is.
- Double click "AR2300ControlSoft.exe" to start the software.
- When you start the software for the first time, Windows might ask you to which COM PORT the receiver is connected. Providing the correct number is entered, it will be saved in the registry, therefore you should not need to enter it again. Nevertheless, after connecting the receiver to a different USB port on your PC, the COM port number might change.
- When you start the software for the first time, a message might ask you to create a ".arc" memory database file. Don't worry, you will be able to do it later in chapter 4.4.3, so the software doesn't ask for it again, every time you start it. For now, just click **OK**.

Default software layout

4. CONTROL SOFTWARE OPERATION

4.1 Connecting power

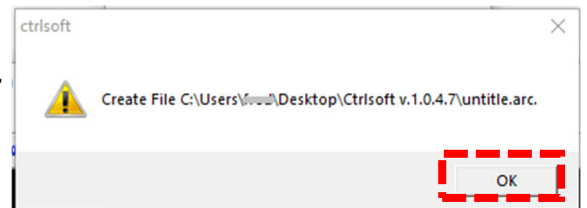Connect the supplied AC power adapter. If using another power supply, make sure it provides DC10.7V～16V with at least 2 A of power.

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Default software layout

4.4   Software windows description

Any or all of the following windows can be displayed.

Main Control
Spectrum display / Menu bar / database
Ctrl1   S-Meter
Ctrl2   Mode etc.
Ctrl3   AF, RF, SQL control
Ctrl4   FFT control
Ctrl5   Option settings
Ctrl6   Frequency panel

In the menu bar, go to WINDOW to select your choice of windows to display.

Layout with all windows displayed:

HINT! Whereas all individual windows can be placed anywhere on the screen, to automatically place windows as on the above picture, in the menu bar go to WINDOW > GATHER WINDOW.

4.4.1 MAIN CONTROL WINDOW DESCRIPTION

Main Control

AUTO Ant 1   IF +0
BUSY   0123.000000 MHz
VFO-A   _____
                                    Offset
MODE:AM(IF6k)   IF BAND:6k   STEP:100.000k
AF:021 SQL:000   RF Amp:ON Att:0dB
TEXT   :
TEXT(RCV)   :
LAST HIT   :   PASS :
LAST LEVEL :dB   TONE:
HIT COUNT   :
SEL   DTMF:
PR   :

FREQUENCY
(Min.: 0000.040000 MHz, max.: 3150.000000 MHz)
Change the receive frequency by either:
-Hovering with the mouse over each digit and scrolling the mouse wheel up or down.
-Entering the frequency via the PC keyboard + ENTER key for MHz.
-Entering the frequency via the PC keyboard + K key for kHz.
-Using the left and right arrow key of the PC keyboard.

To set an OFFSET frequency, enter it via the PC keyboard and validate with the SPACE BAR.

MODE
Left-click to manually select one of the 24 available modes. Selecting AUTO is also possible.
Auto does also automatically select the IF BAND and STEP values.

IF BAND
Left-click to manually select one of the 10 available IF filter bandwidths.

STEP
Manually change the frequency step by hovering the mouse over each digit and increasing or decreasing the value with the mouse scroll wheel.
Min: 000.010k
Max:999.990k

MAIN DIAL / OFFSET DIAL
Tune the frequency up or down by hovering the mouse over either symbol and scrolling the mouse wheel up or down.

Frequency step will be as set in the STEP menu.

The OFFSET symbol only appears if the offset function is active.

AF
Adjust the volume from 000 to 255 by:
-Hovering your mouse over the 3 digits and scrolling the mouse wheel up or down.
-Left-click on the 3 digits to adjust the AF slider and set the audio channel balance when in OFFSET or DUAL BAND mode.

