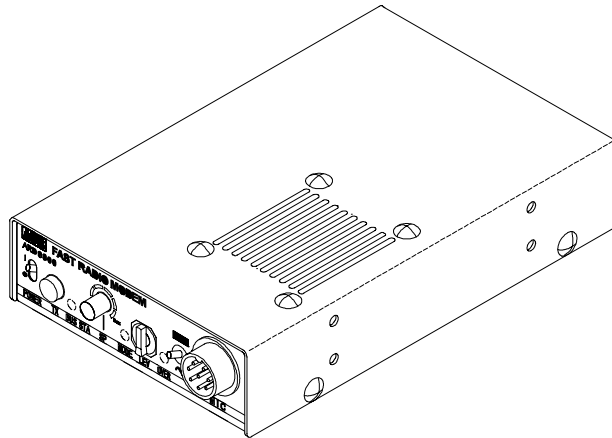# FAST RADIO MODEM

ARD9800

Instruction Manual

Multi-Mode And Digital Voice Interface

AOR LTD.

Authority On Radio Communications

Thank you for purchasing the AOR **ARD9800** Multimode And Digital Voice Interface.

The **ARD9800** is designed to convert your HF radio equipment to a multi mode and digital voice radio without performing any modifications to your transceiver.

Please read through this instruction manual and familiarise yourself with the operation of the **ARD9800**. We suggest you to keep this instruction manual for future reference.

We believe you will enjoy using the **ARD9800** as an enhancement to your enjoyment of amateur radio.

AOR LTD.

F e a t u r e s :

- Digital voice communications using existing analogue 2 way radios. The ARD9800 uses the same audio frequencies (300 Hz ~ 2500 Hz) as microphone audio uses to modulate the signal. This allows you to use an analogue radio as a digital voice transceiver.

- Digital voice communications in 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) -- Optional memory module (ME-1) required for built-in video capture function **(PAL or NTSC depending on the region in which the unit is purchased)**. This feature compresses the signal into our original adaptive JPEG which enables send and receive of images (similar to analogue slow scan TV, but higher resolution) in the Digital mode. Built-in video output connector allows viewing of the picture on an external monitor.

- Built–in high grade Vocoder (AMBE). Uses high-grade digital voice compression to deliver quality digital voice communications.

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

- Data communications on the HF bands. 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 ARD9800 to the microphone jack. 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.

Precautions

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

- Do not attempt to adjust this 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 in propagation or the operating environment.

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 ARD9800 back into analogue mode and making the announcement.

Table of Contents

Supplied Accessories

The following items are provided in the box:

Accessory	Quantity
Speaker Microphone	1
PC interface cable	1
Speaker Cable	1
DC Power cable	1
8P metal plug (for radio cable)	1
Instruction manual (this booklet)	1

Optional Accessories

The following items are available as optional accessories:

Accessory
Memory module ME-1 required for video capture function
Microphone cables for interface with most current amateur transceivers

Please note that the video functions are either PAL **OR** NTSC depending on the country in which the unit was purchased. **Both formats are not supported simultaneously**.

Controls and Functions

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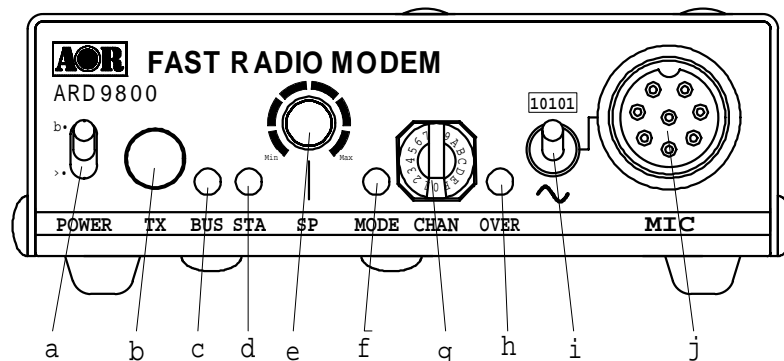
a. **Power on/off switch**

b. **TX switch**

> This switch performs two functions, firstly it enables the capture and sending of video images.
> *(Note: This function is available only when an optional memory unit, model ME-1 has been installed)*
> Press this switch to capture the video image and send. 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 be bypassed to the video output so that you can monitor the video image. Press this switch again to capture the image and then transmit it 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 on page 24 for details.
>
> Secondly it enables the resynchronisation of digital communication if synchronisation is lost during a communication session.
>
> Refer to Operation – Digital Voice Communication on page 22 for details

c. **2 colour LED**

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.

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d. **Status LED (STA_LED)**

It is 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.

