

Title

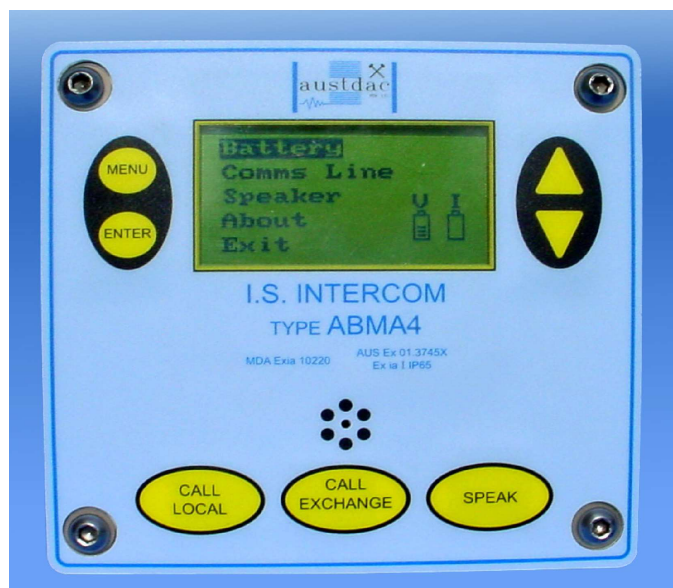
I.S. INTERCOM TYPE ABMA4 USER MANUAL

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Issue

05





05	Address and Logo Update	2017-03-24	CW	CW	PC
04	Images and Contact Details Update	2015-06-09	NK	NK	MC
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1. GENERAL DESCRIPTION

This document should be read in conjunction with 20-079-12 user's manual. The intercom type ABMA4 provides the audio communications and pre-start alarm sounding facilities of the PSACS1 system. Intercoms are distributed along the conveyor at fixed distances apart to provide complete sound coverage along the conveyor. During a pre-start sequence the intercom sounds the pre-start alarm through its two sideways facing speakers. These same speakers and the front panel mounted microphone are used to carry out a half duplex voice conversation with other intercoms on the conveyor or a surface located BMA exchange operator. Photograph 4 below shows the front panel of a type ABMA4 intercom.

