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(2) Introduction

Thank you for purchasing the ARD-2 ACARS / NAVTEX decoder and display unit. This unit is capable of decoding and displaying aircraft ACARS and marine NAVTEX data transmissions via its built-in LCD display (including NAVTEX-J Japanese character set via a PC which supports this character set), add to this power from internal batteries or external d.c. plus the capability to link to a computer for enhanced display and the result is a very flexible transportable unit.

This operating manual is divided into many sections and presented in a logical order assuming that it will be read section by section following the examples. However, if you are familiar with the operations of ACARS and NAVTEX, you may proceed directly to the associated section, missing out the introductions... do however take note of the precautions section (2.2).

Every effort has been made to make this manual correct and up to date. Due to continuous development of the unit and by error or omissions, anomalies may be found and this is acknowledged. Most apparent faults are usually due to accidental misoperation of the unit, carefully read all of the manual before deciding to return the unit for repair.

Operating manual Conventions

Where text appears in **[SQUARE BRACKETS],** the keys are to be pressed exactly as shown. For example: **[LIGHT ON/OFF]** means press the **LIGHT ON/OFF** key. Words contained in speech marks “MODEL ARD-2” refer to indications displayed on the Liquid Crystal Display.

2.1 Supplied accessories

1	ARD-2 main unit
1	d.c. power lead with a fuse, approx 1.8m in length. *Note: in some market areas the ARD-2 may be supplied with an a.c. power supply providing 12V d.c. output*
1	audio connecting lead fitted with 6.3mm mono and 3.5mm mono plug at each end, approx 1.6m in length
1	serial interface cable for connection to a computer, approx 1.6m in length
1	user operating manual (this booklet)
4	AA size cell batteries

2.2 Precautions

Location
Do not use or leave the unit in direct sunlight (especially the LCD). It is best to avoid locations where excessive heat, humidity, dust and vibration are expected. Always treat the unit with care.

Take care to avoid spillage or leakage of liquids into the unit (and a.c. power unit if supplied, dependant on market area). Special care should be taken to avoid liquid entering via the power jack and audio sockets. Always remove batteries if the unit is not going to be used for a while.

Avoid connecting / disconnecting the power connection or batteries with the unit switched On, first switch off using the On/Off switch located on the left side of the unit and avoid a rapid switch On/Off sequence. If switched Off, leave at least two seconds before switching On again.

Looking after the ARD-2
Always keep the unit free from dust and water. Use a soft dry cloth to gently wipe the unit clean. Never use chemicals such as benzine or thinners which will damage certain parts.

Power requirements
The ARD-2 is designed for operation from internal AA batteries, alkaline batteries are recommended for longevity and to minimise the chances of battery leakage which would otherwise prove harmful to the ARD-2. When using batteries always select a quality brand, 4 x AA size 1.2 or 1.5V cells are required. If not being used for a long period of time, remove any batteries to reduce the chances of leakage.

It is possible to use NiCad batteries, however you will need to charge them externally from the ARD-2 as **the ARD-2 does NOT have a charging circuit**. Access to the battery compartment is via a removable sub-panel on the underside of the ARD-2 using a sliding motion. Always switch the receiver Off when inserting or removing batteries.

An external d.c. supply may also be connected, it should be regulated and provide a minimum current capacity of 300mA. **NEVER CONNECT THE ARD-2 DIRECTLY TO THE a.c. WALL SUPPLY**. Always switch the unit Off when connecting or disconnecting power.

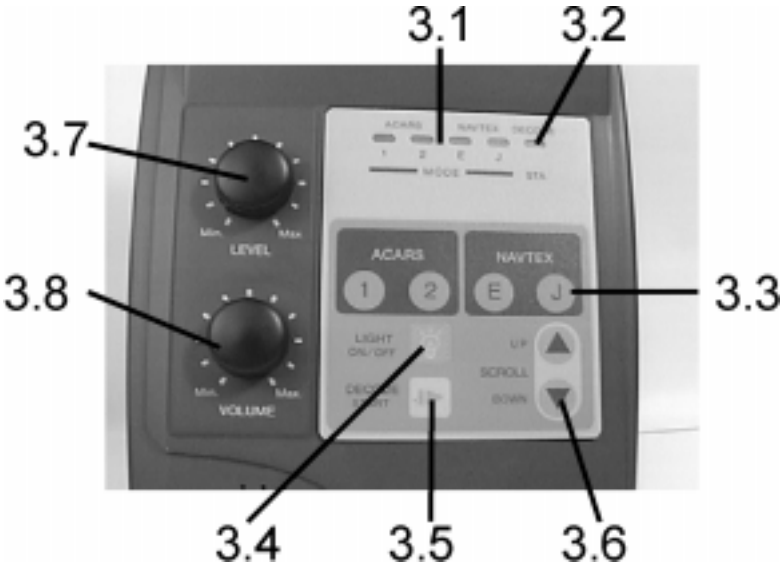
WARNING: Always remove internal fitted batteries when connecting to an external d.c. supply, otherwise the battery cells in the battery compartment may get hot resulting in permanent damage to the unit, there is also a risk of fire and personal injury.

The d.c. input socket uses a specialised dual concentric connector. This connector is **CENTRE POSITIVE** (which is the RED terminal of most DC power supplies). The outer connector is NEGATIVE = ground.

WARNING: Safety statement, Always disconnect the power unit from the a.c. wall supply when not in use.