It is also illuminated orange when unsent data remains in the memory in the video transmission mode.

e. **Speaker volume adjustment**

Adjustment for internal speaker output level. When an external speaker is connected, external speaker level is also adjusted.

f. **Operation Mode LED (3 colours)**

Indicates the current operation mode:

Green colour	Digital Voice mode
Red Colour	Analogue Voice mode
Orange Colour	Data Communication mode
Not lit	Digital Image Communication mode

g. **Transmitting channel (Rotary Switch)**

There are 16 channels. Each channel can be programmed with the remote stations unique digital ID, an appropriate NETMASK and digital squelch setting, depending on the type of communication you are involved in. It can be freely programmed to suit your requirements (see page 19 for details).

h. **OVER-LED (overload indicator)**

Lit when the microphone input is overloaded.

The correct microphone input level will light the LED from time to time when speaking into the microphone at a normal voice level. The microphone level can be changed by adjusting the microphone level setting.

Refer to Level Adjustment - Microphone Level on page 17 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), 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 ARD9800.

i. **Mode switch**
Use to select the Digital voice mode (10101) or Analogue voice mode (~). When the Analogue voice mode (~) is selected, ordinary analogue voice communications will be made. In receive mode however, the ARD9800 will automatically detect the mode of the incoming signal and decode signals accordingly. The LED indicates the appropriate operation mode.

j. **Microphone connector**
Connect the supplied microphone to this connector. Below are the pin assignments of the connector:
1. Speaker output (SP-OUT).
   Monitor output signal is present at this pin.
2. BIAS
   Power source for an electret condenser type microphone (5V DC through 2.2Kohm resistor).
3. GND
   Chassis ground.
4. TX
   Taking this pin to ground will enable the transmit mode
   (Same operation as the TX switch on the front panel).

5. D/A
   Taking this pin to 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. PTT
   PTT (Push To Talk) input.
7. MIC GND
   Microphone ground.
8. MIC IN
   Microphone signal input.

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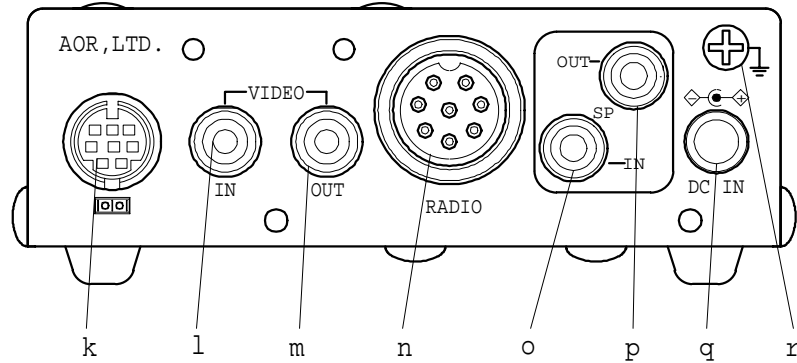
k. **Communication Connector (mini DIN 8 pin)**

Connector to PC (RS-232C)

Pin Number	Signal	Signal Direction
1	TX	ARD9800----->PC
2	DTR	ARD9800----->PC
3	DSR	ARD9800<-----PC
4	GND	GND
5	RX	ARD9800<-----PC
6	RTS	ARD9800----->PC
7	CTS	ARD9800<-----PC
8	NC	No Connection
Shell	FG	Frame ground

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

l. **VIDEO - IN connector PAL/NTSC** depending on region **(1V p–p, 75 ohm)**
Connect a video signal source such as a video camera, VCR output, etc.

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

n. **RADIO Connector**
Using the supplied 8-pin connector or one of the optional cables, connect the

ARD9800 to your radio equipment. If you do not use one of the optional cables You will need to wire a cable according to the microphone connector specifications of your radio (refer to your radio operator's manual).
 Below are the pin assignments of the ARD9800 connector, which for your convenience has been configured using the pin assignments chosen by the popular commercial manufacturer Adonis:

Pin number	Signal	Details
1	MIC GND	Microphone ground
2	MIC OUT	Microphone Output
3	PTT (H)	PTT (Push To Talk) output (PTT)
4	PTT (L)	PTT (Push To Talk) output (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 ARD9800 connector, or RF feedback will result.
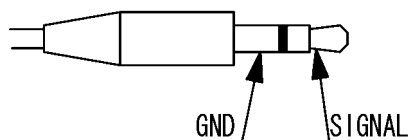
o. **SP IN Connector (3.5 mm mono jack)**
   Connect to the radio equipment's external speaker jack. (Input level: 0.5 V – 5 V p-p). NB: output from any other accessory connector on your transceiver may not be at a high enough level.
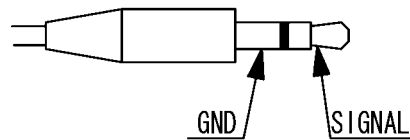
p. **SP OUT Connector (3.5 mm mono jack)**
   Connect an external speaker to this jack to disable internal speaker.