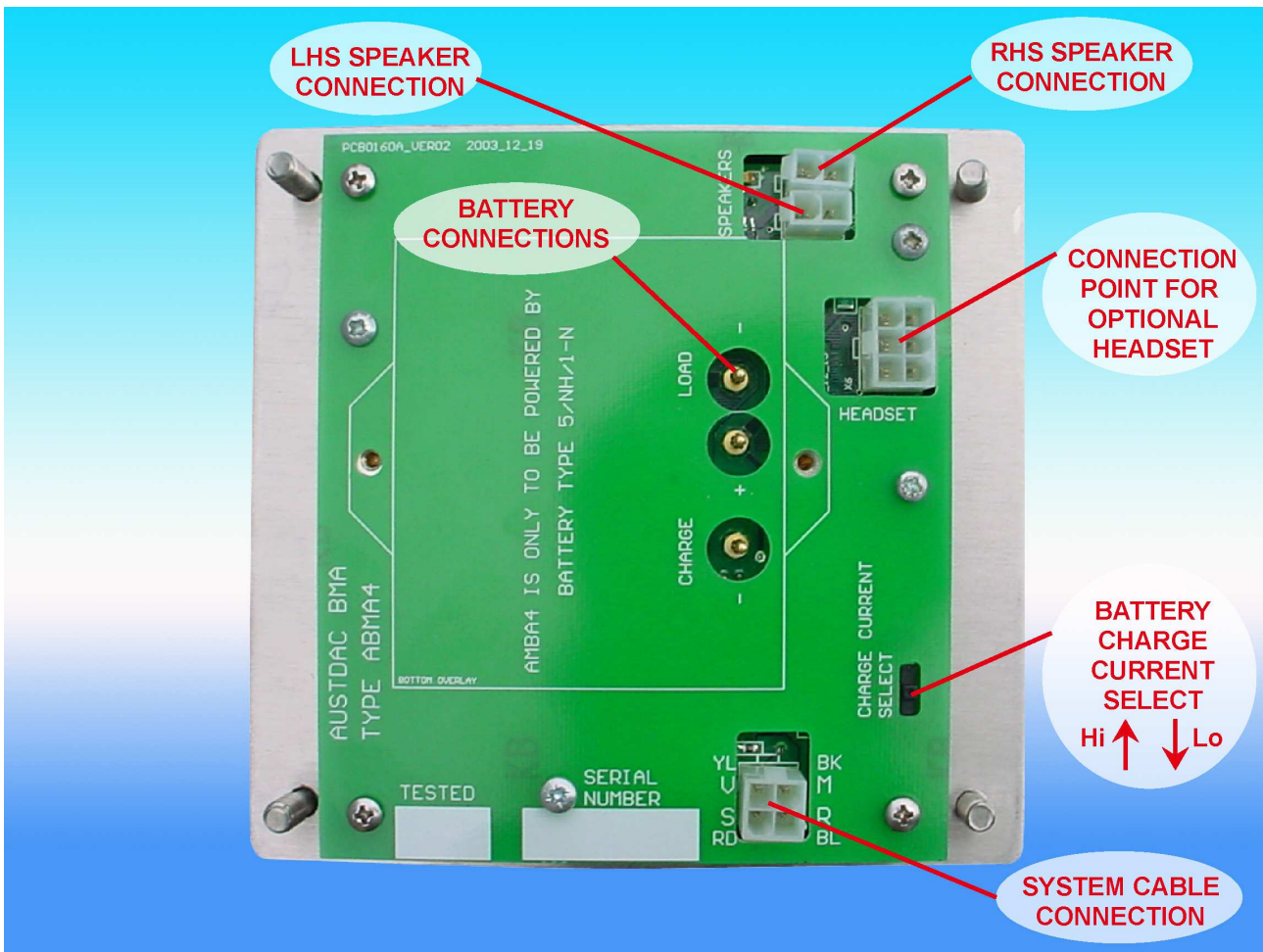


Photograph 1: Intercom type ABMA4 front view.

The intercom type ABMA4 has seven front panel mounted push buttons, a front panel microphone, an LCD display and two side-mounted speakers to provide the voice communications interface for staff working along the conveyor belt. The LCD display allows the operator to view operational and maintenance information about the intercom and the PSACS1 system.

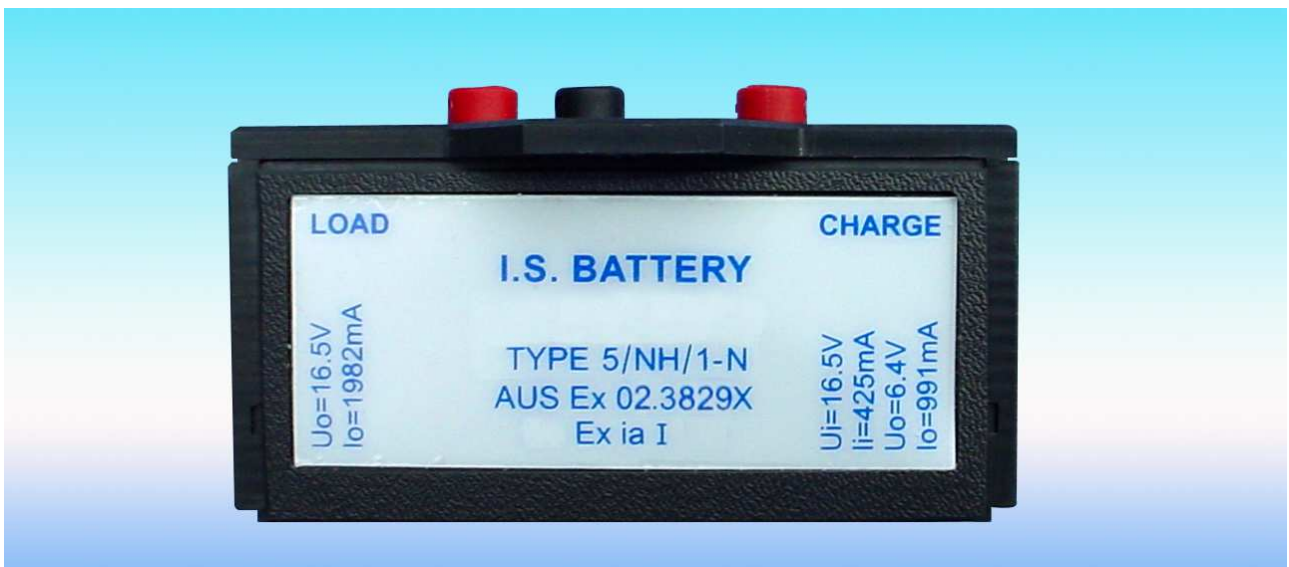
A conversation with another worker along the conveyor belt can be initiated by pressing the local call button once or several times. The local call button is used to signal or attract the attention of workers along the conveyor. The local call button can be pressed and released to sound a series of beeps along the conveyor. The patterns and meaning of these beeps can be used to transmit messages to others along the belt. The call exchange button is pressed to attract the attention of the BMA exchange operator at the surface. Once the operator has acknowledged the call further instructions, such as patching requests, can be given from the intercom.