SQL
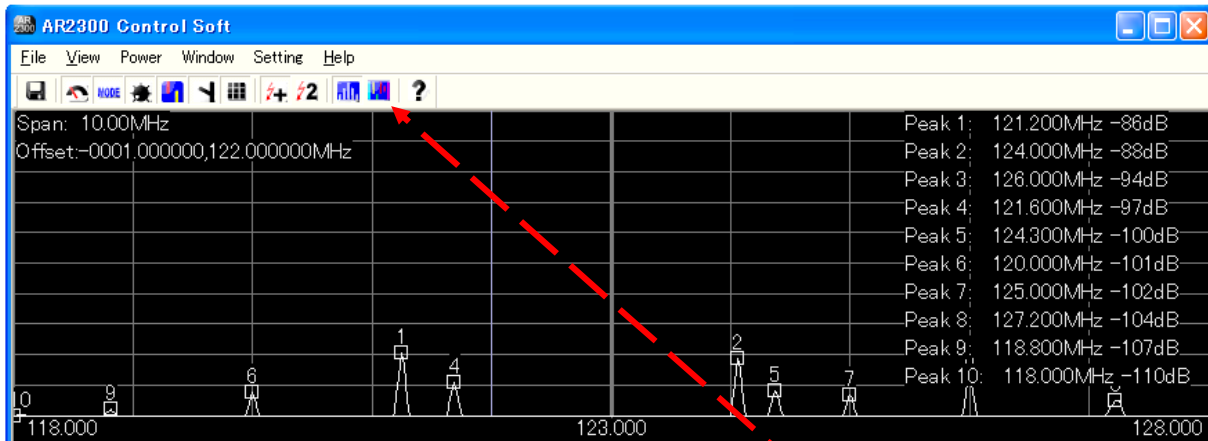Adjust the squelch level from 000 to 255 by:
-Hovering your mouse over the 3 digits and scrolling the mouse wheel up or down.
-Use the keyboard up and down arrows.

RF Amp / Att
Left-click to select either:
-RF Amp: ON or OFF
-Att: 0, -10, or -20dB
-AUTO

4.4.2 SPECTRUM DISPLAY DESCRIPTION

SPECTRUM DISPLAY

Spectrum displayed in real time. Receive frequency is the center frequency.
Left (single) click on spectrum: Receiver is tuned to the clicked frequency.
Right click on spectrum: OFFSET frequency is set and marked by a vertical blue line.
Mouse wheel: Each scroll step increases or decreases the frequency by a value 1/10 of the spectrum width.
For ex.: Spectrum bandwidth = 800kHz =>each wheel step = 80kHz

Click the ▐▌▌ icon to switch to waterfall display.

A waterfall display is the variation of signal strength in conjunction with the time elapsed. The color will vary depending on the signal amplitude.

4.4.3 MENU BAR DESCRIPTION
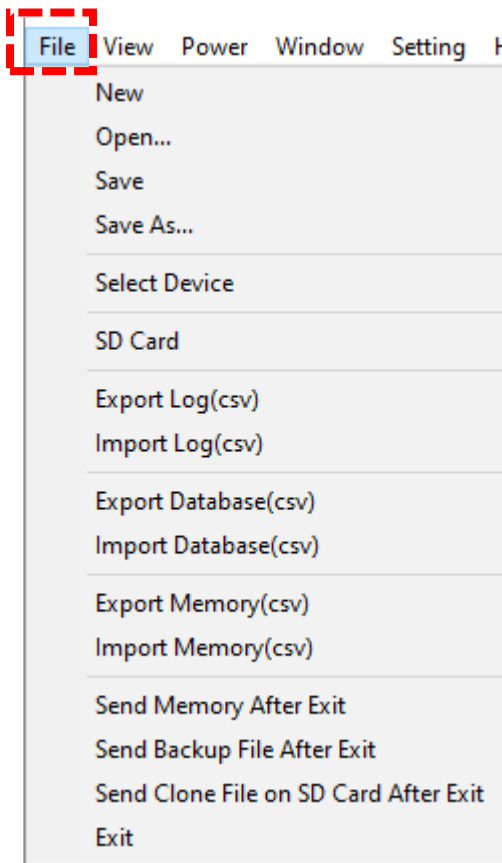
New/Open/Save/Save As concerns ".arc" extension files which represent a PC based database backup of memory channels, banks, search/scan, antenna settings, recordings, scheduling and logs. These ".arc" files are saved in the same folder than the software executable.