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 terminal for battery operation, and then connect external batteries.

   ! If you have changed the internal jumper for low-voltage battery operation, battery voltage must be within the range of 5.6 ~ 6.5 V DC. DO NOT apply 12.0 V or severe damage will result, and the warranty will be void!

   Note: There is no low battery voltage detector built-into the ARD9800.

r. **FG Screw**

Frame ground

Top Panel

s. **Internal Speaker**   s

Internal View

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

u. **Optional Memory module connector**
   Insert the optional Memory module (ME-1) to use Digital SSTV functions.

   Refer to Memory Module Installation Manual for details.

v. **Battery operation selector**
   Place the jumper between 1 – 2 (NOR) for normal operation. Change it
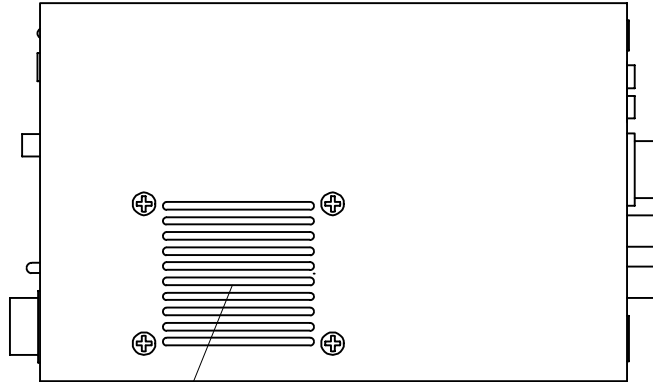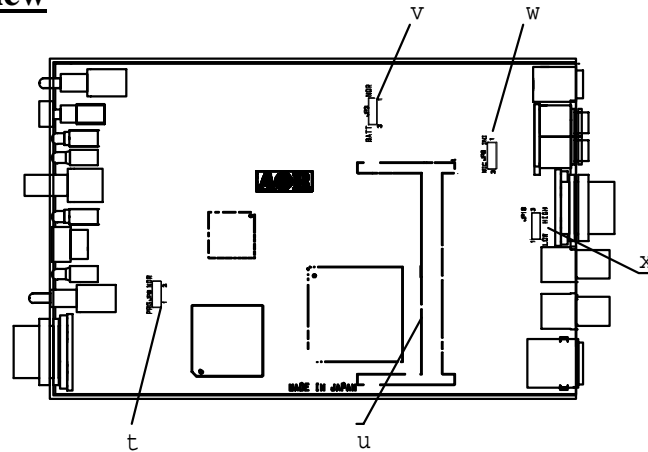   between 2-3 (BATT) for battery operation.

   ! 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 12.0
   V or severe damage will result, and the warranty will be void!

   Note: There is no low battery voltage detector built into the ARD9800.

w. **Internal speaker setting (JP 9)**
   Jumper setting

1 – 2	[INI] Activates internal speaker (default)
2 -- 3	[MIC] Disables internal speaker and enables output from Pin #1 of the microphone Connector.

   Note: The SP OUT (external speaker output) has priority regardless of the above jumper setting.

x**. <u>Output level setting (JP 10)</u>**

Jumper setting
1 – 2	Normal level (default) (LOW)
2 – 3	High level (HIGH)

If the ARD9800 output level is too low to drive your radio equipment, place the jumper in the 2-3 position.

<u>Refer to Level Adjustment - Output Level to Radio Transceiver, page 17 for details.</u>

<u>Bottom View</u>

y
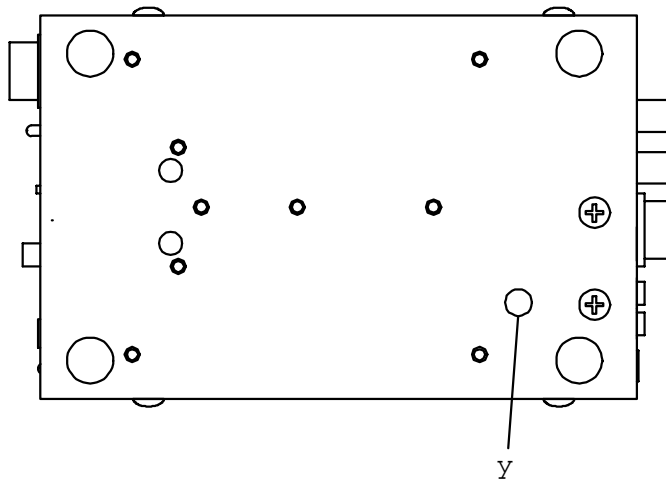
y. **<u>Output Level Adjusting Volume</u>**