The voice communications of the PSACS1 system is a half duplex i.e. only one party can speak at a time. The speak button of the intercom must be pressed whenever the user wishes to speak. It is important to get used to pressing the speak button just before speaking and releasing it just after finishing speaking. Failure to control the speak button correctly will result in the beginning or end of a statement being cut off.



Photograph 2: Intercom type ABMA4 rear view

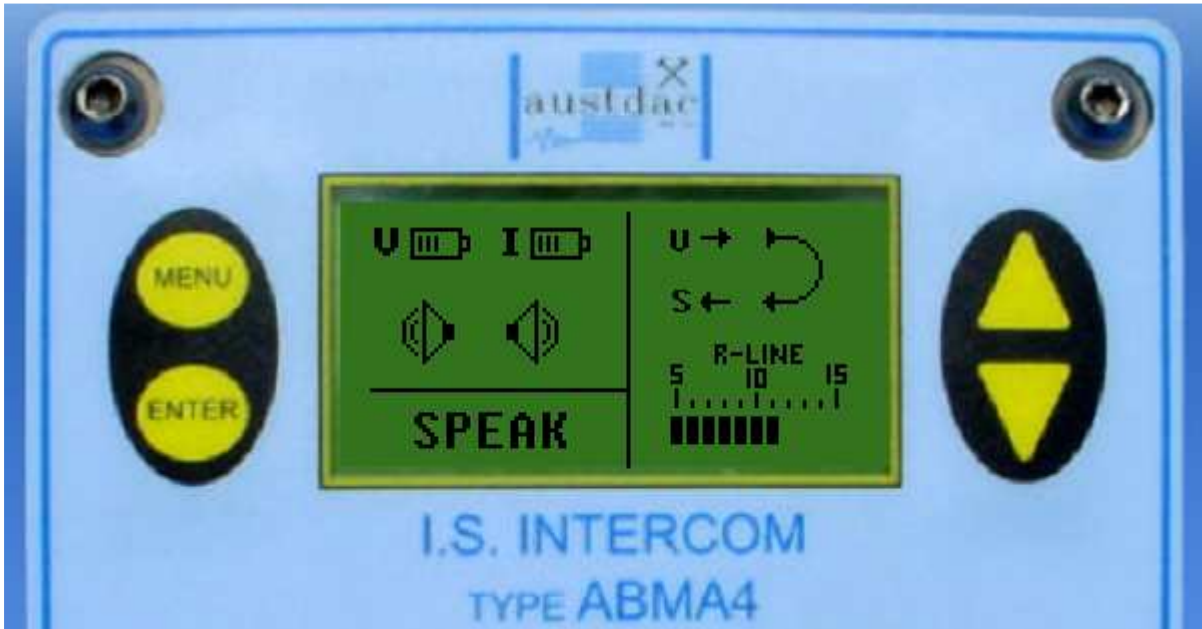
The above photograph shows the rear of the ABMA4 intercom with its battery removed. In the LO position the battery charge current is 11mA and 22mA in the HI position. Refer to the system drawing for the correct charge rate for your intercoms. Generally, the HI position is used in systems with short powered segments and fewer intercoms, the LO position is used in long powered segments with more intercoms.



