FAST RADIO MODEM
ARD9900
Multi-Mode And Digital Voice Interface

Instruction Manual

AOR LTD.

Authority On Radio communications

Thank you for purchasing the AOR ARD9900 Multi-mode and Digital Voice Interface.

The ARD9900 is designed to convert your HF radio equipment to a multi-mode and digital voice capable radio without performing any modifications to your transceiver.

Please read through this instruction manual and familiarise yourself with the operation of the ARD9900.

We suggest you keep this instruction manual for future reference.

We believe the ARD9900 will become a powerful tool to enhance your communication capabilities.

AOR LTD.

Supplied Accessories:

The following items are provided in the box

	Quantity
Speaker microphone	1
PC interface cable	1
Speaker cable	1
DC power cable	1
Microphone connector	1
Instruction manual (this booklet)	1

Optional accessories:

Memory Module ME-1 (necessary for SSTV and video functions).
Interface cables for most proprietary amateur transceivers.

Features:

- Digital voice communications using existing analogue 2 way radios with **encryption capability**.
  The ARD9900 uses the same audio frequencies (300 Hz ~ 2500 Hz) as
  microphone audio to modulate the voice signal. This allows you to use an analogue
  radio as a digital voice transceiver.

- Digital voice communications in the Single Side Band (SSB) mode.
  The automatic frequency clarifier function adjusts frequency drift automatically in the
  SSB mode (approximately up to +/- 125 Hz).

- Utilises an ODFM (Multi Carrier Modulation) circuit that is effective against Multi-path or Selective
  Fading.

- Automatic digital receive.
  Automatic voice signal detector recognises the received signal as analogue or digital,
  automatically switching to the appropriate mode.

- Digital Slow Scan TV (SSTV). NB: Requires optional ME-1 memory module.

- Built-in video capture function (NTSC _or_ PAL depending on Country in which unit is purchased).
  NB: Requires optional ME-1 memory module.
  Compresses the signal into our original adaptive JPEG format.
  Send and receive images in the Digital mode.
  Built-in video output connector (NTSC _or_ PAL depending on the country in which the unit is
  purchased). Allows viewing of the picture on an external monitor.

- Built–in high grade Vocoder (AMBE).
  Utilising high-grade digital voice compression; delivers quality digital voice communications.

- Built-in FEC error correction.
  A powerful error correction circuit delivers stable and reliable communications.

- Data communications on the HF band.
  Data communication is possible on the HF (High frequency) bands at no extra cost.
  (Speed may be limited by regulations in certain jurisdictions.)

- Small and compact unit. Easy to operate.
  Simply connect the ARD9900 to the microphone jack and speaker out jack of your transceiver.
  No complicated or risky radio modifications are necessary.

- Utilises a uniquely designed high performance DSP (Digital Signal Processor) engine.

- Battery operation possible for field use.

Please note that it is a mandatory requirement within terms of the UK Amateur Radio License that the call sign of the station is given at either the beginning and end of each transmission, or at fifteen minute intervals throughout the contact. This should be done by putting the ARD9900 back into analogue mode and making the announcement.

Precautions

To prevent fire, personal injury, or damage to the unit, please observe the following precautions:

- Do not attempt to adjust the unit unless instructed to do so by this manual.

- Do not expose the unit to direct sunlight or place the unit close to heating appliances.

- Do not place the unit in excessively dusty, humid or wet areas.

We are not responsible for any damage to the radio equipment due to improper settings or interfacing.

We are not responsible for any loss of communications due to an unexpected change of propagation or operating environment.

Table of Contents

Controls and functions

Front Panel
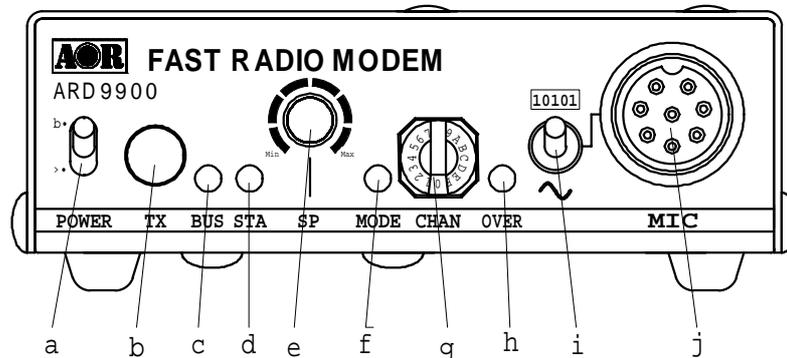
a. **Power on/off switch**

b. **TX switch**

This switch performs two functions:

1. In the Digital Image Communication mode:
   Set the mode switch to [10101] (digital mode).
   Press this switch to capture and send an image.

   Note : *When the Video Through Function is activated (AVT command is ON), pressing this switch will enable output of the video signal connected to the Video Input to also be sent to the video output port, so that you can monitor the transmitted video image.*
   Press this switch again to capture and send the image through the radio equipment.
   When the Video Through Function is de-activated (AVT command is OFF), pressing this switch will automatically capture the video image and then transmit it through the radio equipment.
   (*Refer to: Operation -- Digital Image Communication at page 16 for details.*)

2. Digital Voice Communication mode (non encryption or fixed scramble code mode)
   Set the mode switch to [~] (analogue mode).
   Press and hold this switch to force the ARD9900 to decode digital voice signals.

   Caution : *Frequency tolerance for both parties must within the range of +/- 125 Hz.*
   (Refer to Operation -- Digital Voice Communication "force receive" on page 16 for details).

c. **Bus LED (two colour)**

Illuminated red	The unit is in the transmit mode.
Blinking red	In the digital communication mode, it blinks while the header information is being sent (approximately one [1] second).
Illuminated Green	The unit is in the receive mode.
Unlit	The unit is in the receive standby mode or in the analogue voice receive mode.

d. **Status LED (STA LED) (orange)**
   Lit when unsent data remains in the memory.
   It is illuminated when the Video Through Function is activated in digital video communication mode.
   It is not lit when Video Through Function is deactivated by the dedicated

command (AVT_OFF) using the PC because the TX switch then activates a sequential function of capturing and transmitting the data.

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e. **Speaker volume adjustment**
Adjustment for the internal speaker output level (or the external speaker output level when one is connected).

f. **MODE LED** (Operation Mode LED)
Indicates the current operation mode:
Illuminated green ------------------------- Digital voice mode
Illuminated red -------------------------- Analogue voice mode
Illuminated orange----------------------- Data communication mode
Not illuminated -------------------------- Digital image communication mode

g. **CHANNEL switch**
Select preloaded encryption code.
(Refer to: Channel Switch Setting on page 15 for details.)

h. **OVER-LED**
Lit when the microphone input is overloaded (too high).
A proper microphone input level will cause the LED to flash from time to time when speaking into the microphone at a normal level.
The microphone level can be adjusted with the microphone level controller.
(Refer to: Level Adjustment on page 12 for details.)