<u>Refer to Level Adjustment - Output level to Radio Transceiver at page 17 for details</u>

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Interfacing the ARD9800

Connection to a Radio

NB: For your convenience the microphone socket on the rear of the ARD9800 is wired using the pin out configuration used by the manufacturer Adonis. It is not possible to include pre wired cables to suit every transceiver with the ARD9800, so before using your ARD9800 you will need either to wire the cable between your radio equipment and the ARD9800, or purchase a suitable cable. To assist you, an 8-pin microphone connector for the ARD9800 is included, however you will need to supply and prepare your own microphone connector for your radio equipment.

Alternatively, you may purchase a suitable lead from the AOR range, pre wired to suit your transceiver. Most current transceivers are catered for.

Below are the pin assignments of the 8-pin RADIO connector on the rear panel of the ARD9800:

Pin number	Signal	Details
1	MIC GND	Microphone ground
2	MIC OUT	Microphone Output
3	PTT (H)	PTT (Push To Talk) Output (PTT)
4	PTT (L)	PTT (Push To Talk) Output (PTT ground)
5	NC	No connection
6	NC	No connection
7	GND	Ground
8	NC	No connection
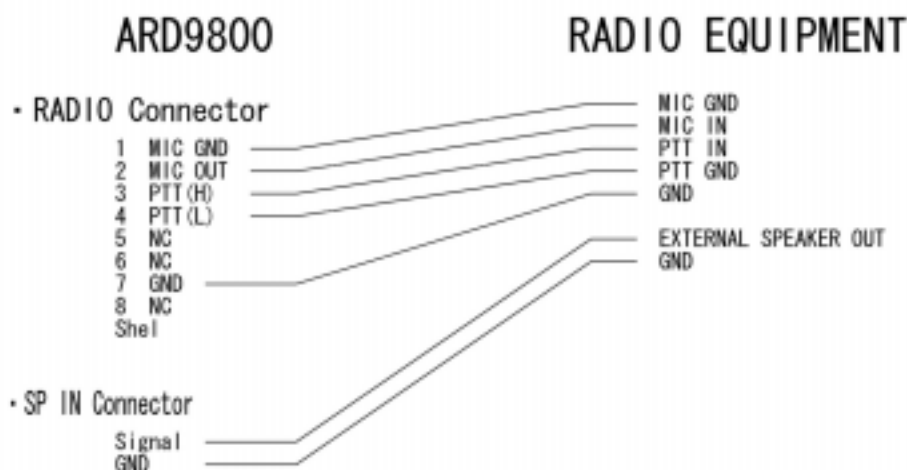
Note: MIC GND and GND must not be connected together in the ARD9800 connector or RF feedback will result.

You will require both a microphone plug and a cable for your radio transceiver

Connection to a Microphone

A speaker microphone is included with your ARD9800. As supplied the speaker output to the front panel microphone is configured off. Refer to page 12 if you wish to enable this. If you wish to use your own microphone with the ARD9800 you may do so by wiring your microphone to the ARD9800. Below are the pin assignments of the Microphone connector of the ARD9800:

1. SP-OUT (Speaker output)
> Monitor output signal is present at this pin.
2. BIAS
> Power source for an electret condenser type microphone.
> 5V DC through 2.2Kohm resistor.
3. GND
> Chassis ground.
4. TX
> Taking this pin to ground will enable transmit
> (Same as operation of the TX switch on the front panel).
5. D/A
> Taking this pin to ground will force the ARD9800 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.

Connection to a PC

A PC interface cable is included with the ARD9800. Parameter settings can be made by using terminal software such as Windows HyperTerminal.

Connection to a Power Supply

To operate your ARD9800, use a regulated power supply. The operating voltage must be within the range of 10.7 ~ 16.0 V DC (approximately 200mA).

A DC power cable is included with the ARD9800.

Colour	Polarity
RED	Positive (+)
BLACK	Negative (-)

! If you have changed the internal jumper for low-voltage battery operation, supply voltage must be within the range of 5.6 ~ 6.5 VDC. DO NOT apply 12.0 V or severe damage will result, and the warranty will be void!

Note: There is no low battery voltage detector built-into the ARD9800.