Photograph 3: Battery type 5/NH/1-N side view

2. OPERATIONAL DESCRIPTION

The intercom type ABMA4 has seven front panel mounted push buttons. The main visual difference between the ABMA4 and other I.S. Intercoms is that the ABMA4 has a LCD graphical display and addition of 'Menu', 'Enter', 'Up' and 'Down' keys or push buttons ('keys' will be used interchangeably with 'push buttons' throughout this document). Another difference is that the ABMA4 has a more powerful micro controller that allows graphical representation of the state of cable, PSA controller and internal operation of ABMA4.



Photograph 4: ABMA4 Menu Keys

There are three main areas showing the working of ABMA4:

1. Background Operations
2. LCD Generic Graphical Display Mode
3. Configuration and Status Mode

3. BACKGROUND OPERATIONS

These tasks happen no matter what state the graphical display is at. These are as follows:

1. Detection of PSA (Pre-Start Alarm)
2. Detection of Speech for Speaker Mute Control
3. Detection of Low R-Line Voltage
4. Pressing of SPEAK key
5. Switching between Sleep and Deep Sleep modes
6. Watchdog kicks

1. Detection of PSA

The unit continuously detects for a PSA paired tone signal on both the V-line and S-line. The V-line is the audio signal from the PSA Controller and the S-line is a return signal from end termination unit or Tail End Unit (TEU). TEU (such as TEU100) returns the signal with the tone frequency divided by eight. The following frequency pairs are detected on the V-line:

1. 1500Hz alternating with 1800Hz @ 0.4mS cadence
2. 1400Hz alternating with 1700Hz @ 0.2mS cadence
3. 1300Hz alternating with 1900Hz @ 0.8mS cadence

The ABMA4 units check for cadence as well as frequency tones pair for a PSA confirmation. The cadence period need to be present for at least three quarters of the cadence for each frequency pairs for detection. For example, a 1500Hz and 1700Hz is an in-correct pair. The frequency and cadence ensures a false PSA

trigger does not occur say in PTT action when someone or a machine is whistling or creating noise near these PSA frequencies.

On detection of the PSA, the unit will wake up the display if asleep and show flashing ticks (✓) in a PSA loop. The flashing indicates that the PSA is occurring.

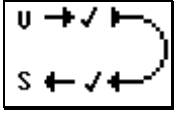


Figure 1: Confirmed PSA Loop

If the ABMA4 sees only an S-line return signal then the V-line will have a cross (X) in the PSA loop and tick (✓) in the S-line (see table 2 for more explanation below). The flashing of the ticks (✓) continue for a small period after the PSA tone has disappeared to ensure the user sees any PSA changes.

When a PSA event occurs, the Speakers output will go to maximum volume on the first tone of the frequency pair immediately that it detects a correct PSA frequency. This is so the user has the maximum opportunity to hear PSA tone at the earliest possible time even before a PSA tone pair has been confirmed by AMBA4.

2. Detection of Speech for Speaker Mute Control

On detection of speech because someone has pressed the SPEAK key and is speaking above the mute level or squelch levels the speakers are turned on and will remain on for 3 seconds after speech has stopped. This is to give the speakers some hysteresis so talking does not pop in and out.

3. Detection of Low R-Line Voltage

If the R-line is weak and falls below 6 Volts then a warning message is displayed if in the Generic mode on the LCD screen. If it remains low, the then unit will fall into a deep sleep to conserve power, all background functions, and LCD display will stop. This mode should only be used to store units on the store shelves. If in 'deep-sleep' the unit can be, awoken up by holding down the 'Menu' key for three seconds. If the R-line is removed, the warning message 'ZERO' will be displayed beneath R-line Bar graph.