__In addition, the OVER-LED operates in receive mode as an input level indicator:__

To set the optimum level of audio from the transceiver (crucial for good decoding of digital signals), the OVER-LED operates as an input level indicator in receive mode in the following ways:

Operation of input level indicator (transceiver squelch control fully open):

Input level indicator flashes whilst receiving	Input level is too low
Input level indicator extinguished	Input level is optimally set
Input level indicator is solidly lit	Input level is too high

__NB: When the squelch is closed on the transceiver the OVER–LED will flash continuously indicating that no signal is being fed to the ARD9900.__

i. **Mode switch**
Selects the Digital voice mode [10101] or the Analogue voice mode [~].
When the Analogue voice mode [~] is selected, ordinary analogue voice communications will be made.
In the receive mode however, the ARD9900 will automatically detect the mode of the incoming signal and decode signals accordingly.
The LED indicates the respective operation mode.

j. **Microphone connector**
Connect the supplied microphone to this connector.
Below are the pin assignments of the connector:

1. SPEAKER OUTPUT --   Monitor output signal available at this pin.
2. BIAS ----------------------   Power source for an electret condenser type of microphone. (5V DC through 2.2K Ohm resistor).
3. GND ----------------------   Chassis ground.
4. TX-------------------------   Taking this pin to the ground will enable the transmit mode; the same as operating the TX switch on the front panel.
5. D/A -----------------------   Taking this pin to the ground will force the unit into the digital voice communication mode. When this pin is left open, the operation mode will be set by the mode switch on the front panel.
6. MIC PTT ----------------   PTT (Push To Talk) input.

7. MIC GND ---------------- Microphone ground signal.
8. MIC IN ------------------- Microphone signal input.

Rear Panel
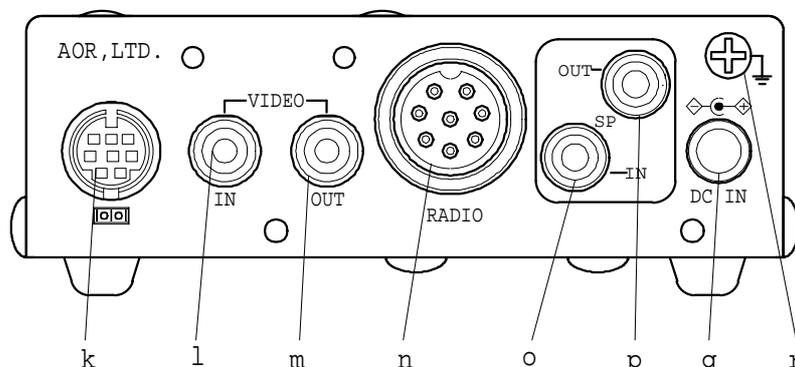
k. **Communication Connector (mini DIN 8 pin)**

Connector to PC (RS-232C)

Pin Number	Signal	Signal Direction
1	TX	ARD9900----->PC
2	DTR	ARD9900----->PC
3	DSR	ARD9900<-----PC
4	GND	GND
5	RX	ARD9900<-----PC
6	RTS	ARD9900----->PC
7	CTS	ARD9900<-----PC
8	NC	No Connection
Shell	FG	Frame ground

Baud Rate	9600
Data bit	8
Start bit	1
Stop bit	1
Parity	None
Synchronisation	Asynchronous
Flow control	Hardware

l. **VIDEO - IN connector**
   NTSC *or* PAL depending on country of purchase, 1V p – p, 75 ohm (RCA type connector).
   Connect a video signal source such as a video camera, VCR output, etc.

m. **VIDEO – OUT connector**
   NTSC *or* PAL depending on country of purchase 1V p – p, 75 ohm (RCA type connector).
   Connect a video monitor to this connector to monitor a received image or a picture to be sent.

n. **RADIO Connector**
   The pin connections of this port conform to those used by the manufacturer Adonis and many of the current amateur radio transceivers are catered for by ready made cable assemblies available from AOR. Otherwise, use the supplied 8-pin connector to connect the ARD9900 to your radio equipment.
   You will need to wire a cable according to the microphone connector specifications of your radio.
   Below are the pin assignments of the connector on the ARD9900:

Pin number	Signal	Details
1	MIC GND	Microphone ground
2	MIC OUT	Microphone Output
3	PTT	PTT (Push To Talk) output
4	GND	PTT ground
5	NC	No connection
6	NC	No connection
7	GND	Ground
8	NC	No connection

Caution: MIC GND and GND must not be connected together in the ARD9900 connector, or RF feedback will result.

o. **SP IN Connector** (3.5 mm mono jack)
Connect to the radio equipment's external speaker jack.
(Input level: 0.5 V – 5 V p-p)
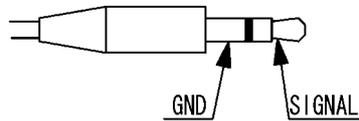
p. **SP OUT Connector** (3.5 mm mono jack)
Connect an external speaker to this jack (the internal speaker will be disabled).
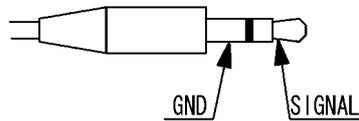
q. **DC IN Connector** (EIAJ Type 4)
Connect to a regulated power supply. (10.7 ~ 16.0 V DC, Centre pin – positive)
For lower voltage battery operation, set the internal jumper JP 9 for battery
operation, and then connect external batteries   (see page 9 for details).

Caution: If you have changed the internal jumper for low-voltage battery operation, the
battery voltage must be within the range of 5.6 ~6.5 VDC.
(DO NOT apply 12.0V or severe damage will result, and the warranty will be void!)
Note: No low battery voltage detector is built-in the ARD9900.

r. **FG**
Frame Ground

Top Panel

s
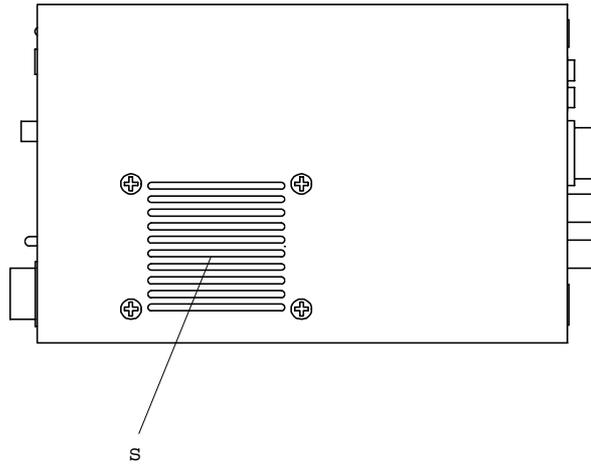
s. **Internal speaker**

Internal View

v   w

BATT_NOR

KOVER_SW

JP8

SP_N
INT

x

MEM_MODULE

A9900

MADE IN JAPAN

t   u
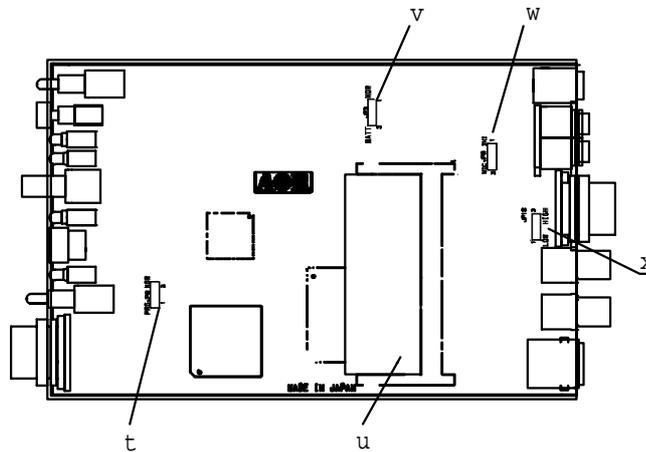
t. Factory setting jumper (JP 8)
   Must be set between 2-3.   (Do not change this setting at any time.)

u. Memory module
   Optional memory module for use with Digital SSTV functions.

v. Battery operation selector (JP 3)
   Place the jumper between 1 – 2 (NOR) for normal operation.
   Change it between 2-3 (BATT) for battery operation.
   If you have changed the internal jumper for low-voltage battery operation,
   battery voltage must be within the range of 5.6 ~6.5 VDC.
   DO NOT apply 12.0V or severe damage will result, and the warranty will be
   void!
       Note: *No low battery voltage detector is built-in the ARD9900.*

w. Internal speaker setting (JP 6)
   Jumper setting
   1 -- 2   Activates internal speaker (default).
   2 -- 3   Disables internal speaker and enables output from pin #1 of the
                 microphone connector. Use this position when using the speaker of the
                 speaker microphone provided.
       Note: *The SP OUT (external speaker output) has priority regardless of the*
       above jumper setting.)