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Connection to an External Speaker

If an external speaker is desired, connect it to the SP OUT jack. This will also disable the internal speaker.
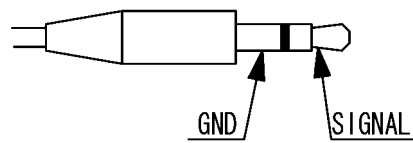
Pre-setting

<u>Output Level to Radio Transceiver</u>

This level must be correctly set to enable effective operation with your transceiver.

1. Connect the supplied hand microphone to the ARD9800 first, then connect your radio to the RADIO terminal on the ARD9800 by using your prepared connection cable. Now turn ON the ARD9800.

2. Make sure that the **output level adjusting volume** (y) accessible through the bottom of the ARD9800) is set to minimum (page 13 refers).

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

4. Press the PTT switch on the supplied hand microphone and speak normally into the microphone.

5. Adjust microphone gain control on the radio transceiver to a suitable level. It is recommended that you adjust the level so that the ALC function is activated. If the ALC function activates too much indicating the transceiver is being overdriven, it might create audio distortion and as a result, the communication link with the distant station may be broken.

6. Adjust the **output level adjusting volume** (y) supplied on the bottom side of the ARD9800 when the microphone gain control on the radio transceiver does not adjust for sufficient level.

7. If the microphone gain is still not enough despite carrying out the above procedure in step 6, **turn OFF the ARD9800 then:**

8. Take off the upper case of the ARD9800 and reposition the jumper pin for **<u>Output level setting.</u>** (The default setting is inserted between 1-2) set the jumper to link 2-3 for high level output. Replace the upper case. (page 13 refers).

   After changing the jumper setting, repeat steps 1 to 6 above again.

9. If the microphone gain is still not enough even after carrying out the above process in 8, the ATT command available on the ARD9800 through PC control should be turned OFF. Now repeat steps 1 to 6 again (page 33 refers).

<u>Microphone Input Level</u>

The microphone level has been properly adjusted at the factory with the provided microphone therefore no further adjustment should be 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 ARD9800, and then adjust

the microphone level as described in the following steps:

1. Connect your microphone to the Microphone connector on the ARD9800.
    (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 ARD9800 while pressing the **TX** switch. The status LED will blink orange indicating the ARD9800 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.

9. Turn the power OFF on the ARD9800 to terminate the microphone level-adjusting mode.

Audio Input From Transceiver To ARD9800

a. Connect the speaker output of the transceiver to the ARD9800 and turn the power switch on.

b. Set the squelch control on the transceiver fully off, i.e. permanent background noise.

c. Set the volume control on the transceiver to zero.

d. Confirm the OVER-LED is flashing at this stage.

e. Gradually turn the volume on the transceiver up until the OVER-LED stops flashing and is extinguished.

f. If you continue to rotate the volume control further the LED will become solidly lit, if this happens, rotate the volume control counter clockwise until the LED is extinguished.

g. Use the SP control on the front panel of the ARD9800 to adjust the audio volume output to a comfortable level for listening.

NB: *When the squelch is closed on the transceiver the OVER–LED will*

User ID Setting

The ARD9800 provides a function of user ID that allows the assigning of your own unique identification number using the AUI command. In digital mode you can then specify the ID number for the chosen destination's station or combine this with the NETMASK (Group Code) and SQUELCH (DCS) function to have a contact that is accessible to either one specified individual or a specified group, but no other ARD9800 users. The ARD9800 has 16 channels to enable setting of 16 separate communication scenarios and this feature is discussed in greater detail below. **NB: This function is only effective in digital mode.**

TX Channel Setting

The ARD9800 provides 16 channels (**A~F, 0~9**). 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. Connect the supplied PC interface cable between ARD9800 and a PC.

2. Set up terminal software on your PC such as Windows HyperTerminal (note that all communication with the ARD9800 is only possible using upper case).

3. Decide on your own individual identification number and program this using the AUI command. Type AUI at the 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 ARD9800. Note that only numbers not letters or any other characters are acceptable.

4. Select the TX channel [**CHAN**] where you want to assign the ID, NETMASK and SQUELCH parameters using the front panel switch.

5. At the command prompt: on the terminal software, type **ACP<CR>** to display the current channel setting.

   For example,

   cmd>ACP<CR>
   CH:A_ID:BBBBB_NM:CCCCC_MD:D

   cmd>

<CR>	Carriage Return to confirm the command entry.
A	Channel number that you selected with [**CHAN**] switch.
_	Space

BBBBB   Destination ID. You can only assign a number from
               00000 to 99999. **No other characters can be used.**

_   Space
CCCCC   Assign the NETMASK activity. You can only select 0
               (=zero) or 1.
                         1= Activate
                         0= Deactivate

Note that 1 indicates as F on the terminal software in Windows.