Select Device: Allows to manually select a receiver to connect to, if more than one receiver is connected to your PC.

SD Card: Manually record and playback audio files, from the SD card inserted into the receiver.

Export / Import Log(csv): Export and import PC based log files of all scan and search hits, including time stamp, signal level, mode, RF amp and ATT settings, and hit counts.

Export / Import Database(csv): Export and import a PC based database with info limited to frequency, mode and text.

Export / Import Memory(csv): Export and import PC based memory content (frequency, bank, channel, mode, tone, ATT, ANT, priority, select, REC, memo, pass, voice SQL)

Send Memory After Exit: Uploads the currently active (PC based) MEMORY content to the receiver, then closes the software.

Send Backup File After Exit: Uploads a selectable (PC based) backup text file to the receiver, then closes the software. This backup text file is sent by the receiver every time the software is started and saved inside the software folder.

Send Clone File on SD After Exit: Uploads a complete receiver clone file, from the SD card inside the receiver, to the receiver. (To create clone files, go to MENU BAR > SETTING > OPTION)

4.4.3 MENU BAR DESCRIPTION (continued)
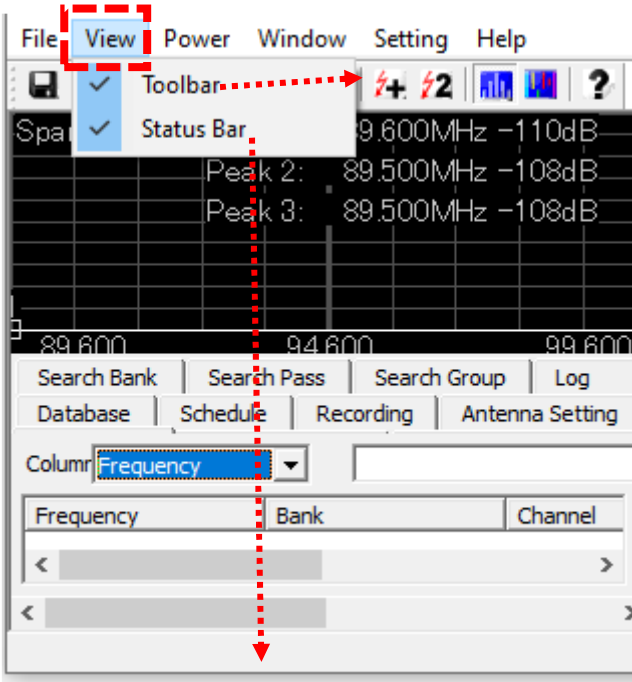
Here you can select whether or not to display the toolbar and status bar, depending on the available desktop space.

Power the receiver **ON** or **OFF**.
Power off does actually put the receiver in standby mode, as to be completely off, the receiver's front panel switch has to be used.
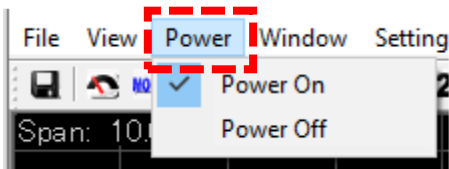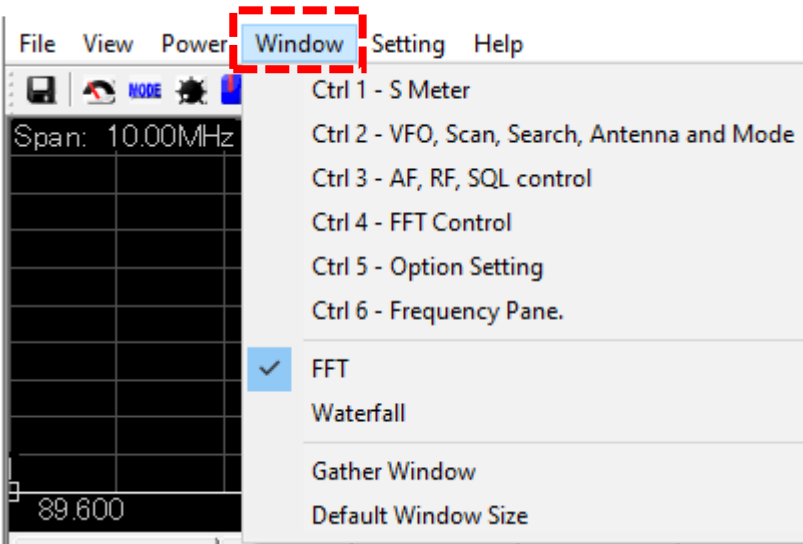
Ctrl 1 to Ctrl 6: Select here which of the windows you would like to display for convenient receiver operation.