9

x. Output level setting (JP 10)

Jumper setting
1 - 2   Normal level (default)   (LOW)
2 - 3   High level (HIGH)
If the microphone output level is too low to drive your radio equipment,
place the jumper in the 2-3 position.
(Refer to: Radio Input Level setting on page13 for details.)

Bottom View
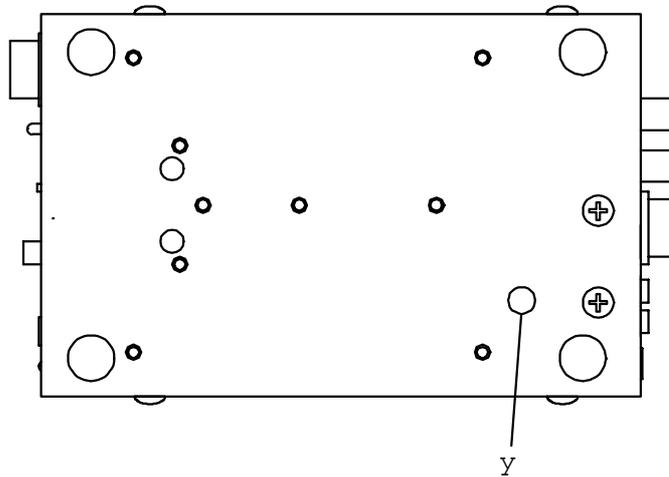
y. Microphone output (Radio Input) level
(Refer to setting level adjustment on page 13 for details)

Interfacing the ARD9900

Connection to a Radio

Before using your ARD9900, you will first need to wire the cable between your radio equipment and the ARD9900. For convenience the connector on the ARD9900 is wired to a standard specification used by the manufacturer Adonis.

ARD9900   **Radio Equipment**

Radio Connector

1	MIC GND	————————————	MIC GND
2	MIC OUT	————————————	MIC IN
3	PTT (H)	————————————	PTT IN
4	PTT (I)	————————————	PTT GND
5	N.C.		GND
6	N.C.		EXTERNAL SPEAKER OUT
7	GND		GND
8	N.C.		
	SHELL		

SP IN Connector

Signal
GND
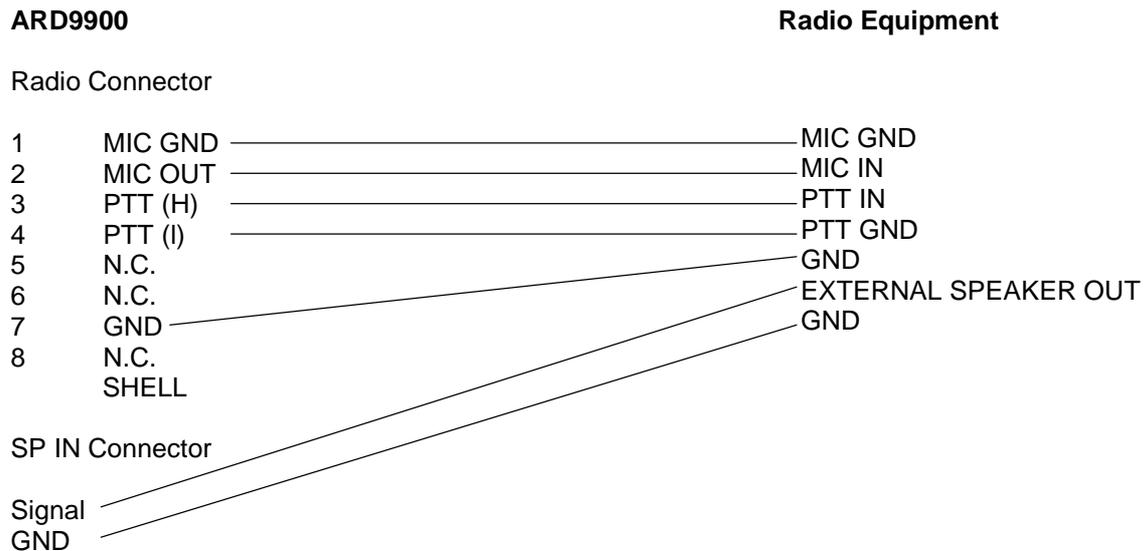
An 8-pin microphone connector for the ARD9900 is included to enable you to make your own connection cable, however you will need to supply and prepare your own microphone connector for your radio equipment. Alternatively, various ready-made cables to suit most of the current transceivers on the market are available from AOR.

Below are the pin assignments of the 8-pin RADIO connector on the rear panel of the ARD9900.

Pin number	Signal	Details
1	MIC GND	Microphone ground.
2	MIC OUT	Microphone output.
3	PTT (H)	PTT (Push To Talk) output.
4	PTT (L)	PTT (Push To Talk) ground.
5	NC	No connection.
6	NC	No connection.
7	GND	Ground.
8	NC	No connection.

Note: *MIC GND and GND must not be connected together in the ARD9900 connector, or RF feedback will result.)*

Connection to a Microphone

A speaker microphone is included with your ARD9900. However, if you wish to use your own microphone with the ARD9900, you may do so by wiring your microphone to correlate with the input socket of the ARD9900. Below are the pin assignments of the

Microphone connector of the ARD9900:

Pin	Function	Description
1.	Speaker output	Monitor output signal is present at this pin when the internal speaker Jumper is set to 2 – 3.
2.	BIAS	Power source for an electret condenser type of microphone. (5V DC through a 2.2K Ohm resistor).
3.	GND	Chassis ground .
4.	TX	Taking this pin to the ground will enable transmit. (The same as the operation of the TX switch on the front panel.)
5.	D/A	Taking this pin to ground will force the ARD9900 into the Digital voice communication mode. When this pin is left open the operation mode will be set by the mode switch on the front panel.
6.	PTT	PTT (push to talk) input.
7.	MIC GND	Microphone ground signal.
8.	MIC IN	Microphone signal input.

Connection to a PC

A PC interface cable is included with the ARD9900.
Parameter settings can be made by using terminal software such as Windows HyperTerminal.
(Refer to: Control Commands on page 24 for details.)

Connection to a Power Supply

To operate your ARD9900, use a regulated power supply.
The operating voltage must be within the range of 10.7 ~ 16.0 V DC (current requirement approximately 200mA).
A DC power cable is included with the ARD9900 following the standard convention:

RED   Positive (+)
BLACK   Negative (-)

If you have changed the internal jumper for low-voltage battery operation, the voltage used must be within the range of 5.6 ~ 6.5 VDC.
DO NOT apply 12.0 V with the jumper in this position or severe damage will result, and the warranty will be void!
Note*: There is no low battery voltage detector built into the ARD9900.*

Connection to an External Speaker

If you wish to use an external speaker, connect it to the SP OUT jack. This will also disable the internal speaker.

GND   SIGNAL
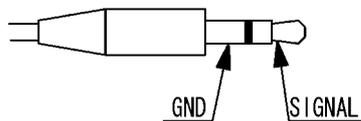
Level Adjustment

Microphone Level

The microphone level has been properly adjusted at the factory for use with the microphone provided, therefore no further adjustment is needed for normal operation.

If you wish to use your own microphone rather than the included one, you will need to wire your microphone connector to match the pins of the ARD9900, and then adjust the microphone level as described in the following steps:

1. Connect your microphone to the Microphone connector on the ARD9900.
   (Note: The microphone cable to the radio MUST be unplugged at this time.)