D   Activate or Deactivate Digital Squelch function.
                         1= Activate
                         0= Deactivate

You can use either the spacebar key or the underscore key (_) both are equally effective.

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 on the AUI code set on the remote ARD9800. 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:

Tx 1
ID:12345
NM:FFF00
MD:1

Rx 1
AUI:12345
MD:1

Tx2
ID:12345
NM:FFFF0
MD:1

Rx 2
AUI:12355
MD:1

Tx3
ID:12345
NM:FFFFF
MD:1

Rx3
AUI:12348
MD:1

Tx4
ID:12345
NM:FFFFF
MD:0

Rx4
AUI:13345
MD:1

Rx5
AUI:12345
MD:0
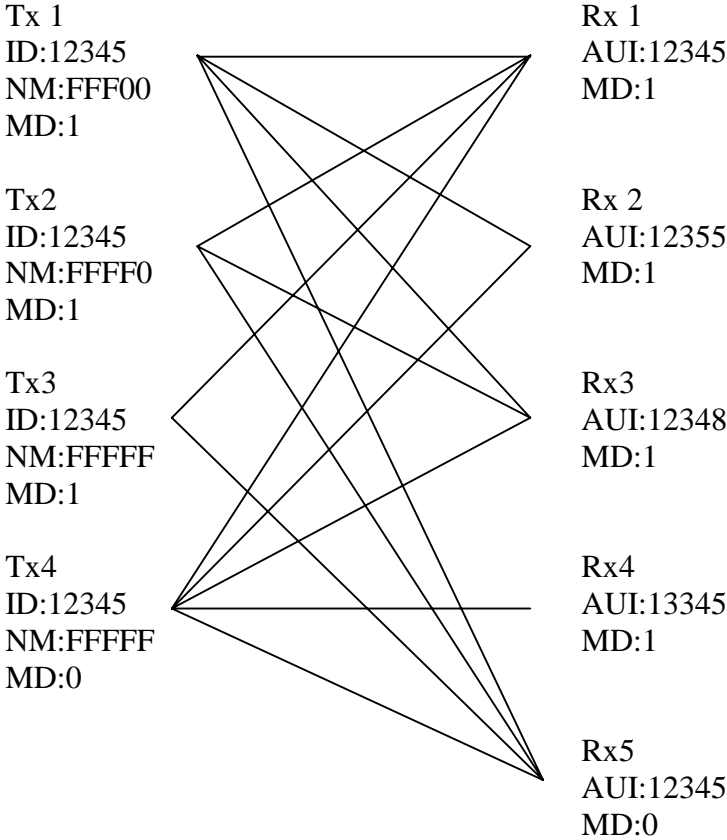
Note: All adjustments must be properly performed before operation.

O p e r a t i o n

<u>Voice Communication</u>

Your ARD9800 is capable of Digital Voice Communication and Analogue Voice Communication. In receive mode, the ARD9800 will automatically recognise the type of communication and set the appropriate operation mode.
In transmit mode, the operation mode can be selected by using the front panel Mode switch.

<u>Digital Voice Communication</u>

Set the mode switch [10101 - ~] upward to the digital mode position. [10101] Press and hold the PTT switch of the microphone. The STA (Status) LED will flash for about one (1) second while sending a data header signal. When the LED stops flashing, speak into the microphone normally.

Under normal circumstances the ARD9800 will synchronise on the header tones at the initial contact with the other ARD9800 user. If at any point it is unable to correctly decode the OFDM signal it is possible to initiate re-synchronisation using the following methods:

If the optional memory module (ME-1) is fitted:

a.   If the signal is received but not correctly decoded with only digital noise being heard, press and hold the TX button.
b.   If this is successful, the received signal will gradually be decoded to produce legible audio.
c.   Release the TX button when audio is completely recovered.

If the optional memory unit is not fitted:

a.   If the signal is received but not correctly decoded, with only digital noise being heard, flip the digital analogue selector switch to the analogue position.
b.   Press and hold the TX button.
c.   If successful, the received signal will gradually be decoded to produce legible audio.
d.   Release the TX button when the audio is completely recovered.

NB: the forced synchronisation facility is not applicable to the data communication mode, or digital image communication mode.