(3) Controls

Top panel



3.1 Decode mode indicator

Directly underneath the LCD is a row of five LEDs, the first four (counting from the left) are GREEN and used to indicate which of the four data modes provided by the ARD-2 is currently selected. The default is ACARS-1:-

ACARS-1 mode (far left)
ACARS-2 mode (second from the left)
NAVTEX-E mode (third from the left)
NAVTEX-J mode (fourth from the left)

3.2 Decode status lamp

Directly underneath the LCD is a row of five LEDs, the far right LED is coloured RED and flashes to indicate when ACARS or NAVTEX data has been detected by the ARD-2, the ARD-2 will start to decode the data and display the result on the LCD simultaneously passing the decoded information to the RS232 port.

3.3 Decode mode selection keys

Toward the centre of the front panel are four keys labelled **[1]**, **[2]**, **[E]** and **[J]**. These keys are used to select the desired data mode, confirmation of data mode is provided by LEDs positioned above the keys:-

[1] ACARS-1 mode *(far left)*
[2] ACARS-2 mode *(second from the left)*
[3] NAVTEX-E mode *(third from the left)*
[4] NAVTEX-J mode *(fourth from the left)*

3.4 Light ON/OFF key

When first powered up, the back light for the LCD is activated to provide best visibility. However, it is recommended that the LCD back light is switched off while operating from internal batteries in order to conserve power from the battery cells (saving about 35mA). Use the **[LIGHT ON/OFF]** key to toggle the back light Off/On.

3.5 DECODE START key

When first powered, the ARD-2 will start to decode received data immediately (if a valid signal is presented). However, if the SCROLL UP/DOWN keys are used to review received data, it is necessary to press the **[DECODE START]** key to reactivate the decode process (or no new data will be decoded). Use of the scroll keys temporarily disables decode until the **[DECODE START]** key is pressed.

3.6 SCROLL UP/DOWN keys

When data has been received and decoded, only the last two lines will be visible on the LCD, to review previously decoded data, press the **[SCROLL UP]** key to view the message up to 32 characters at a time from the buffer memory which can contain up to a maximum of 512 characters. While scrolling, the **[SCROLL DOWN]** key may be used to move forward through the data.

Note: Decoding is temporarily suspended while the buffer is being scrolled. The scroll keys cannot cause data displayed on an external computer to be scrolled. These keys are invalid when the buffer memory has no data.

3.7 LEVEL adjustment Knob

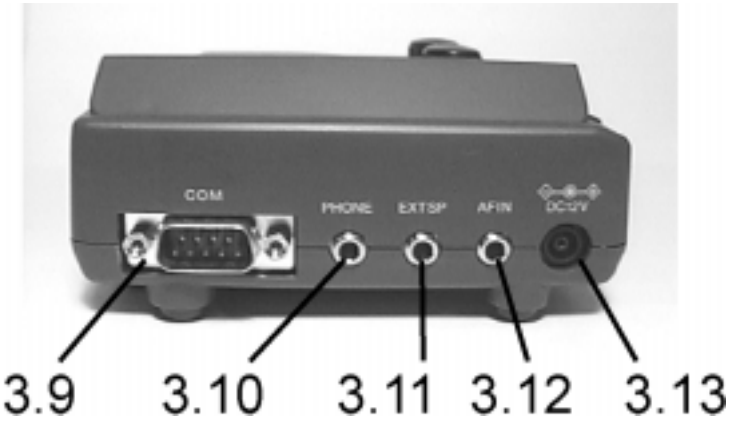
This knob is used to obtain the optimum level to distinguish the audio signal (encoded signal) from the noise. Normally this control should be centred at the 12 o'clock position.

3.8 VOLUME adjustment knob

Rotate this knob to vary the audio volume from the built-in speaker. This is useful to determine if data is present on the selected frequency and to help fine tune the receiver and set the level adjustment knob. When monitoring for long periods, it is often most comfortable to reduce this control to zero (7 o'clock position).

When the ARD-2 is switched off, audio is passed straight through the unit making the position of this control irrelevant (reducing the requirement to keep adjusting the control).

Rear panel



3.9 COM connector

This 9-pin male D-type socket is used to pass data to a computer via RS232. Refer to section 4.3 for connection and properties.

3.10 PHONE connector

This 3.5mm mono jack socket is provided so that a mono headphone of 8 to 32 OHMS may be connected for personal monitoring (reduced level for comfort), an identical socket is mounted on the front panel.

3.11 EXT SP connector

This 3.5mm mono jack socket is provided so that an external 8 OHM loudspeaker may be connected for improved audio fidelity for normal monitoring reducing the necessity to unplug the ARD-2 from the radio receiver. An identical socket is mounted on the front panel.

3.12 AF IN connector

This 3.5mm mono jack socket is used to connect audio input to the ARD-2 from the external speaker socket of your receiver. The standard accessory lead is supplied to fit into this 3.5mm mono socket, however the other end of the lead should be suitably terminated to match your radio receiver. Usually the radio receiver's volume should be set to about 40% (11 o'clock) but if course will vary from set-to-set.