4. Pressing of SPEAK key

On pressing of the SPEAK key (a press to talk, 'PTT' action) the unit will wake up momentarily if asleep and display 'SPEAK' in the message text box on the Generic mode of the LCD screen. The ABMA4 will turn off speakers and turn on the microphone. The unit will return to sleep mode as soon as Speak key is release.

5. Switching between Sleep and Deep Sleep modes

To save battery power when not in use, the ABMA4 goes to sleep when no keys are pressed after 30 seconds. The unit is woken when a PSA occurs (for only 8seconds), SPEAK (for only 1 second) or any of the menu keys are pressed (30 seconds). The unit is not woken for 'Call Exchange' or 'Call Local' keys. These just signal directly to the PSA controller. Sleep consists of turning off the LCD display and backlight. The unit is still very active doing all other background tasks listed above.

The other mode is 'Deep Sleep'. This **should not occur in the field** (see 'Detection of Low R-Line Voltage' in previous section above). Deep sleep mode is to save battery shelf life. In an emergency or on the test bench to confirm operations, you can wake the ABMA4 from deep sleep either by pressing the 'Menu' key for three seconds, adding power to the R-line or pressing 'SPEAK' key.

The activation from 'Deep Sleep' mode when the 'SPEAK' key is pressed (without PSA R-line power) is for an emergency when you need to speak to other ABMA4 intercoms to attract attention. If the other ABMA4 intercoms have R-line power then the system will work as normal until the unit that has no R-line battery runs flat. If all other ABMA4 units are in 'Deep Sleep' as well, they will only monitor for speech every few seconds, upon the detection of which they will awake and turn speakers on. Thus in 'Deep Sleep' mode you need to speak for longer than one second before the ABMA4 will open their speakers. This assumes there is enough battery power in the units, which would be true for the case for a power-outage of a few days or weeks.

6. Watchdog kicks

'Watchdog' is a background task that continuously monitors for tasks that have locked up (i.e. stopped). If the task stops for more than 10 seconds, then it is kicked and the unit resets.

4. GENERIC DISPLAY DESCRIPTION

When the unit powers up after going through the Austdac logo and version information, the Generic (default) graphical mode is displayed on the LCD as seen below:

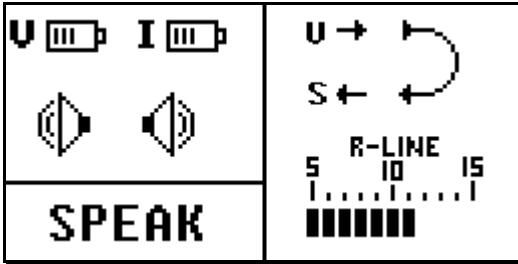


Figure 2: LCD Generic View

The LCD display is separated into three sections using bars. The top left shows battery health and speaker volume state. Right of the bar shows external health of interface to PSA controller. The left bottom shows a message box area for display messages such as 'SPEAK' when the SPEAK key is pressed.

Battery and Speaker Health Icons







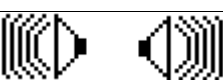

Icon explanation:	Icon:
Full battery and not charging	
Partly full battery and charging	
Dead battery and charging	
Dead battery, charging fault	
Good Speakers (low volume)	
Good Speakers (med volume)	
Good Speaker (high volume)	
Bad Speakers (speakers not connected)	

Table 1: Top Left Generic Icons

The current icon has bars that fluctuate from one bar to five bars depending on how much charge current is flowing.

The hardware can show left or right speaker faults or both, as shown above. While in Generic Display view, you can change the speaker output volume by pressing the up or down keys.