2. Select **the mode switch** (i) to the digital [**10101**] position.

3. Select the 0 (zero) transmitting channel **[CHAN].**

4. Turn ON the ARD9900 while pressing the **TX** switch. The status LED will blink orange indicating the ARD9900 is now in the microphone level-adjusting mode.

5. Now speak into the microphone whilst pressing PTT button. Rotate the transmitting channel **[CHAN]** control clockwise until the **[OVER]** LED is lit on speech peaks.

6. After you have chosen the appropriate microphone level, press **TX** switch while pressing PTT button. The TX LED will illuminate orange and the new microphone level will have been memorised.

7. Release the PTT button and select Mode switch to **analogue (~)** position.

8. The microphone level adjustment in Analogue mode is not normally required however, if the audio signal level is weak at the distant station, you can carry out the same process from 1 to 4 above even though it is for analogue mode. Pressing TX switch while pressing the PTT button will confirm the new setting as before.

Turn the power OFF on the ARD9900 to terminate the microphone level-adjusting mode.

Radio Input Level

Perform the following steps to obtain the correct level of input for your radio equipment: connect the microphone to the ARD9900, and then connect the ARD9900 to your radio equipment. Finally, Connect the ARD9900 to a power supply and turn the output level adjustment on the bottom of the ARD9900 fully counter clockwise. Now:

1. Turn the power on to the ARD9900.
2. Turn the power on to your radio equipment.
3. Set the mode switch to [10101] (digital mode).
4. Press the [PTT] switch of the microphone to transmit from the radio equipment.
5. Adjust the microphone gain of the radio equipment until the ALC function just activates.
6. If the microphone gain is too low, readjust the output level on the bottom of the ARD9900 (See page 8 for adjustment location).
7. If the microphone gain is still too low after adjustment, turn off the ARD9900, remove the top cover and set the output level setting jumper (JP 10) to the high level position [2-3] and repeat the above procedure (See page 9 for jumper position).

Code Setting

Master Key code setting

The master key code is a password to allow the authorised operator access to the system management settings for maintenance. **It also forms the key onto which the encryption algorithm is applied.**

To prevent unauthorised tampering with the system code settings and possible damage to the unit from incorrect code entry (see warning below), the master key code MUST be changed to your own code prior to operation and the new code should be noted and securely stored.

To change the Master Key code, type the [AMS] command using a terminal program on a PC.

cmd>AMA_123456789012 [CR]   ← Enter the factory default code. (_ : space key)
CMD>AMA OK   (Response from PC)
CMD>AMS_************ [CR]   (Enter a new master key code.)

Note : The master key code consists of 12 digits of numeric code (0 ~ 9). Default code: 123456789012
(Refer to: Control commands on page 24 for details.)

Warning!

The master key code MUST be kept in a secure place. Without a master key code no code changes can be made.

If you made an entry error during the initial code setting, correct it under the Master Key code entry screen before exiting. Once you exit from the master key code setting screen with an incorrect/unknown code, neither you nor the factory will be able to change it!

User ID code Setting

The User ID code is a unique code set by you to identify your own ARD9900 for use with the digital squelch mode.

To change the ID code, first type the [AMA] command to allow entry into the
Data management Menu:

cmd>AMA_************ [CR]   ← Enter the master key code
CMD>AMA OK   (Response from PC) note that the command prompt is now upper
                           case to indicate you are in the System Management screen.
CMD>AUI_***** [CR]   (Enter a new user ID code.)
Note : The user ID code consists of 5 digits of numeric code (0 ~ 9)
Default : 77777
(Refer to: Control command on page 24 for details.)

Air Key code Setting

The Air Key code is a string of encryption code information that is attached to the beginning of the transmitted data packet.

To set the Air Key code, first type the [AMA] command to allow entry into the
Data management Menu:

cmd>AMA_************ [CR]   ← Enter the master key code
CMD>AMA OK   (Response from PC)
CMD>AAK_**** [CR]   (Enter a new Air Key code.)
Note : The Air Key code consists of 4 digits of numeric code (0 ~ 9)
        Default : 0000
                (Refer to: Control commands on page 24 for details.)

Channel Switch Setting

There are 16 different channel settings for the ARD9900. By simply rotating the channel switch on the front panel of the ARD9900 to the desired setting, a pre-programmed encryption mode can be easily recalled from the memory.

To set the Channel Switch setting, first type the [AMA] command to gain entry into the data management menu.

Rotate and select the desired channel switch position (0 ~ F).

cmd>   (Stand by for command)

cmd>AMA_ ************ [CR]

(Enter the master key code.)

CMD>AMA OK   (Response)

CMD>AAK_**** [CR]   (Enter a new Air Key code.)

Note: *The Air Key code consists of 4 digits of numeric code (0 ~ 9)*

Default : 0000

(Refer to: Detailed function description on page 22 and Control Commands on page 24 for details.)

CMD>ACP [CR]   (Display current channel)

CH: $ _ ID: !!!!!! _ NM: @@@@@ _ MD : &

 (Setting for the current channel data)

CMD>   (Standby for command)

CMD>ACP _ !!!!! _ @@@@@ _ XX ZZ (Set current channel data)

CH : 1 _ !!!!! _ NM : @@@@@ _ MD : &   (Response)

Note : *[$] , [!], [@] , [&], [X], [Z] - - - Parameters]*

$ Channel number   (Selected by the front channel switch)

_ Space   (Press the space key of the PC keyboard)

!!!!! Other party's ID   (Other party's unique ID i.e. their AUI code)

@@@@@   Netmask   (Current Netmask)

F (1): Netmask valid   0: Netmask invalid

&   Communication mode (Displays the communication mode on the channel)

0 : Non encryption mode

1 : Digital squelch mode

2 : Fixed encryption mode

3 : Random encryption mode

> This is how the modes are displayed under the ACP command, they cannot be entered as 1 digit codes like this, they are entered as part of the setting mode and algorithm setting parameters below (XXZZ)

! ! ! ! !   Other party's ID   (Set other party's unique ID i.e. their AUI code)

I D : 00000 ~ 99999

@@@@@ Netmask

 (Set Netmask valid/ invalid)

Enter "1" or "0" to each digit.

1 : ID digit valid

0 : ID digit invalid

> The net mask serves to identify how much of the other party's unique ID i.e. AUI code is necessary for communication to be achieved. If you enter an ID of 12345 and a net mask of 11100 only the first three digits will be required to match for communication to take place. This means you can arrange a net communication if all members AUI identifier begins with the numbers 123.

Note : *On the PC screen, "1" will be displayed as "F."*

X X Setting mode 80 : Non encryption mode

00 : Fixed encryption mode

40 : Fixed airkey random encryption mode

50 : Random encryption mode

Z Z   Algorithm   Set communication algorithm

Note : *When the communication mode is set to Non Encryption mode (80), then the algorithm must be set to either[0 0] or [01] .*

00 : Non encryption mode (default)

01 : Digital squelch mode

Note : *When the communication mode is set to Fixed Encryption*

mode (00) or Random Encryption mode (40, 50), then the

algorithm must be set as follows:

00 ~ 79 : Fixed Scramble Code

80 ~ 99 : Variable Scramble Code

(every 20 mS)

Note : *When you execute the ACP command, it will not display detailed communications settings or algorithm*

values. If you wish to check detailed settings, use the ADS command in the system management mode.

Typical example of channel setting entry for with the ARD9900 set to channel 1:

ACP_12345_11100_8001<CR>
When you then type ACP<CR> at the command prompt, to check this, it will return the following:

CH: 1 ID:12345 NM:FFF00 MD:1 indicating that channel 1 has been set for a remote ID of 12345 where only a match on the first three digits is required and the digital squelch is set to on. The fact that the number 8001 was used shows that a none encryption mode has been selected and the digital squelch is set to on.