FFT (default) displays the frequency and signal spectrum.
A **waterfall** display is the variation of signal strength in conjunction with the time elapsed. The color will vary depending on the signal amplitude.

Whereas all individual windows can be placed anywhere on the screen, to automatically place windows on a default layout, select **Gather Window**.

Default Window Size: (No function)

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4.4.3 MENU BAR DESCRIPTION (continued)
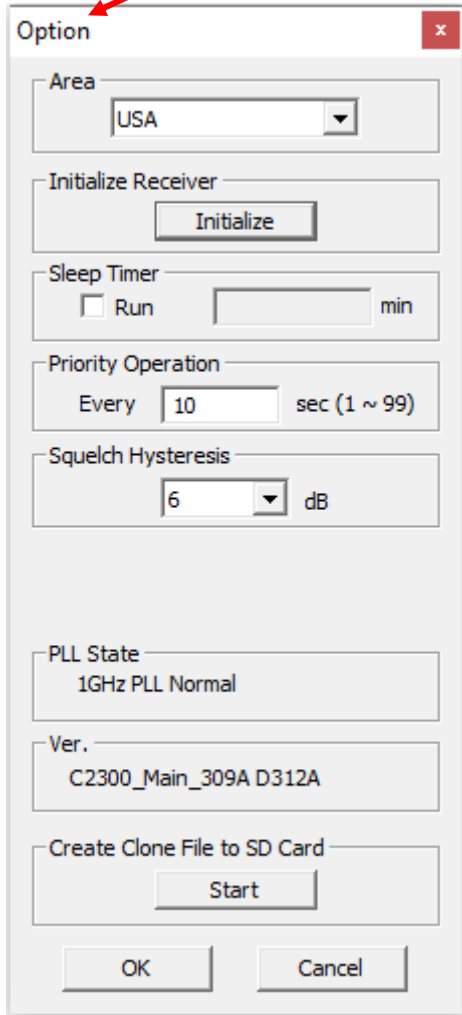
Area: Select the band plan region (USA, Japan or Europe).

Initialize Receiver: This will revert all settings to factory default and erase ALL memory data. It is advised to do a backup to SD before using this function.

Sleep Timer: Check the RUN box to activate, and set the number of minutes before the receiver goes to sleep.

Priority Operation: The priority feature permits checking for activity on one of the 2000 memory channels, while the AR2300 continues scanning, searching or monitoring. The receiver is momentarily tuned to the priority channel frequency to listen for any signal. If activity is found, the receiver will remain on the active frequency until the signal disappears.

Squelch Hysteresis: Sets the squelch hysteresis depth. For ex.: When squelch is -100dB and hysteresis is 6dB, the squelch opens when the reception level exceeds -100dB. The squelch does not close until the reception level is -106dB or less.

Create Clone File to SD Card: Saves all receiver settings and memory data to the SD card which is inside the receiver.
To restore such a backup to a receiver, from the MENU BAR go to FILE > SEND CLONE FILE ON SD CARD AFTER EXIT.
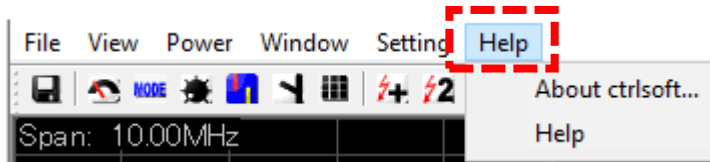
About ctrlsoft: Displays the software version. (Version 1.0.4.7 is final)

Help: Accesses the inline help file for this software. The content is outdated and supplied for reference only. The printed or pdf manual you are reading now is up to date.