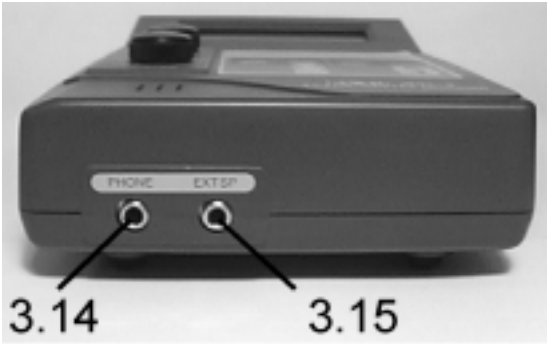
3.13 DC 12V connector

An external d.c. supply may be connected to this connector using the supplied fused d.c. lead. An external 12V d.c. regulated supply should be used which has a minimum current capacity of 300mA. The ARD-2 may also be connected via a cigar lighter plug to your 12V vehicle supply.

> **NEVER CONNECT THE ARD-2 DIRECTLY TO THE a.c. WALL SUPPLY**.
> ***Note: Remove the batteries when using an external d.c. supply.***

The d.c. input socket uses a specialised dual concentric connector. This connector is **CENTRE POSITIVE** (which is the RED terminal of most DC power supplies). The outer connector is NEGATIVE - ground.

Front Panel



3.14 PHONE connector

This 3.5mm mono jack socket is provided so that a mono headphone of 8 to 32 OHMS may be connected for personal monitoring (reduced level for comfort), an identical socket is mounted on the rear panel.

3.15 EXT SP connector

This 3.5mm mono jack socket is provided so that an 8 OHM external loudspeaker may be connected for improved audio fidelity for normal monitoring reducing the necessity to unplug the ARD-2 from the radio receiver. An identical socket is mounted on the rear panel.

(4) Connections, getting started

There are a few simple steps needed to get the ARD-2 up and running, first make sure that the unit is switched off on the left hand side of the cabinet.

4.1 Power supply

Batteries
The ARD-2 may be powered from 4 x AA size internal batteries, the battery compartment being located in the base of the unit accessed using a sliding action. It is permissible to use alkaline (recommended), manganese or ready charged NiCad cells.

> ***Note: If you are to use batteries, ensure that external power is not connected to the ARD-2 or damage and personal injury may occur due to over-heating of the batteries.***

External power
If using external power, connect 12V d.c. using the supplied fused lead or power unit (depending upon market) to the d.c. socket (item 3.13). A regulated a 12V d.c. supply is required with a minimum current capacity of 300mA or greater. If using the power lead, strictly adhere to the polarity of the power lead... the red lead is + (positive) and the black lead is - (negative). See the note above regarding batteries.

4.2 Connecting audio input from a radio receiver

Plug the supplied audio connecting lead (6.3mm to 3.5mm) into the phone / external speaker socket of the receiver, if the radio receiver does not have a 6.3mm socket, use a suitable adapter or replace the plug / lead with one with suitable terminations. Connect the 3.5mm plug into the AF IN socket on the rear panel of the ARD-2 (item 3.12).

4.3 Connecting to a PC (optional, skip as appropriate)

Use the supplied serial interface cable to connect the COM socket of the ARD-2 (item 3.9) with the connector labelled TNC on the lead, the COM port of the PC may be connected to either of the two remaining plugs... whichever fits! Refer to the handbook of your PC for availability of COM ports or number of socket pins, etc. If making up your own lead, use screened cable, the following terminations are suggested as typical:-

ARD-2 9-way male	PC 9-way male	PC 25-way male
2	2	3
3	3	2
5	5	7 *GND*
7	7	4
8	8	5

Parameter of ARD-2 and PC

Baud rate	9600 bps
Data length	8 bit
Stop bit	1 bit
Parity	None
Local echo	OFF
RX mode	CR
TX mode	CR
Kanji conversion code	Shift JIS
Flow control	Hard flow (RTS)

4.4 Let's power it up

The power switch is located on the left hand side panel. When the unit is switched on, the LCD will show the opening message followed by the ACARS-1 mode message indicating that the ARD-2 is operating correctly.

Opening message, displayed for approximately two seconds after the ARD-2 is switched on:-

MODEL ARD-2
Ver 1.00 $XX

The active data mode is then confirmed as ACARS-1, this confirmation message being displayed following the opening message:-

ACARS-1 mode
idle

When the ARD-2 is connected to a PC, the computer monitor screen will show the following example (running Windows95™ Hyper-Terminal):-

Note: The 2 letters following the $ mark in the opening message are derived from the last 2 digits of ROM check-sum and have no significance.

4.5 Selection of Decode Mode

The ARD-2 has four different data decoding modes, the desired mode can be selected via the mode selector keys (item 3.3). The four decode mode lamps (green) are located underneath the LCD to confirm which decode mode is currently selected.

Note: When the ARD-2 is switched on, ACARS-1 mode will always be selected by default regardless of which mode was last used.

Use the mode select keys to choose the desired data mode:-

[1] ..... ACARS-1 mode (far left)
[2] ..... ACARS-2 mode (second from the left)
[E] ..... NAVTEX-E mode (third from the left)
[J] ..... NAVTEX-J mode (fourth from the left)

The ARD-2 will start decoding as soon as an acceptable audio signal is received which matches the required parameters appropriate to the data mode currently selected. While decoding, the DECODE lamp (red) will light or appear to flash with bursts of data.

4.6 ACARS-1 mode **[1]**

This mode is automatically selected whenever the ARD-2 is switched on regardless of the data mode last used. Press the ACARS-1 key **[1]** if you wish to select this mode if another mode is already in use (item 3.3).