For details of all the communication modes possible, see page 19 **communication Selection Guidance.**

Operation

> Note : *All adjustments must be properly performed before operation.*

Voice Communication

Your ARD9900 is capable of digital or analogue voice communications. In the receive mode, the ARD9900 will automatically recognise the type of communication, and set itself to the appropriate mode. In the transmit mode, the desired operating mode can be selected by using the front panel Mode switch.

Digital Voice Communication

Set the mode switch [10101 ~] upward to the digital mode position [10101].
Rotate the Channel switch on the front panel to select the desired communication code setting.
Press and hold the PTT switch on the microphone. The STA (Status) LED will flash for about 0ne (1) second while sending a data header signal.
When the LED stops flashing, speak into the microphone normally.

Analogue Voice Communication

Set the mode switch [10101 ~] downward to the analogue mode position [~] .
Press and hold the PTT switch on the microphone, and speak into the microphone normally.

> Note : *The front Channel switch setting will be ignored in the Analogue Voice Communication mode.*

Force Receive

While in the Non Encryption mode (80) or Fixed code encryption mode (00) if a Header signal is not properly received during communication, you can "force" the ARD9900 to receive in the digital voice mode under following conditions:

- The communication mode is in the Non Encryption mode (80) or the Fixed Encryption mode (00).
- The frequency difference between both parties is within +/- 125 Hz.
- Both parties have the same communication settings.

[Procedure]

1. Set the mode switch [10101 ~] downward to the analogue mode position [~].
2. Press and hold the TX switch for about 5 ~ 10 seconds until an audio signal is heard from the speaker.
3. Once an intelligible audio signal is obtained, release the TX switch.

Data Communication

Run a terminal software program such as Windows HyperTerminal to control the ARD9900, and enter control commands.

[Refer to: Control Commands at page 24 for details.]

Two different types of data, ASCII or binary data can be used. Both data types can be mixed as communication data.

Receive

Enter the command [ACO] to go into the converse mode. The valid received data will be decoded and displayed on the PC screen. If received data is missing, (which may occur during poor propagation conditions) "garbage" data may be displayed on the PC screen.

Transmit

Enter the command [ACO] to enter the converse mode then type text on the keyboard. When you have finished, press the enter key.

NNNNNNNN [CR]

NNNNNNNN : ASCII character
[CR]:   Carriage Return
Note: *Maximum data length is 2046 bytes per packet.*

To send binary data, add [FE] (hexadecimal) as a header and footer to your data.

FE BBBBBBBBBBBBBBBB FE

BBBBBBBBBBBBBBBB : Binary data
FE :   ID as a binary data
Note : *If you need to insert the data [FE] in hexadecimal in the middle of the text, convert it into two (2) bytes of hexadecimal data.]*

FE → FDD8
If you need to insert the data [FD] in hexadecimal in the middle of the text, convert it to two (2) bytes of hexadecimal data.

FD → FDDD
Note : *Maximum data length is 2046 bytes per packet.]*

At the receive side, the data will be automatically decoded and displayed on the PC screen. If the [ALF] command is set ON, the LF (line feed) code will be added at the end of the received data.

Digital Image Communication

Receive

When valid digital image data is received, it will be decoded and output as a video image from the VIDEO OUT connector.

If received data is missing during a transmission, that portion will be displayed as invalid (Like noise).

Transmit

When pin - 4 of the microphone connector is grounded, the ARD9900 starts sending an image.

When the Video Through Function is activated (AVT command is ON), pressing the TX switch

once will enable output of the video signal connected to the Video Input to be sent to the video output port so that the video image can be checked before transmission. Pressing the TX switch again will capture the image and then transmit it through your radio equipment. When the Video Through Function is de-activated (AVT command is OFF), pressing the TX switch will automatically capture the video image and then transmit it through the radio equipment. A Progress indicator will display on the monitor during image transmission.

Types of communication and their respective features:

Encryption Method

```
TX Encryption Table                                 RX Encryption Table
         .                                                    .
         .                                                    .
Encryption Code n-4                                  Encryption Code n-4
Encryption Code n-3                                  Encryption Code n-3
Encryption Code n-2                                  Encryption Code n-2
Encryption Code n-1                                  Encryption Code n-1
Encryption Code n     ◄─ AirKey         AirKey ─►    Encryption Code n
Encryption Code n+1                                  Encryption Code n+1
Encryption Code n+2                                  Encryption Code n+2
Encryption Code n+3                                  Encryption Code n+3
Encryption Code n+4                                  Encryption Code n+4
Encryption Code n+5                                  Encryption Code n+5
Encryption Code n+6                                  Encryption Code n+6
Encryption Code n+7                                  Encryption Code n+7
Encryption Code n+8                                  Encryption Code n+8
Encryption Code n+9                                  Encryption Code n+9
Encryption Code n+10                                 Encryption Code n+10
Encryption Code n+11                                 Encryption Code n+11
         .                                                    .
         .                                                    .
```

- **The Master key and algorithm is used to create the encryption table therefore the Master key and algorithm must be set to the same values for both the transmit and receive units.**

- The actual encryption code is selected from the encryption table by the Air Key.
  In the Fixed Encryption mode (Flag : 00), the transmit data does not contain the Air Key. To decode the received signal then, both parties must set the air key to the same value. **Therefore the Air Key must be obtained in advance, to select the encryption code and decode the signals.**

- **In the Random Encryption Mode 1, 2** (Flag : 40), the Air Key selected at the transmit end is sent along with transmit data. **At the receive end, the received data will be decoded by selecting from the encryption table using the received Air Key, therefore matching Air Keys are not required between parties.**

- **In the Random Encryption Mode 3, 4** (Flag : 50), the random number coded Air Key is sent along with transmit data. At the receive end, **the received data will be decoded by selecting from the encryption table using the received Air Key so again matching Air Keys are not required.**

- **Additionally, in the Random Encryption Mode 2, 4** (algorithm 80 – 99), the scramble function is enabled and the encryption code will be changed in every 20 mSec. At the receive end, the received data will be decoded by changing the encryption code in every 20 mSec. in synchronisation with the original Air Key so **again matching Air Keys are not required.**

With reference to the points above, choose the most appropriate communication mode from the table below:

Communication Selection Guidance

The following is a list of communication modes for the ARD9900. Choose the most suitable communication mode for your application. The factory default setting is the non encryption mode (Communication mode : 0).

Communication Mode	Mode	Setting		Function				
		Flag	Algorithm	Encrpt.	SQ	Air Key at RX	Air Key TX	Scramble
Non Encryption Mode	0	80	00	No	No	---	---	---
Digital Squelch Mode	1	80	01	No	Yes	---	---	---
Fixed Encryption Mode	2	00	00-79	Yes	No	Pre-set	No	Fixed
Random Encryption Mode 1	3	40	00-79	Yes	Yes	Received Air Key	Pre-set	Fixed
Random Encryption Mode 2	3	40	80-99	Yes	No	Received Air Key	Pre-set	Variable
Random Encryption Mode 3	3	50	00-79	Yes	Yes	Received Air Key	Random number	Fixed
Random Encryption Mode 4	3	50	80-99	Yes	Yes	Received Air Key	Random number	Variable

(Note: Encrpt: Encryption.   SQ: Squelch   RX : Received transmission)

- When the flag value is set to [80], enter the algorithm value for either [00] or [01] only. No other value must be entered.

- When the flag value is set to [00], enter algorithm value between [00] to [79]. No other value must be entered.