4.4.4 DATABASE WINDOW DESCRIPTION

MAIN MEMORY LIST
Single left click: Highlights the line
Left double click: Activates the related function
Slow left double click: Edits the content of this cell
Right click: Opens a sub-menu related to this line

PC keyboard P key: Tunes to the frequency of the upper line
PC keyboard N key: Tunes to the frequency of the lower line
PC keyboard + key: Sets the upper line as a sub-band frequency
PC keyboard - key: Sets the lower line as a sub-band frequency

SEARCH BOX
Allows incremental and case sensitive word search, narrows down to the column selected on the left side of the box.

MEMORY tab
List-up of all stored memory channels. Can be edited, increased and erased. Max. 2000 channels

MEMORY GROUP tab
Settings for each memory bank:
-Scan delay time (after signal is gone)
-Free time (arbitrary time for each signal)
-Bank enable / disable
-Bank linking

MEM BANK TITLE tab
Assign or edit a title for each of the 40 memory banks.

SEARCH BANK tab
Create, edit, erase search banks (max.40). Individually set the frequency, mode, step, RF amp and ATT values.

SEARCH PASS tab
Lists all pass frequencies created during a bank search. Each entry can be enabled, disabled or erased. Max. 30 pass frequencies per bank.

SEARCH GROUP tab
Settings for each search bank:
-Scan delay time (after signal is gone)
-Free time (arbitrary time for each signal)
-Bank enable / disable & linking

LOG TAB
Log file of all scan and search hits, including time stamp, signal level, mode, RF amp and ATT settings, and hit counts.
Each hit can be copied to a bank / channel.

DATABASE tab
List-up of the database which can be imported as a ".csv" file. Information is limited to frequency, receive mode and text. The descriptive text appears on the "main control" panel whenever a signal is received on a frequency stored in the database.

SCHEDULE tab
Schedule multiple events such as scan, search, VFO reception and audio recordings.

RECORDING tab
List-up of all audio recordings in "wav" format. (AR2300 line-out needs to be connected to line-in of PC audio card)

ANT. SETTING tab
For frequencies over 25 MHz you can program an automatic selection between 2 antennas. Multiple band selections are possible.

4.4.5 DESCRIPTION OF CONTROL WINDOWS 1 AND 2

CONTROL 1
(S-meter)

The S-meter indicator shows the relative strength for the received signal in dB.

CONTROL 2
(receive mode, etc)

VFO
Stored tunable data that contains frequency, step, attenuator, etc. Each click on this icon toggles between the 4 available VFOs (A~D).

SEARCH
The receiver sweeps between previously set start and end frequencies, in search of active frequencies. Each click toggles to the next previously set search bank.

SCAN
The receivers checks a list (bank) of frequencies, in search of active frequencies. Each click toggles to the next previously set scan bank.

S.SCAN
The receiver checks a list of memory channels tagged as "select", in search of active frequencies. Maximum of 100 select scan channels throughout all 40 memory banks.

L.SCAN
The receiver checks ALL memory channels listed in the MEMORY tab, in search of active frequencies.

MONI
Click to temporarily set the squelch threshold level to 0 (open). Any signal level will be audible as a result. Click again to return to the previous squelch value.

+MEM
Click to add the currently received frequency to the main memory list tab. You will be able to specify the bank, channel, mode, antenna, RF Amp and ATT settings.

+PASS
While scanning or searching, the frequency received at the time you click this button will be excluded from your next scan / search.

OFFSET
To set an offset frequency, enter it via the PC keyboard and validate with the SPACE BAR. Click this button to tune the receiver to the offset frequency. Click again to return to the main frequency. Limitations: Only works for frequencies over 25MHz and IF filter max. 100kHz. Offset frequency must be withing +/-5MHz from the main frequency.

DUAL
To enter dual band reception mode. One band must be below, the other over 25MHz. To set the audio channel balance, left click on the 3 digits of the AF indicator in the MAIN CONTROL panel.