To further help you achieve good digital communication, the OVER-LED acts as an audio level indicator in receive mode. Optimum audio level from the transceiver audio line to the SP in socket on the ARD9800 is critical for successful communication when decoding digital signals. To help with this, the OVER-LED is active in receive mode to show the operator whether the input audio level is optimum or not. It operates in the following way:

Flashing whilst receiving	Input level is too low
Extinguished	Input level is optimal
Solidly lit	Input level is too high

To set up the input audio carry out the following procedure:

a. Connect the speaker output of the transceiver to the ARD9800 and turn the power switch on.
b. If the set has a squelch control make sure the squelch is fully open (i.e. audio can be heard), now turn the volume control to zero so that no audio is present and confirm the OVER-LED is flashing at this stage.
c. Gradually begin to increase the volume.
d. Stop increasing the volume when the OVER-LED has stopped flashing and is extinguished. At this point you have the optimum audio input level.
e. If you rotate the volume control any further the OVER-LED will become solidly lit indicating the audio level is too high. If this happens, back the volume control off until the OVER-LED is just extinguished.

Use the SP control on the front panel of the ARD9800 to achieve the audio level you find comfortable for normal listening.

Analogue Voice Communication
Set the mode switch [10101 - ~] downward to the analogue mode position. [~]
Press and hold the PTT switch of the microphone, and speak into the microphone normally.

Data Communication
Run a terminal software program such as Windows HyperTerminal to control the ARD9800, and to enter control commands. **NB commands are only accepted in upper case.**
        Refer to Control Commands on page 27 for details

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

Receive
  Enter the command [ACO] to go into the converse mode.
  The received valid 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 go into the converse mode. Type text from the keyboard, then hit the enter key at the end of the text.

    NNNNNNNN [CR]

NNNNNNNN   ASCII character

[CR]   Carriage Return

Note: The maximum data length is 2046 bytes per packet.

To send binary data, add [FE] (hexadecimal) to the header and footer of the data.

FE BBBBBBBBBBBBBBBB FE

BBBBBBBBBBBBBBBB   Binary data

FE   Binary data ID

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 into two (2) bytes of hexadecimal data.

FD → FDDD

Note: The 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 received data.

Digital Image Communication PAL/NTSC (depending on region)

Note: An optional memory module (ME-1) is required to use this function.

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

Push the TX switch to send the image.
(When pin - 4 of the microphone connector is grounded this is the same as pressing the TX switch.)

Note: When the Video Through Function is activated (**AVT command is ON**= **default**), pressing the TX switch will enable output of the video signal connected

to the Video Input to also be sent to the video output, so that you can monitor the video image. Press the TX switch again to capture the image and then transmit it through the 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.

The Progress indicator will display on the monitor during image transmission.

Specifications

Modulation Method	OFD	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)
Auto Frequency Offset	+/- 125 Hz	
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: Automatic selection Transmit: Data communication mode: Automatic exchange according to TX request from PC Digital voice mode: Manual select by the mode switch Digital Image mode: Manual select by pressing the TX switch Analogue voice mode: Manual select by the mode switch	
Video Compression	AOR original JPEG format	
Video Input/output	PAL or NTSC depending on region (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	
Dimension	100 (w) x 32 (h) x 156 (d) (mm) 4 (w) x 1.3 (h) x 6.2 (d) (inch) Projections not included Weight: Approximately 600 g (1 lb. – 5 oz)	

Control Commands

Interfacing to a PC

Using the supplied PC interface cable to connect between the COM connector at the rear panel (marked as [10101]) and 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 ARD9800.

ARD9800 COM connector Pin #		Serial connector to the PC (D-Sub 9 – 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
Specification:	RS-232C compatible

Command Format

Run a terminal software program such as Windows HyperTerminal and then turn on the power to the ARD9800. The following message should appear on the PC screen:

cmd>

This indicates the ARD9800 is ready to accept commands from the PC.

Each command consists of three (3) alphabetical characters and must be entered in upper case.

cmd>CCC_NN [CR]

CCC: Command   (Must be in capital letters)
_: 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 ARD9800 will respond as follows:

cmd>
?
cmd>

Command List

Command	Function
AAQ	Send VIDEO In signal to VIDEO OUT (to a monitor screen) Capture image into memory of the ARD9800
ACO	Enter the Converse mode
ACP	TX channel settings
ADC	List the current commands
ADS	Display current settings
AFC	Activate AFC (Automatic Frequency control) function
AHL	Set the duration of the synchronisation header
ALF	Add the LF (Line Feed) code at the end of the CR code
APR	Reset the unit to factory default settings
ARA	Monitor both digital/analogue voice signal or monitor digital voice only
ATT	Select output level for the radio equipment
ATX	Send digital image
AUI	Sets the five digit ID of the ARD9800
AVT	Activate the Video through function when capturing an image
AVR	Display the current firmware version