- The scramble function is valid only in the random encryption mode when the algorithm is set Between flags [80 – 99]. During the communication, the encryption code will be changed every 20 mSec according to the algorithm.

Communication Mode Setting

The communication setting is set into discrete channels.

[Procedure]
1. Using the AMA command, enter the Master Key Code to gain access to the System Management Screen.
2. Select the desired channel on the front panel.
3. Using the ACP command set the desired communication mode setting.

To verify details of the setting, use the ACP command.
ACP [CR]

To verify details of the communication channel, use the ADS command.
ADS [CR]

[Example]   ACP [CR]
    CH: 5   ID : 12345 NM : FFFFF MD : 0

CH : 5	Channel 5 is selected
ID : 12345	Destination ID is set to 12345
NM : FFFFF	Displays the nest mask setting. [F] is indicating the digit is valid.
MD : 0	Communication mode is [0] (Non encryption mode entered as 8000).

This would have been entered as:
ACP_12345_11111_8000

Checking with the ADS command would reveal the following:

Flag:80	None encryption mode
Algorithm:00	Digital squelch off
AirKey:0000	Air key (previously set with AAK command)
UserID:77777	Your unique user ID set with the AUI command
CH:8 ID:12345 NM:FFFFF MD:0	Reported back information from ACP setting

The ARD9900 provides 16 channels (**A~F, 0~9**) and has a digital squelch system that enables you to avoid hearing any transmissions that are not specifically intended for you. This is achieved by matching the remote stations AUI (or part of it) using the ID command and setting the appropriate NETMASK. This is only applicable to those modes that have a squelch function attributable to them; referring to the communication selection guidance table on page 19, you will see that this is applies to modes 1 and 3 only. You can assign each channel for the remote ID of your chosen contacts, and use the NETMASK feature to set up group communications. Depending on your desired communication scenario, you can then select the channel number suitable. Take the following steps to perform the channel setting:

1. Decide on your own individual identification number and program this using the AUI command. Type AUI at the System Manager command prompt, press return and the current 5 digit setting will be displayed. To change this to your chosen number type AUI_xxxxx (where xxxxx is your chosen 5 digit code) and press return. The AUI number is now saved in the memory of the ARD9900. Note that only numbers not letters or any other characters are acceptable.

2. Select the TX channel [**CHAN**] where you want to assign the ID, NETMASK and SQUELCH parameters (and any encryption you wish) using the front panel switch and program the information using the ACP command.

The system works by using the ID (AUI) of the station you are attempting to communicate with, and the NETMASK to define how much of that ID is used. If you are contacting someone with an ID of 12345 and you use a NETMASK of 11111 this means you are requiring all five of the digits of the other user to match before their digital squelch will be broken and communication can take place.

Example

Consider setting an ID of 12345 and a NETMASK of 11100 with the digital squelch set on.
The NETMASK you have set enables contact with any remote station that contains the numbers 123 in the first part of the AUI code set on the remote ARD9900. This means that someone with an AUI of 12345 or 12366 or 12367 etc will all hear your transmission. If you consider this carefully, this enables you to have an exclusive net by using appropriate AUI codes within your group. You have 16 channels that can be set with varying ID and NETMASK settings so it is possible to store many communication scenarios.

The diagram below illustrates the types of communication possibilities using the DCS and the ID of the remote stations you are contacting:

Tx1
ID:12345
NM:FFF00
MD:1

Tx2
ID:12345
NM:FFFF0
MD:1

Tx3
ID:12345
NM:FFFFF
MD:1

Tx4
ID:12345
NM:FFFFF
MD:0

Rx1
AUI:12345
MD:1

Rx2
AUI:12355
MD:1

Rx3
AUI:12348
MD:1

Rx4
AUI:13345
MD:1

Rx5
AUI:12345
MD:0
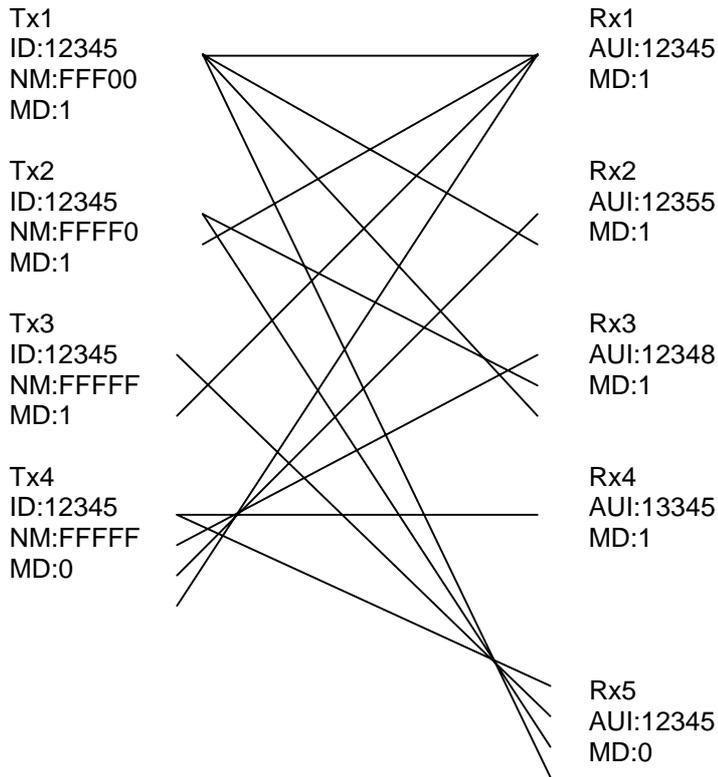
Detailed function of communication modes

[Caution: Communication mode must be set to the same for transmit and receive stations.]

Mode		Non encryption mode
Features		Non encryption (factory default setting). Force receiving available.
Setting	Flag	80
	Algorithm	00
Functions	Encryption	No
	Squelch	No
	Air Key at RX end	---
	Air Key TX	---
	Rolling Code	---
Mode Code		0
Remarks		Factory default setting Non encryption

Mode		Digital Squelch mode
Features		Digital Squelch is available.
Setting	Flag	80
	Algorithm	01
Functions	Encryption	No
	Squelch	No
	Air Key at RX end	---
	Air Key TX	---
	Rolling Code	---
Mode Code		1
Remarks		Squelch will open or close by comparing the destination ID and value of the net mask with the receiver's user ID.

Mode		Fixed Encryption mode
Features		Effective against noise. Force receiving is available.
Setting	Flag	00
	Algorithm	00-79
Functions	Encryption	Yes
	Squelch	No
	Air Key at RX end	Use the Air Key set at the receive end
	Air Key TX	No
	Rolling Code	Fixed
Mode Code		2
Remarks		Air Key, Flag, Algorithm must be set to the same for both parties prior to communication

Note: A value of algorithm must be set between [00 ~ 79].

Mode		Random Encryption mode 1
Features		Communication can be made with the station that has Flag 40 or Flag 50. (The Master key and algorithm must be set to the same value.)
Setting	Flag	40
	Algorithm	00-79
Functions	Encryption	Yes
	Squelch	Yes
	Air Key at RX end	Use the Air Key in the transmit data
	Air Key TX	Send the pre-set code from the transmit end
	Rolling Code	Fixed
Mode Code		3
Remarks		Once the mode code and algorithm is set to the same at both ends, communication can be made with the station that has Flag 40 or Flag 50. Since the Air Key is sent from the transmit end, It is not necessary to have the same Air Key at the receive end.