ANTENNA
"PRG" automatically switches to antenna 1 or 2 according to the programmable settings in the "Antenna Setting" tab.
You can also manually select the antenna by clicking "1" or "2".

MODE (AUTO IF BAND) / MODE
By clicking AUTO, the receive mode and IF filter bandwidth are chosen automatically by the receiver depending on the frequency. The "Auto IF Band" buttons allow you to manually select a mode, but the receiver sets the IF filter bandwidth automatically depending on the frequency. With the simple "Mode" buttons you can manually select the mode. IF filter bandwidth has to be selected manually.

4.4.6 DESCRIPTION OF CONTROL WINDOWS 3 AND 4

CONTROL 3
(AF, RF, SQL, etc...)

STEP
This is the frequency increment used when selecting a frequency using the blue tuning dial, or the PC keyboard's left and right arrows.
0.001kHz to 999.999kHz in 0.001kHz increments.

AF GAIN
Speaker and headphone volume slider.

ATTENUATOR and RF AMP
With the slider select either RF Amp: ON or OFF, Att:0, -10, -20dB, or AUTO. Refer to the Main Control window for selection indication.

AGC
The AGC function controls receiver gain to produce a constant audio output level even when the received signal strength is varied by fading, etc. Select either FAST, MID, SLOW or MANUAL (adjust the AGC level with the slider).

SQL (noise squelch)
Use the slide to adjust the squelch threshold level. The squelch removes noise output from the speaker (closed condition) when no signal is received.

VOICE SQL
This function opens the squelch only when receiving a modulated voice signal. Adjust aggressiveness and delay (time until squelch opens) with the slide bars.

IF BAND
Use the slide bar to select one of the 10 available IF bandwidth filters. Refer to the Main Control window for exact values.

IF SHIFT
The IF shift function changes the center of the IF (intermediate frequency) passband frequency to reject interference.
+/-1200Hz
Refer to the main control window for exact values.
Not active in FM modes.

CONTROL 4
(FFT Spectrum)

SPAN
Control the displayed spectrum bandwidth from 0.8MHz to 10MHz. The top left corner of the spectrum indicates the exact span value.

CALC
The calculation function offers 2 alternative spectrum modes:
MAXIMUM: Each sweep is retained as data and built-up on screen.
AVERAGE: Signal averaging over the sampling cycle. A stable pattern is produced even if the signal is fluctuating.

PEAKS
This function searches for the strongest signals in real time, in the displayed spectrum, above a threshold level you can set with the slide bar.
10 peaks maximum. Select 0 to erase all peaks.
You can tune to the strongest signal in the spectrum with MAX, or only in one half of the spectrum with LEFT or RIGHT.
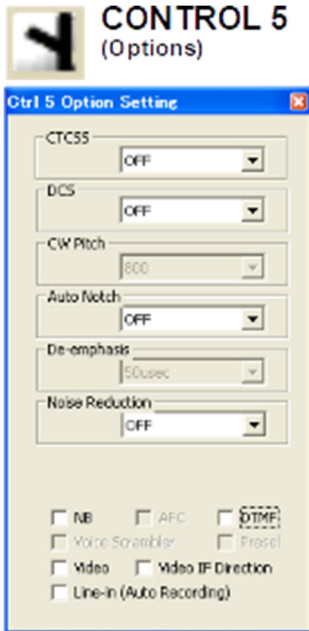
WATER FALL SPEED
Control the waterfall speed by moving the slider.

WATER FALL COLOR
Control the waterfall color codes depending on the signal strength between -30 and -110dB.

4.4.7 DESCRIPTION OF CONTROL WINDOW 5

CONTROL 5
(Options)

CTCSS
Select a CTCSS tone frequency between 60 and 254.1Hz. The squelch will only open if that tone is received on the audio signal.

DCS
Set a code between 017 and 754 (or all). The squelch will only open if this signal code is received.

CW PITCH
Change the CW audio pitch from 300 to 900Hz in 50Hz steps.

AUTO NOTCH
Automatically attenuates beat tones, tuning signals, etc., even if they are moving. 3 levels of aggressiveness.