This mode enables you to decode an aircraft ACARS transmission, the first 26 characters of the ACARS signal are received in the following sequence:-

1. Mode Number
2. Address Field Number
3. Message Label Number
4. Message Block Number
5. Message Sequence Number
6. Flight ID

Useful headers are forced into place as the ARD-2 attempts to analyse the received data to present a more understandable format, especially useful for ***glancing*** through the received data, the slight down-side is that more lines will be used for each transmission received.

The 27th character and thereafter are used for general communication and may comprise of plain text or other data such as flight position, engine performance etc. This section of the transmission is displayed as raw data ***as received***.

For normal monitoring, the ACARS-1 mode is most appropriate, ACARS-2 provides a continuous string of data which may be less easy to interpret but is more useful for external software control by authors.

How the ARD-2 operates while decoding using ACARS-1 mode.
An ACARS transmission runs for approximately 0.2 to 1.0 seconds per packet, the term ***packet*** being given to the data string formed of the groups listed above 1 to 6 plus message content. The ARD-2 starts decoding the received data upon detection of the synchronise character of the packet data and ends when the end character is detected. If for some reason the end character can not be detected, the ARD-2 will be forced to end the decoding when the decoded characters reach a total of 300. Also when a received signal has fallen below a pre-set level *(refer to Level Adjustment control section 3.7)* the decoding will be forced to end.

Refer to section 5 for use of the SCROLL and DECODE START keys.

4.7 ACARS-2 mode **[2]**

Press the ACARS-2 key **[2]** when you wish to select this mode. The ACARS-2 mode lamp (green) will light to confirm selection (item 3.3).

In ACARS-2 mode, a single string of raw data will be generated and simultaneously fed to the LCD & COM port for each ACARS signal received. The ARD-2 will otherwise operate in the same way as ACARS-1 mode, this mode being most suitable for software authors when writing software for display of data on a PC (other than in terminal mode).

Refer to section 5 for use of the SCROLL and DECODE START keys.

4.8 NAVTEX-E mode **[E]**

Press the NAVTEX-E key **[E]** when you wish to select English language marine NAVTEX decoding. The NAVTEX-E mode lamp (green) will light to confirm selection (item 3.3).

How the ARD-2 operates while using NAVTEX-E mode.
The decoding is executed based on the specification set by CCIR Rec476-2B mode. A receiver with short wave coverage must be tuned in SSB mode to provide tones of 1500 to 1900 Hz. NAVTEX transmits busts of data a few characters at a time, transmissions can comprise of a transmit & receive pair (ship & coastal station) or a single station broadcasting (such as a coastal weather transmission). The sound of

this transmission is often compared noise made by the grasshopper type insect "cricket"... 'chirp' 'chirp' 'chirp' 'chirp' 'chirp' 'chirp'... The decoding takes effect character by character from the received signal and data. The red STA (status) LED will flash to confirm correct levels and frequency.

The decoding ends upon detection of the end character. The decoding will be forced to end also when the received signal has fallen below the pre-set level *(refer to Level Adjustment control section 3.7)*.

> ***Note: Decoding will also fail when the centre frequency of the received audio has drifted away from a range of 1500 to 1900 Hz so that careful tuning and a stable radio receiver is essential, adjust the radio receiver to the correct frequency as and when required.***

Refer to section 5 for use of the SCROLL and DECODE START keys.

4.9 NAVTEX-J mode **[J]**

There are marine NAVTEX transmissions in the Japanese language around the Japanese sea water, these may be decoded by the ARD-2 via NAVTEX-J mode. This section is excluded from this English language handbook for obvious reasons.

(5) Display

The internal Liquid Crystal Display (LCD) provides two lines of text, decoded text scrolls up the display and is held in a buffer of 512 characters with scroll facilities.

5.1 Scroll

Press the SCROLL **[UP]** or **[DOWN]** arrow keys to scroll the received message as a block of 32 characters at a time taken from the memory buffer. The memory contents will be lost once the set is switched off (see item 3.6).

In any decode mode, the decoding action will be suspended once the **[UP]** or **[DOWN]** key is pressed. In order to restart the decoding, you need to press the **[DECODE START]** key (item 3.5). Scroll does not operate when the buffer memory is empty (has no contents, such as when the ARD-2 is first switched on).

5.2 Back-light

The ARD-2 LCD is equipped with a green back-light. Press the **[LIGHT ON/OFF]** key to toggle the back-light on and off (item 3.4).

Note: It is suggested that the back-light is switched off when the unit is running from internal batteries to preserve power and extend operational time.

(6) Input of audio signal and adjustment

For best results, it will be necessary to adjust the audio output level from your radio receiver and set the optimal input threshold level using the ARD-2 LEVEL control.

6.1 Audio input level optimal setting

An audio signal must be fed into the ARD-2 via the AFIN socket (item 3.12) on the rear of the ARD-2. This is usually taken from the PHONE socket or speaker output socket of the radio receiver. The ARD-2 is designed to provide best results with an input audio level of 0.5 - 2.0V p-p, this being a typical level under which the radio receiver generally produces comfortable sound. Adjust the audio volume control of the radio receiver for best results, decoding may be difficult if the audio level is too low.

6.2 Level adjustment knob

This knob is normally set to the 12 o'clock position (item 3.7). This control is used to obtain the optimum threshold whereby the correct signal and unwanted noise can be distinguished. The ARD-2 compares the strength of the received signal, after being fed through the audio bandpass filter, to the level of the noise in order to correctly identify the ACARS/NAVTEX signal. An **A**utomatic **L**evel **C**ontrol (ALC) is used to provide a constant signal level over a wide range of audio inputs, for this reason, the level adjust control is most effective on weak signals, little effect will be noticed on strong signals.