Mode		Random Encryption mode 2
Features		Communication can be made with the station that has Flag 40 or Flag 50. (The Master key and algorithm must be set to the same value.)
Setting	Flag	40
	Algorithm	80-99
Functions	Encryption	Yes
	Squelch	No
	Air Key at RX end	Use the Air Key in the transmit data
	Air Key TX	Send the pre-set code from the transmit end
	Rolling Code	Will change in every 20 mSec according to the algorithm
Mode Code		3
Remarks		Once the mode code and algorithm is set to the same at both ends, communication can be made with the station that has Flag 40 or Flag 50. Since the Air Key is sent from the transmit end, It is not necessary to have the same Air Key at the receive end. The code will be scrambled and will change in every 20 mSec.

Mode		Random Encryption mode 3
Features		Communication can be made with the station that has Flag 40 or Flag 50. (The Master key and algorithm must be set to the same value.)
Setting	Flag	50
	Algorithm	00-79
Functions	Encryption	Yes
	Squelch	Yes
	Air Key at RX end	Use the Air Key in the transmit data
	Air Key TX	Send the random coded Air Key from the transmit end
	Rolling Code	Fixed
Mode Code		3
Remarks		Once the mode code and algorithm is set to match, communication can be made with the station that has Flag 40 or Flag 50 since the Air Key is sent from the transmit end. It is not necessary to have the same Air Key at the receive end. The code will be scrambled and will change every 20 mSec.

Mode		Random Encryption Mode 4
Features		Communication can be made with the station that has Flag 40 or Flag 50. (The Master key and algorithm must be set to the same value.)
Setting	Flag	50
	Algorithm	80-99
Function	Encryption	Yes
	Squelch	Yes
	Air Key at RX end	Use the Air Key in the transmit data
	Air Key TX	Send the random coded Air Key from the transmit end
	Rolling Code	Will change in every 20 mSec according to the algorithm
Mode Code		3
Remarks		Once the mode code and algorithm is set to the same at both ends, communication can be made with the station that has Flag 40 or Flag 50. Since the Air Key is sent from the transmit end It is not necessary to have the same Air Key at the receive end. The code will be scrambled and will change every 20 mSec.

Control Commands

Interfacing to a PC

Using the supplied PC interface cable, connect the COM connector at the rear panel (marked [10101]) to the serial port of a PC.

NOTE : *Be sure your PC's serial port is active. Check for correct hardware and software settings!]*

Below are the pin assignments of the COM connector of the ARD9900:

ARD9900 COM connector pin)	Serial connector of a PC (D-Sub 9-pin)
Pin	Pin
1	2
2	6
3	4
4	5
5	3
6	8
7	7
8	1
GND	GND

Terminal Settings

Communication Speed:	9600 bps
Data Length	8 bit
Start Bit	1
Stop Bit	1
Parity:	None
Flow Control:	Hardware
Local Echo	None
Specifications:	RS-2332C

Command Format

Run a terminal software program such as Windows HyperTerminal, and then turn the power of the ARD9900 on.
The following message should appear on the PC screen:
cmd>
This indicates the ARD9900 is ready to accept commands from the PC.
Each command consists of three (3) alphabetical characters:

cmd>CCC_NN [CR]

CCC: Command   (Must be in upper case)
_   Space
NN: Parameter
[CR]: Carriage Return

Entering a command without a parameter will display the current parameter (value) setting.

cmd>CCC[CR]

If an invalid parameter or command is entered, the ARD9900 will respond as follows:

cmd>
?
cmd>

Entering the System Management Screen

Using the AMA command with the master key code, you can enter the System Management Screen. To let you know that you are in the System Manager Screen, the command prompt changes from lower to upper case:

cmd>AMA_************ [CR]   (← Enter the master key code.)
          (_ : space key)
CMD>   (Response from PC)
Note : The master key code consists of 12 digits of numeric code (0 ~ 9).
          The factory default is 123456789012]

Warning !

The master key code MUST be kept in a secure place. Without the proper master key code, no System Manager specific code changes can be made. In addition, it is the number on which the encryption algorithms base their encryption so as the system manager, you will need to be aware of the number to arrange communications within your communication group.

> **If you made an entry error whilst changing the Master Key Code, correct it before pressing the return key. If you exit from the master key code setting screen with an incorrect/unknown code neither you nor our factory can change it.**

Operator's Command List

Command	Function
AAQ	Send VIDEO In signal to VIDEO OUT (to a monitor screen) Capture image into memory of the ARD9900
ACD	Display the last received sender's ID
ACN	Display the last received net mask
ACO	Enter the Converse mode
ACS	Display the last received sender's ID
ADC	List the current commands
ADS	Display current settings
AMA	Entering to the System Management Screen
ATX	Send digital image
AVR	Display the current firmware version

Operator's Command details

AAQ	
Function	Send VIDEO In signal to the VIDEO OUT (to the monitor screen) Capture image into memory of the ARD9900
Default	None
Format	AAQ {0 / 1} [CR]
Parameter	1: Send VIDEO In signal to the VIDEO OUT (to the monitor screen) 0: Capture image into memory of the ARD9900
Details	While AVT command is OFF, [AAQ 0] will be accepted. Entering AAQ[CR] will respond with the current status. AAQ ON --- Video signal is passed to the VIDEO OUT port AAQ OFF --- Video signal is not passed to VIDEO OUT
Example	AAQ_0 [CR]

ACD	
Function	Display the last received sender's ID
Default	12356
Format	ACD [CR]
Parameter	None
Details	Display the last received sender's ID
Example	ACD [CR]

ACN	
Function	Display the last received net mask
Default	FFF00
Format	ACN [CR]
Parameter	None
Details	Display the last received net mask
Example	ACN [CR]

ACO	
Function	Enter the Converse mode
Default	None
Format	ACO [CR]
Parameter	None
Details	Change from the command mode (displaying [cmd>] on the screen) to the converse mode. In the converse mode, characters and/or binary data can be sent. To return to the command mode, press the "C" key while holding the "Ctrl "(control) key.
Example	ACO [CR]

ACS	
Function	Display the last received sender's ID
Default	12356
Format	ACS [CR]
Parameter	None
Details	Display the last received sender's ID
Example	ACS [CR]

ADC	
Function	List the current commands
Default	None
Format	ADC [CR]
Parameter	None
Details	List the current commands
Example	ADC [CR]

ADS	
Function	Display current settings
Default	Headerlen: 1.00 AFC = ON Analogue : ON UserID : 77777 CH : X ID : 00000 NM : 00000 MD : 0 X : Currently selected channel number
Format	ADS [CR]
Parameter	None
Details	Display current settings
Example	ADS [CR]

AMA	
Function	Entering to the System Management Screen
Default key	123456789012
Format	AMA_ {000000000000 – 999999999999} [CR]
Parameter	000000000000 - 999999999999
Details	Entering the System Management Screen by using the master key code.
Example	AMA_123456789012 [CR]

ATX	
Function	Send digital image
Default	None
Format	ATX [CR]
Parameter	None
Details	An image must be captured and stored into memory before it can be sent.
Example	ATX [CR]

AVR	
Function	Display the current firmware version
Default	None
Format	AVR [CR]
Parameter	None
Details	Displays the current firmware version
Example	AVR [CR]

Command List for the System Manager

Command	Function
AAK	Set an Air Key code
ACP	Set the transmit channel
ADC	Display the current commands
ADS	List the current channel settings
AFC	Set AFC on/off
AHL	Set the duration of the synchronous header signal
ALF	Adds the LF command when the [CR] key of the PC is pressed
AMS	Change the master code key
APR	Reset the unit to the factory's default setting
ARA	Select to monitor digital voice and analogue voice or analogue only analogue voice
ATT	Set the output level of the ARD9900 to the radio
AUI	Set user ID
AVT	Activate/deactivate the video through function

Command details for the System Manager

AAK	
Function	Set an Air Key code
Default	0000
Format	AAK {0000 – 9999} [CR]
Parameter	{0000 – 9999}
Details	Set an Air Key code
Example	AAK_1111 [CR]