PSA Health Interface Icons


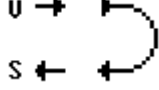
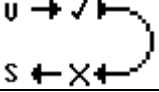
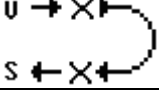
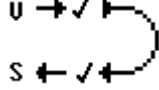
Icon explanation:	Icon:
R-Line bar-graph Voltage level of R-line at $\pm 0.5V$ resolution	
Un-tested PSA loop See "Comms Line" Menu to see last confirm state.	
Partly working PSA loop	
Faulty PSA loop	
Fully working PSA loop	

Table 2: Top Right Generic Icons

The 'PSA Loop' icon flashes when a PSA test is occurring and shows that a change in state may happen. The flashing will occur a few second after PSA to ensure the user notices any changes especially if it is a short PSA.

A partly working PSA loop can happen if there is an S-line connection fault or V-line connection fault. If both lines have a fault, then the unit cannot see the PSA controller and will display an un-tested PSA icon. See System Test section below.

Text Box

The text box area of the screen provides the user with text information referring to the operation of ABMA4. For example, it displays 'SPEAK' when the speak key is pressed or 'LOW LINE VOLTAGE' when the R-line voltage is low.

5. CONFIGURATION MENU DESCRIPTION

While in Generic Display mode (see Figure 2), pressing the 'Menu' key will get the following menu options:

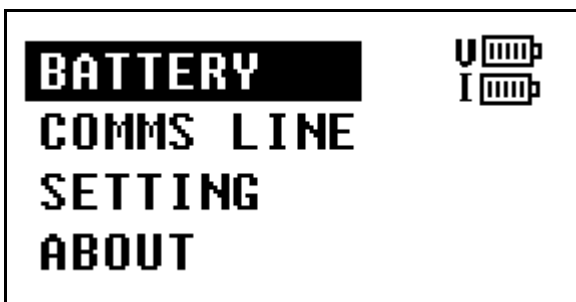


Figure 3: Menu Options

Each Configuration menu option provides either more detailed status information or the ability to change settings in the ABMA4. To 'Exit' the menu display mode, press 'Menu'. The 'Menu' key toggles you in and out of the Configuration and Generic display modes. To enter a menu option (eg. 'Battery') you press the 'Enter' key. To move between menu options press the up (\uparrow) or down (\downarrow) keys.

Battery Menu

This menu shows the health of battery status.

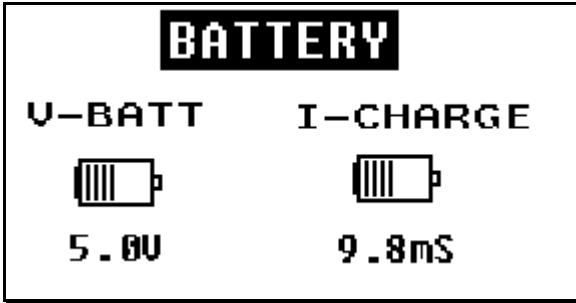


Figure 4: Battery Menu View

The figure 4 above, shows battery voltage in volts and charge current in mA units. The battery voltage should be around 4.6 to 5.6Volts and the current between 0mA and 25mA maximum, depending on the charge state of the battery.

To exit this menu, press either 'Menu' or 'Enter' key.

Comms Line

This menu shows the health of the interface to the PSA controller.

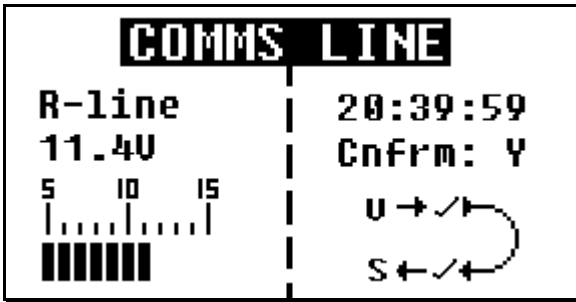


Figure 5: Comms Line View

Figure 5 gives a reading of the R-line voltage and PSA loop status. As in Generic mode, the PSA loop shows the health of the V and S lines to the PSA controller in this menu. In addition, in this menu you have time and confirmation of the last PSA. If 'Cnfrm:' has 'Y' next to, then directly above it will have the time in hh:mm:ss since the last PSA was confirmed. If 'Cnfrm:' has 'N' next to it then PSA has not been confirmed and no time will be displayed. The maximum number of hours recorded since last PSA confirm is 99hrs, which is 4 Days and 3 hours.