6.3 Volume adjustment knob

This knob is used to set a comfortable monitoring level for the ARD-2 internal speaker. Monitoring data can be useful to check that all data is being decoded and to check that activity is present on the receiver. The control may be used to reduce monitor level to zero to make long periods of monitoring ***easier on the ears***. When the ARD-2 is switched off, audio bypasses this control to minimise the need to keep adjusting level (item 3.8).

(7) Display and serial data output

This section will provide examples of display and serial data output.

7.1 ACARS-1 Mode **[1]**

This mode enables the formatted display of the first 26 characters from the received ACARS signal followed by the raw message data, this simplifies the understanding of received data:

1. Mode Number
2. Address Field Number
3. Message Label Number
4. Message Block ID
5. Message Sequence Number
6. Flight ID

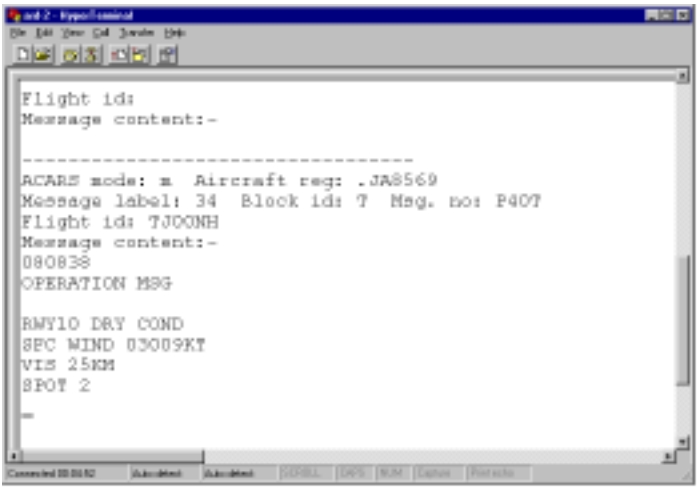
Example of display format :-

ACARS mode: m	..... *(1) Mode Number*
Aircraft reg:: .JA8569	..... *(2) Address Field Number*
Message label: 34	..... *(3) Message Label Number*
Block id: T	..... *(4) Message Block ID*
Msg. No: P40T	..... *(5) Message Sequence Number*
Flight id: TJ00NH	..... *(6) Flight ID*
Message content:	
080838 OPERATIO N MSG RWY10	
DRY COND SFC WI ND 03009KT VIA	
25KM SOPT2	

* The mode number will be displayed when the decoding of one packet ends.
* A control code during transmission is converted and displayed as a space " ".
* Any character which fails parity check (parity check error) is replaced and displayed as a loop " ° ".
* Use the scroll key to scroll up/down the message 2-lines at a time.

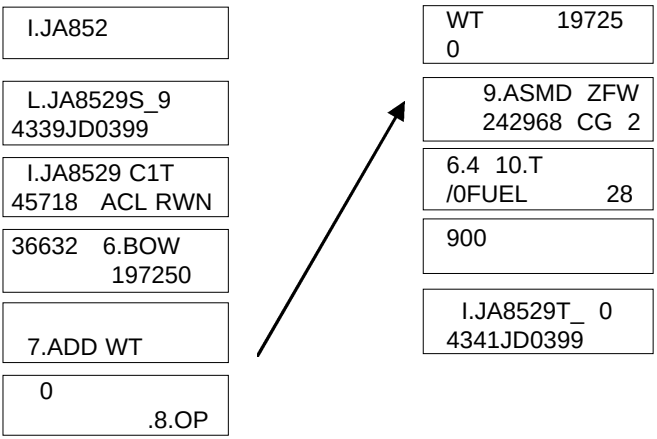
Example of Serial Data Output Format :-

The ACARS signal can be viewed more comfortably via a PC monitor screen by feeding the serial data output to the PC. Any character under parity check error will appear as a loop " ° "



7.2 ACARS-2 Mode **[2]**

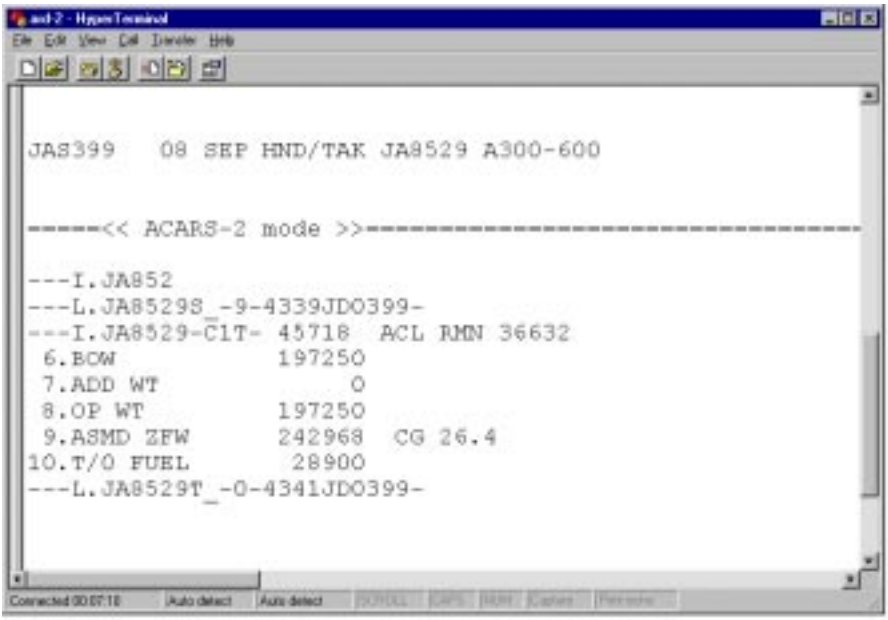
In this mode the ACARS signal will be displayed straight as raw data.
Display format (example) :-