DE-EMPHASIS
Decrease the magnitude of higher frequencies for a better signal to noise ratio. WFM and FM only. Default: $50\,\mu$ sec.

NOISE REDUCTION
Reduces noise components and picks out desired signals which are buried in noise. Audio signal masking may occur. Set the level for maximum readability.

NB
Removes pulse-type noise. Not effective against natural noise such as atmospheric static.

AFC
Tunes the IF filter's center freq. automatically when an unstable frequency is received. (Changes not visible on spectrum!)

DTMF
If DTMF tones are present in a transmission, the decoded letters, numbers and symbols will be displayed in the main control window.

VOICE SCRAMBLER
Decodes voice inverted signals. The carrier frequency can be adjusted between 2kHz and 7kHz, in SETTING > OPTION.

PRESEL
RF preselection filters help to prevent overloading caused by strong out of band interfering signals. Only for frequencies below 25MHz.

VIDEO
Enables the video-out on the AR2300 front panel. Decodes and displays only analog video signals. Standard of the video display connected must match the video standard of the transmission.

VIDEO IF DIRECTION
Changes the video IF direction. Mostly used to receive analog wireless camera signals.

LINE-IN (AUTO RECORDING)
Check the box to start audio recording of the frequency actually received. A ".wav" file will be saved on your PC in the same folder than this program.
Note: AR2300 line-out needs to be connected to line-in of the PC audio card.
(To record to SD card, go to FILE > SD CARD)

4.4.8 DESCRIPTION OF CONTROL WINDOW 6

CONTROL 6
(Frequency input)

Ctrl 6 Frequency Pane.	
1	2	3
4	5	6
7	8	9
0	.	CLR
Close	kHz	MHz

To input a frequency, click on the ten-key digits and validate with kHz or MHz.
To cancel the last entered digit, click the CLR key.

GENERAL

Frequency range	40kHz to 3.15GHz
Frequency resolution	1Hz
Tuning steps - program	1Hz to 999.999kHz in 0.001kHz increments
Receiving mode	USB/LSB(J3E), CW(A1A), AM(A3E), FM(F3E), WFM(F3E), FM-Stereo(F8E), APCO P-25(D3E) Optional
Number of VFO	5 (A through E)
Memory channel	2,000 channels (50 channels x 40 Memory banks)
Memory bank	40 banks (each bank can be customized between 5 to 95 channels)
Pass frequencies	1,200 frequencies or 1,200 frequency ranges 30 frequencies(ranges) x 40 banks
Priority channel	1 (one)
Selected memory channel	100 channels through memory banks
Typical scanning speed	Approx. 100 channels/steps per second
Antenna impedance	50W
Operating temperature range	0°C to +50°C / 32°F to 122°F
Frequency stability	Less than ±1ppm after warm-up (5 minutes). Less than ±0.01ppm with optional GPS unit.
Power supply requirement	DC 10.7V to 16V, 2.0A @ 12V
Audio output	> 2W into 8W load
Power consumption*	Stand-by : 200mA, Max. Audio : 1.5A
Ground system	Negative ground
Dimensions*	285mm(D) x 220mm(W) x 70mm(H) 11¼" (D) x 8½" (W) x 2¾ (H)
Weight*	3kg. (6.6 lb.)

RECEIVER

Receiver system	40kHz - 25MHz	Direct conversion
	25MHz - 220MHz	Double super-heterodyne
	220MHz - 360MHz	Triple super-heterodyne
	360MHz - 3.15GHz	Double super-heterodyne
Intermediate frequencies	1st -	294.5MHz / 1.7045GHz
	2nd -	45.05MHz / 294.5MHz
	3rd -	45.05MHz
Third-order IMD	> +20 dBm at 14.1MHz	
	> +9 dBm at 50MHz	
	> +5 dBm at 620MHz	
Spurious and image rejection	> 70dB :	40kHz - 25MHz
	> 50dB :	25MHz - 2GHz
	> 40dB :	2.0GHz - 3.15GHz
Digital IF filter bandwidth	200Hz, 500Hz, 1kHz, 3kHz, 6kHz, 15kHz, 30kHz, 100kHz, 200kHz - Receiving mode depended	
Selectivity	CW - 500Hz	-3dB: > 380Hz -80dB: > 500Hz
	AM - 6kHz	-3dB: > 5.5kHz -80dB: > 6.9kHz
	SSB - 3kHz	-3dB: > 2.7kHz -80dB: > 3.1kHz
	NFM - 15kHz	-3dB: > 14.2kH -80dB: > 15.6kHz
	WFM - 200kHz	-3dB: > 200kH -80dB: > 250kHz