Command details

AAQ	
Function	Send VIDEO In signal to VIDEO OUT port (to the monitor screen) Capture image into memory of the ARD9800
Default	None
Format	AAQ {0 / 1} [CR]
Parameter	1: Send VIDEO In signal to a VIDEO OUT (to the monitor screen) 0: Capture image into memory of the ARD9800
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 port Note: Optional memory module MUST be installed to use this function.
Example	AAQ_0 [CR]

ACO	
Function	Change from the Command mode to the Converse mode
Default	None
Format	ACO [CR]
Parameter	None
Details	Change from the Command mode (while cmd> appears on the PC screen) into the Converse mode In the Converse mode, data from the PC keyboard can be sent. To return to the Command mode, enter [Ctrl – C] (holding the Control key while entering the character C)
Example	ACO [CR]

ACP	
Function	Assign parameters on each TX channel
Default	CH:* ID:00000 NM:00000 MD:0
Format	ADC_ [00000-99999][CR]
Parameter	ID: 00000 – 99999 (No other figures are acceptable.) NM: Place: 1/0 (No other figures are acceptable) MD: 0----- Deactivate 1----- Activate NM: ----- NetMask MD ----- Digital Squelch
Details	The ARD9800 provides a function of user ID that allows assigning your own identified number. In operation with digital mode, you can assign the ID number for the specified destination's station along with NETMASK (Group Code) and SQUELCH (DCS) functions together. **This function is only effective in digital mode.** The ARD9800 provides 16 channels (**A~F, 0~9**). You can assign each channel for ID, NETMASK and SQUELCH parameters individually. Depending on your communication requirement, you can select the appropriate channel number.
Example	In case of: Channel: 8 Destination ID :12345 Netmask: 11100 Squelch: 1 (= activate) ACP_12345_11100_1[CR]

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

ADS	
Function	Display current settings
Default	Headerlen : 1.00 AFC = ON Analogue : ON User ID: 77777 CH:0 00000 00000 0
Format	ADS [CR]
Parameter	None
Details	Displays the current parameter settings
Example	ADS [CR]

AFC	
Function	Activate AFC (Automatic Frequency control) function
Default	On
Format	AFC {ON/OFF} [CR]
Parameter	ON: Activates the AFC function OFF: Deactivates the AFC function
Details	Must be set to ON for the SSB mode Set to OFF for the FM mode
Example	AFC_ON [CR]

AHL	
Function	Set the duration of the synchronisation header
Default	100 (1 second)
Format	AHL {050 – 198} [CR]
Parameter	050 – 198 (0.02 increments)
Details	Sets the duration of the synchronisation header {100} represents 1.00 second .
Example	AHL_146 [CR] → Set duration to 1.46 seconds.

ALF	
Function	Add the LF (Line Feed) code at the end of the CR code
Default	ON
Format	ALF {ON/OFF} [CR]
Parameter	ON : Add the LF code at the end of the CR code OFF : The LF will not be added to the end of the CR code
Details	When this command is set to ON, it facilitates the entry of new data from the transmit terminal, as a new line is automatically started (and the previous line is automatically sent).
Example	ALF_ON [CR]

APR	
Function	Reset unit to factory default settings
Default	None
Format	APR [CR]

ARA	
Function	Monitor both digital/analogue voice signals or monitor digital voice only
Default	ON
Format	ARA_ {ON/OFF} [CR]
Parameter	ON : Monitor digital voice and Analogue voice OFF : Monitor Digital voice only
Details	Monitor both digital/analogue voice signal or monitor digital voice only
Example	ARA_ON [CR]

ATT	
Function	Selects the output level to the radio equipment
Default	ON
Format	ATT_ {ON/OFF} [CR]
Parameter	ON : Lower level OFF : Higher level
Details	Selects the output level to the radio equipment
Example	ATT_ON [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. Note: Optional memory module MUST be installed to use this function.
Example	ATX [CR]

AUI	
Function	Set the unique ID value for the ARD9800
Default	77777
Format	AUI_[ID] [CR]
Parameter	None
Details	This is your own identifier for use with the digital squelch function
Example	AUI_12345 [CR] sets ID as 12345

AVT	
Function	Activate the Video through function when capturing an image
Default	ON
Format	AVT_ {ON/OFF} [CR]
Parameter	ON : Activate the Video through function OFF : Deactivate the Video through function
Details	When the AVT command is ON, pressing the TX switch will enable output of the video signal connected to the Video Input to be passed to the video output port so that you can monitor the video image. Press the TX switch again to capture the image and then transmit it through the radio equipment. When the AVT command is OFF, pressing the TX switch will automatically capture the video image and then transmit it through the radio equipment.
Example	AVT_ON [CR]

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