* The first 32 characters will be displayed when the decoding of one packet ends.
* A control code during transmission is converted and displayed as space " ".
* Any character which fails parity check (parity check error) is replaced and displayed as a loop " ° ".
* Use the scroll key to scroll up/down the message 2-lines at a time.

Serial Data Output Format

The ACARS signal can be viewed more comfortably via a PC monitor screen by feeding the serial data output to the PC. Any character under parity check error will appear as a loop " ° "



7-3 NAVTEX-E mode **[E]**

In this mode the marine NAVTEX signal will be decoded and displayed in the following format:-

NNNN ZCZC IA42

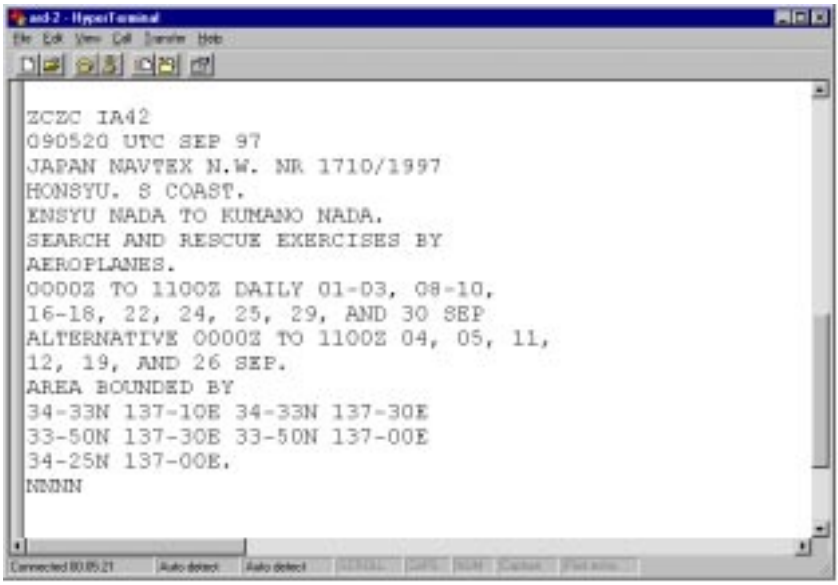
..... End of message from previous transmission
..... Displaying the message from the start. Carriage return when the line is full.

090520 UTC SEP9 7	..... Display the following messages. Carriage return when the line is full.
JAPAN NAVTEX N.W .NR1710/1997	..... Continue to display. Carriage return when the line is full.
HONSYU,S COAST. ENSYU NADA TO KU	..... Continue. Carriage return when the line is full.

* A control code during transmission is converted and displayed as space.
* Any character which fails parity check (parity check error) is replaced and displayed as an asterisk " * ".
* Use the scroll key to scroll up/down the message 2-lines at a time.

Serial Data Output Format

The NAVTEX signal can be viewed more comfortably via a PC monitor screen by feeding the serial data output to the PC. Any character under parity check error will appear as " * "



(8) What is ACARS/NAVTEX

The ARD-2 is capable of decoding aircraft ACARS and marine NAVTEX traffic, a brief outline is given here.

8.1 ACARS

ACARS which stands for **A**ircraft **C**ommunications **A**ddressing and **R**eporting **S**ystem is a digital system transmitted over the VHF aircraft band around 131 MHz AM. Traffic is handled by a computer network, in the USA Aeronautical Radio Inc (ARINC) are responsible but in other countries different organisations are responsible. Not all aircraft are equipped with ACARS but the mode is becoming more widely used.

Data does not simply comprise of text messages (although the request for tickets and shower facility at airport terminals have been noted). A series of sensors on the aircraft automatically collate information from the management unit and control units, these relate to height, speed, outside temperature, wind, fuel, engine performance etc, this information being transmitted by ACARS along with general positional data and more.

The ACARS data is processed into ***packets*** of serial data for efficient handling. The transceiver onboard the aircraft checks the frequency before transmission to ensure that it is clear then produces the short burst of data lasting less than one second.

Transmission takes place from air to ground (downlink) and from ground to air (uplink). A flurry of data may be passed at take-off and landing (termed DEMAND MODE as it is triggered by events) but positional transmissions may only occur occasionally, up to an hour apart so it is best to catch transmissions close to a major airport or flight paths to and from. General transmissions during flight (such as weather reports) may not be specifically acknowledged at the time of transmission (to minimise congestion) but reception will be acknowledged when the next transmission occurs.

Primary ACARS frequencies are: 131.550 MHz in the USA, Canada & Pacific (secondary being 132.025, 129.125 MHz), 131.450 MHz in Japan and 131.725 MHz in Europe.