ACP	
Function	Set the transmit channel
Default	CH : X ID : 00000 NM : 00000 MD : 0 X : The current selected channel
Format	ACP _ {00000 – 99999} _ {each digit 1/0} _ {80/00/40/50}{00 – 99}[CR]

Parameter	00000 – 99999
	       Other party's ID (numbers only, no other characters)
	Number 1/ 0
	       Net mask setting
	           0 : Net mask / squelch invalid
	           1 : Net mask / squelch valid
	           (Note: the "1" will be displayed as "F" on the screen.)
	80/00/40/50
	       Flag setting
	           80 : Non encryption communication mode
	           00 : Fixed encryption communication mode
	           40 : Random encryption communication mode 1 or 2
	           50 : Random encryption communication mode 3 or 4
	           Note : When the flag is set to [40], then the Random
	              encryption mode 1 or 2 will be selected according
	              to the value of algorithm.
	              When the flag is set to [50], then the Random
	              encryption mode 3 or 4 will be selected according
	              to the value of algorithm.
	00 –99
	        Algorithm setting
	         When the flag is set to [80], the algorithm **MUST** be set to 00 (Non encryption mode) or 01(Digital squelch mode.)
	
	         When the flag is set to [00], the algorithm **MUST** be set between 00 – 79.
	         When the flag is set to [40] or [50], the algorithm **MUST** be 00 – 79 (Fixed rolling code mode) or 80 – 99 (Variable rolling code changing every 20 mSec.)

Details	Each channel can store and select any desired setting. In the factory default setting typing ACP [CR] will display the following setting parameters:
	
	  CH : 0 ID : 00000 NM : 00000 MD : 0
	     : : : :
	     : : : Communication mode
	     : : : [0] Non encryption mode
	     : : : [1] Digital squelch mode
	     : : : [2] Fixed encryption mode
	     : : : [3] Random encryption mode
	     : : Net mask setting [1] valid, [0] invalid
	     : Other party's ID {00000 – 99999}
	  Channel switch number
	
	  Note: Using the ACP command will NOT display the algorithm
	  value. Use the ADS command instead.

Example	Channel : 8, ID : 12345, Net mask : 11100, Fixed encryption mode, algorithm : 20
	
	     Set the channel switch to [8].
	     ACP_12345_11100_0020 [CR] (_ indicates a space)

ADC	
Function	Display the current commands
Default	None
Format	ADC [CR]
Parameter	None
Details	Display the current commands
Example	ADC [CR]

ADS	
Function	List the current channel settings
Default	Flag : 80 Algorithm : 00 Air Key : 0000 User ID : 77777 CH : X ID : 00000 NM : 00000 MD : 0 X : The current selected channel
Format	ADS [CR]
Parameter	None
Details	List the current commands
Example	ADS [CR]

AFC	
Function	Set AFC on/off
Default	ON
Format	AFC {ON/OFF} [CR]
Parameter	ON : AFC valid OFF: AFC invalid

Details	Set the AFC (Automatic Frequency Control) function on/off.
	  In the SSB mode, the AFC function must be set to be valid.
	  In the FM mode, the AFC function may be set to be invalid

Example	AFC_ON [CR]

AHL	
Function	Set the duration of the synchronous header signal
Default	1.00 (1 second)
Format	AHL {050 – 198} [CR]
Parameter	050 – 198 (0.02 incremental)
Details	Set the duration of the synchronous header signal. {100} means 1.00 second of duration.
Example	AHL_146 [CR] - - - Set AHL to 1.46 seconds

ALF	
Function	Select to add the LF code followed by the CR to the terminal
Default	ON
Format	ALF {ON/OFF} [CR]
Parameter	ON : Add LF after CR OFF: Does not add LF after CR
Details	Select to add the LF (Line Feed) code followed by the CR (Carriage Return) to the terminal
Example	ALF_ON [CR]

AMS	
Function	Change the master code key
Default	123456789012
Format	AMS_ {000000000000 – 999999999999} [CR]
Parameter	000000000000 - 999999999999
Details	Change the master code key
Example	AMS_111333444555 [CR]

Warning !

If you made an entry error whilst changing the Master Key Code, correct it before pressing the return key. If you exit from the master key code setting screen with an incorrect/unknown code neither you nor our factory can change it.

APR	
Function	Reset the unit to the factory's default setting
Default	None
Format	APR [CR]
Parameter	None
Details	Reset the unit to the factory's default setting
Example	APR [CR]

ARA	
Function	Select to monitor digital voice/analogue voice or only analogue voice
Default	ON
Format	ARA_{ON/OFF} [CR]
Parameter	ON : Monitor digital voice and analogue voice signal OFF: Only analogue voice signal can be monitored
Details	Select to monitor digital voice/analogue voice or only analogue voice
Example	ARA_ON [CR]

ATT	
Function	Set the output level of the ARD9900 to the radio
Default	ON
Format	ATT_{ON/OFF} [CR]
Parameter	ON : Select low level signal output to the radio OFF: Select high level signal output to the radio
Details	Set the output level of the ARD9900 to the radio
Example	ATT_OFF [CR] - - - Select high level output

AUI	
Function	Set user ID
Default	77777
Format	AUI_{00000 – 99999} [CR]
Parameter	00000 – 99999
Details	Set user ID. The user ID is used in the digital squelch mode
Example	AUI_12345 [CR]

AVT	
Function	Activate/deactivate the video through function
Default	ON
Format	AVT_{ON/OFF}[CR]
Parameter	ON: Activate the video through function OFF: Deactivate the video through function
Details	When the AVT is set to ON, pressing the TX switch will display the "live" image on the screen. Pressing the TX switch again will capture the image and send it from the ARD9900. When the AVT function is set to OFF, pressing the TX switch will automatically capture the image **_and_** send it from the ARD9900.
Example	AVT_ON [CR]

Specifications

Modulation Method	OFDM	Band Width: 300 Hz ~ 2.5 KHz, 36 carrier
	Symbol Rate	20 mS (50 Baud)
	Guard Interval	4 mS
	Tone Space	62.5 Hz
	Individual Tone Modulation Method	36 carrier: DQPSK(3.6K)
Frequency Offset	+/- 125 Hz AFC	
Error Correction	Data: Reed Solomon + Vitabi Decoder Voice: Golay + Hamming	
Header	1 second, 3 tone + BPSK training pattern for synchronisation	
Digital Audio	AMBE ® 2020 Coder/Decoder	
Mode Selection	Receive: --------------------- Transmit: -------------------- Digital voice mode: ------- Digital Image mode:------- Analogue voice mode:----	Automatic selection. Data communication mode: Automatic exchange according to TX request from PC. Manually selected by the mode switch Manually selected by pressing the TX switch Manually selected by the mode switch.
Video Compression	AOR original JPEG format	
Video Input/output	NTSC _or_ PAL depending on country in which unit is purchased. (1Vp-p 75ohm).	
Power Requirement	10.7 ~ 16 V DC (Approximately 200 ma @ 12 V DC) 6.0 V DC with battery operation (5.6 ~ 6.5 V DC)	
Communication	RS-232C Asynchronous, 9600 bps (setting / data) 115.2 kbps (image)	
I/O Connectors	Microphone: 8 – pin metal Radio: 8 – pin metal PC interface: Mini 8 – pin DIN Video In/Out: RCA Speaker In/Out: 3.5 mm mono jack Power: EIAJ type 4	
Dimensions	100 (w) x 32 (h) x 156 (d) (mm) 4 (w) x 1.3 (h) x 6.2 (d) (inches) Projections not included Weight: Approximately 600 g (1 lb. – 5 oz)	

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