Sensitivity

Mode	SSB, CW	AM	FM	WFM
Test Method	10dB S/N	10dB S/N	12dB SINAD	12dB SINAD
Filter B/W	3kHz	6kHz	15kHz	200kHz
40kHz to 100kHz	2.0μV	4.0μV		
100kHz to 1.8MHz	1.2μV	2.0μV		
1.8MHz to 25MHz	1.0μV	2.0μV		
25MHz to 1GHz	0.25μV	1.0μV	0.5μV	1.5μV
1GHz to 2.4GHz	0.3μV	1.0μV	0.5μV	1.5μV
2.4GHz to 3GHz	0.5μV	1.7μV	0.5μV	2.5μV
3GHz to 3.15GHz	1.0μV	2.0μV	0.8μV	3.5μV

AUXILIARY FUNCTIONS

Simultaneous reception	Two types of simultaneous reception (dual-watch) are possible.
2 band reception	One HF (40kHz-25MHz) frequency plus one VHF/UHF(25MHz and above) frequency.
Offset reception	Main frequency plus sub-frequency (within ±5MHz from the center frequency) Offset reception is possible only for VHF/UHF.
Triple reception	Triple receptions are possible by combining simultaneous reception mode. I.E. One HF frequency plus offset reception.
Squelch system	CTCSS, DCS
Demodulation Aid	Auto Notch Filter(NOTCH), De-Noiser(NR), Noise Blanker, IF Shift, CW Pitch, AGC, AFC, DTMF APCO P-25 Digital voice decoder (option)

AUDIO RECORDING

Type of recording	Record/Playback function through SD or SDHC
SD card type	SD or SDHC card per SD Card Association More than 256MB is required. Use card adapter for miniSD and microSD cards. FAT16 and 32 only.
File Format	Windows compatible WAV file format. RIFF (little-endian) data, WAVE audio, Microsoft PCM, 16-bit mono 17.578kHz
Recording time	Approximately 8 hours of continuous recording by 1GB SD Card. Squelch synchronization is possible to eliminate inactive time.

INPUT & OUTPUT

Antenna Input	ANT 1: 25MHz - 3.15GHz, N-J connector ANT 2: 40kHz - 3.15GHz, N-J connector
10MHz reference input	SMA-J connector, Typical input: -2dBm±2dBm for 50Ω
45.05MHz Analog IF output	BNC-J connector, 45.05MHz±7.5MHz Typical output: Antenna input +10dBm for 50Ω Frequency range 25MHz - 3.15GHz only.
Digital I/Q output (Option)	USB2.0 compatible isochronous transfer Digital I/Q output through USB Type-A Jack. Frequency range 25MHz - 3.15GHz only.
12kHz offset output	12kHz offset analog I/Q through 3.5mmΦ stereo-phone jack.
Line output	3.5mmΦ stereo-phone jack. (3-wire)
Accessory	8-pin miniature DIN
DC Power Input	EIAJ MP-121C (5.5 x 2.1mm) plug. Positive center.
External speaker	3.5mmΦ miniature phone jack (2-wire)
RS-232C	9-pin D-subminiature type (Male) - Firmware update and remote control by PC.
USB	USB Type-A; USB 1.1/2.0 Jack for PC control.
VIDEO output (Front Panel)	RCA Jack, 75Ω 1V p-p

Specifications subject to change without prior notice for product improvement or modification.   * Power consumptions, size and dimensions are only approximate value. Dimensions does not include projections. E. & O. E.