For transmission efficiency, many abbreviations and codes are used. A full list is beyond the scope of this manual but further reading is recommended by book or internet:

Understanding ACARS by Ed Flynn, Copyright Fred Osterman and published by Universal radio Research, 6830 Americana Pkwy. Reynoldsburg, Ohio 43068, USA. ISBN 1-882123-36-0

ACARS-Link, About ACARS http://www.grove.net/~acarslink/alabout.htm

Sample of typical abbreviations used by ACARS:

AL (or FL)	Flight level
CZ	Cruising speed
DP	Dew point
HD	Heading
WX	Weather
ADF	Automatic direction finding
ALT	Altitude
CPT	Captain
ENG	Engine data
FOB	Fuel on board
GND	Ground
OAT	Outside air temperature
TRB	Turbulence
POSWX	Position weather
WXRQ	Weather request

8.2 NAVTEX

NAVTEX which stands for **NAV**igational **T**el**EX** is a well organised international digital system transmitted over the short wave bands.

Coastal stations regularly broadcast traffic lists of names of ships for which it holds messages, weather reports etc. This automated system now enables marine traffic to log on to a coastal stations mailbox and download its data without human intervention.

Each transmission is coded by category and station identified by a four character group at the start of the transmission B(1) B(2) B(3) B(4).

B1	Station identifier
B2	Subject of message
B3 & B4	Message type

Example of B1:

G	Cullercoats, UK
S	Niton, UK
R	Reykjavik, Iceland

When geographically separated, the same letter may be allocated to more than one coastal station without any problems occurring.

Example of B2:

A	Navigational warnings
B	Meteorological warning
C	Ice reports

It is possible for shipping to program what will be received and what will not, certain categories of urgent transmission cannot be locked out.

Primary NAVTEX frequencies are 518 kHz and 424 kHz but other frequencies are used. In the coastal waters around Japan NAVTEX-J may be encountered where Japanese characters may be decoded by the ARD-2 and displayed on a PC which supports this character set.

For transmission efficiency, many abbreviations and codes are used. A full list is beyond the scope of this manual but further reading is recommended by book or internet:

http://www.navcen.uscg.mil/marcomms/gmdss/navtex.htm

(9) Radio receiver and aerial

The ARD-2 is compatible with many radio receivers. For aircraft ACARS reception, a VHF AM receiver is required (AOR AR5000, AR3000A etc) while for marine NAVTEX reception a short wave receiver capable of SSB receive is required (AOR AR7030, AR3030 etc). The AR5000 is particularly suitable as it provides high quality reception on both short wave and VHF in a single package, the AR3030 also fits this application well.

9.1 When the AR5000 is used, as an example with notes on AR3030 & AR7030

The AR5000 will provide good results if connected to suitable aerial systems. For ACARS reception, connect a VHF aerial or a wide band aerial with VHF coverage such as the AOR SA7000 or DA3000 aerials. For NAVTEX reception, select a long wire aerial, long wire balun or wide band system with short wave coverage such as the SA7000.

1. Connect the ARD-2 to the AR5000 using the supplied connecting lead between the PHONES socket of the AR5000 and AF IN of the ARD-2.

2. Set the AR5000 volume control somewhere between the 10 - 11 o'clock position to provide a suitable AF INPUT LEVEL for the ARD-2. It is best to set the squelch control fully open (anti-clockwise) so that background white noise is audible, this will prevent increased chances of "clipping" due to squelch opening characteristics and will ensure that weaker signals are audible.

AR3030: Connect from the phones to the ARD-2, alternatively the CR400 tape lead may be used with the AR3030 AUX output.

AR7030, NAVTEX only: Connect from the external speaker output using an adapter or separate lead, alternatively the CR400 tape lead may be used with the AR7030 AUX output.

3. Receiving ACARS: Tune the AR5000 to the local primary ACARS frequency: 131.550 MHz in the USA, Canada & Pacific, 131.450 MHz in Japan or 131.725 MHz in Europe. If the AR5000 is placed in AUTO MODE the receive mode of AM will be automatically selected, if not select AM, the optimal IF bandwidth is 6.0 kHz and set AGC to FAST.

When a transmission occurs, the STATUS lamp will flash and decoded data will appear on the LCD. Use the SCROLL keys to review the received data, don't forget to press the START key to re-enable decoding. Adjust the LEVEL control (item 3.7) for optimal results when monitoring weaker signals.

AR3030: The AR3030 optional VHF airband converter is required. Select AM receive mode and NOR 6.0 kHz AM filter, set AGC to FAST.

4. Receiving NAVTEX: Tune the AR5000 to 516.3 kHz or 422.3 kHz in USB mode with IF band-width 3.0 kHz and slow tuning step of around 10 Hz, set AGC to FAST.

> ***Note: In order to receive the NAVTEX signal correctly always tune the receiver in USB mode 1700 Hz below the centre frequency of the transmission, nominally 518 kHz & 424 kHz. The ARD-2 will only correctly decode NAVTEX signals when the centre frequency of the transmission is within +/- 200Hz from the standard 1700 Hz shift.***

When monitoring an active frequency and the centre frequency of the audio signal comes within 1700 Hz +/- 100 Hz, the DECODE lamp will flicker every 0.2 seconds. In some critical conditions you may still need to tune the receive frequency while observing the DECODE lamp.

The DECODE lamp may come on occasionally when background noise is received within the range of 1700 Hz +/- 100 Hz, of course the ARD-2 will not decode data from the noise despite the DECODE lamp flickering. Adjust the LEVEL control (item 3.7) for optimal results when monitoring weaker signals.

AR3030: Select FAX receive mode and SSB NORMAL 2.4 kHz filter. Tune to 518 kHz or 424 kHz.

9.2 About the aerial

The subject of aerial choice and earth can be quite complex. The results obtained from the ARD-2 will depend upon the efficiency of your aerial and earth system and the effectiveness of your radio receiver. Aerial theory and practice can be surprisingly different, keeping common sense in mind it is one of the few remaining areas for listeners to easily experiment and often achieve fantastic results.

Whip aerial: Avoid the use of whips if possible and keep the ARD-2 & receiver combination as far away from the aerial as possible to minimise noise. Of course if running portable, it may be necessary to use whip aerials but remember that the results may be compromised.

Mounting location: It is important to mount any external aerial as high as possible and in clear space although this is more important at VHF frequencies than for short wave. If possible the aerial should have a clear path to the horizon. Results are usually disappointing when an installation is in a loft space.

Long wire aerials: For short wave reception a random length of long wire approximately 10 to 20 metres in length forms a good compromise. If possible try to locate the receiver close to a window so that the wire has the shortest and most direct run from the rear of the receiver to the outside World. Never attach the wire aerial directly to a support or wall. Instead attach a small length (one metre) of insulating material such as nylon to each support (house or tree for example) and then onto the aerial wire. Allow the wire aerial to drop diagonally into the window and receiver rather than straight down the wall. Keeping the aerial away from supports and building will reduce the loss of signal from the wire aerial and prevent unwanted noise from entering the aerial system. **Magnetic balun** long wire aerials are becoming very popular as they allow coaxial cable to be used as the down-lead from the wire aerial into the receiver.

Loop Aerials: Short wave desk-top loop aerials have the advantage of small size (such as the AOR LA320). They have tuning controls to reject unwanted signals. As the loop is within easy reach of the operator it can be rotated to provide directivity. They can be particularly useful for DX'ing the lower bands. Generally speaking they offer excellent portability but cannot compare on the higher bands with a well sighted long wire aerial.

Active aerials: Active aerials are normally quite compact. They require power to enable them to operate. Not all designs allow you to switch the preamplifier off although some have a gain control. As with loop aerials they tend to provide good results on the lower bands when compared to poorly sighted short'ish wire aerials. Overload can be a problem on the busy 7 and 9 MHz bands. If you have a small garden space, an active aerial may be worth considering.

Discone: For wide coverage in the VHF-UHF bands a compromise has to be met and the most popular aerial is a discone (AOR DA3000). Their appearance is like a large spider or umbrella without the covering material, the better models have about 16 elements. Typical usable coverage starts from about 25 MHz and extends continuously to 500 MHz 1300 MHz or even 2000 MHz. The coverage peaks and dips throughout it's range as the elements interact to provide the widest possible coverage. Due to their necessary construction discone aerials are a little prone to "wind noise" due to vibration and possible damage in severe gales.

Wide band SA7000: This AOR compact aerial system comprises of two elements totalling 1.8m in height. A single coaxial downlead connects to the radio receiver to provide coverage from 30 kHz to 2 GHz. Certainly worth consideration if a single unobtrusive aerial is required for full coverage or where space is limited.

ABF125: VHF civil airband filter to reduce the chances of breakthrough especially from powerful VHF Band-2 transmitters and pagers.

Earth systems: A separate EARTH connection to the receiver can reduce noise levels significantly. Suitable earth points include connection to a water pipe, central heating radiator or external earth rod.

If fitting a separate external earth rod, consider the implications carefully if your mains supply uses Protective Multiple Earth (PME) system. If in doubt consult an experienced electrician.

A short length of thick gauge earth wire may be connected to a nearby central heating radiator or water pipe but **never use a gas pipe for earthing**. Ideally a separate earth rod should be used but the length between the receiver and rod becomes restrictive, if too long the earth system may well "pick up" noise rather than remove it in which case it may be worth considering a "screened earth system" comprising of coaxial cable.

(10) Specification

Model	ARD-2 ACARS/NAVTEX decoder
Power Supply	12V dc or 4 x AA battery cell
Current Consumption.....	Max. 280mA
Fuse	1A instantaneous
Decode Signal	
ACARS	Modulation MSK
	Carrier 2400 Hz
	Bit rate 2400 bps
	Code type NRZi
	Length of 1 character 7 bit+1 parity bit
NAVTEX	CCIR Rec476-2B
	Mark 1615 Hz
	Space 1785 Hz
	Shift 170 Hz
	Bit rate 100 bps
	Length of 1 character 7 bit
Display	LCD: 16 character x 2 line
Control	Lamp LED: 4 x Mode Selection (green)
	1 x DECODE (red)
Key	4 x Mode Selection
	1 x Scroll UP
	1 x Scroll DOWN
	1 x Back Light ON/OFF
	1 x Decode Restart
Audio signal	
Input	3.5 mm mono jack
	Input impedance 1k OHM
	Input level 0.2 - 2V p-p
	External speaker 3.5mm mono jack
	Earphone socket two, each on front and rear panel
Serial Interface	Connector: D-Sub 9-P male
	Baud rate: 9600 bps
	Data length: 8 bit
	Stop bit: 1
	Parity: None
	Flow control: RTS hard flow
Operating temp	0 - 45° C
Dimensions	158L x 109W x 53H mm excl projections
Weight	330g excl. batteries