To exit this menu press either 'Menu' or 'Enter' key.

Setting

This menu shows the current setting or configuration setting that can be made in the ABMA4:



Figure 6: Setting menu

To enter a menu option (eg. 'Volume') you press the 'Enter' key. To move between menu options press the up (↑) or down (↓) keys.

1. **Volume Option**

Allows you to adjust speaker volume levels using the up (↑) or down (↓) keys. The default setting is 'LOW' and there are two settings above this i.e. 'MED' and 'HIGH' (see below).

2. **Test Speakers**

Test the speakers by creating a tone and measuring current usage. If no current is detected then no speakers are connected (see below).

3. **Mute Level**

Allows you to go into the Mute sub menu (see below).

4. **Menu to Exit**

Either by pressing 'Menu' or moving to this selection and pressing 'Enter' will return you to the previous main menu.

You can exit at any time by pressing the 'Menu' key.

1. **Volume Option**

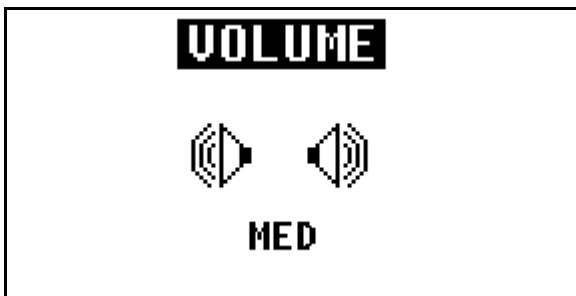


Figure 7: Volume Menu View

The Volume of the speaker output can be adjusted using the up (↑) or down (↓) keys. You have three levels: 'LOW', 'MED' and 'HIGH'. The volume icon changes depending on different volume levels. The settings can be used to set the speaker volume level depending on your current position along the system cable

You can exit at any time by pressing the 'Menu' or 'Enter' key.

2. **Test Speakers**

This Configuration Menu function allows testing of Speakers and Output Amplifiers. This is a critical part of the operation of the ABMA4. Without working speakers, the PSA alerts will not be heard and the unit fail as working intercom. As soon as you enter this menu, the speakers are tested by generating a 1.2KHz tone into both stereo speakers. The Test Speakers menu view look like:



Figure 8: Test Speaker Menu View

After the test depending on the state of the speakers, (i.e. working or not) the Speaker Icons will be displayed as crossed out if not working or as low volume speaker icons. For example, as figure below shows

that left hand speaker is good and right hand speaker is faulty. Either the fault is due to an open circuit to the speaker or speaker is not pulling enough current for normal operations.

The tone occurs for almost a second for menu changing from 'Testing' to 'Complete'.



Figure 9: Test Speakers Completed View

After the test has been completed, you can exit at any time by pressing either the 'Menu' or Enter Key.

3. Mute Level Menu

This menu allows you to view the mute level state and to adjust the mute level. Mute level is sometimes called Squelch (2-way radio terminology) and is used to turn the speakers off to save battery power until someone talks or PSA is received. You should adjust the mute level for noisy environments such as background electrical noise or RF pickup, which will cause speakers to open (turn-on). The default level is set to 'Low' noise. There is a setting below that called 'Clean' for very electrically quiet areas and two settings above that called 'Med' and 'High' for noisier areas. The menu is shown:



Figure 10: Mute Level Menu

To enter a menu option (eg. 'View Mute') you press the 'Enter' key. To move between menu options press the up (↑) or down (↓) keys.

1. **View Mute**

Allows you to view the mute level.

2. **Set Mute**

To enter 'SET MUTE' you must enter a four-digit password. The password prevents unauthorised access to the AMBA4 and should be setup when an authorised technician installs the unit. The current password for version 1.0 of the software is 4321 and is set using the up (↑) or down (↓) keys and the 'Enter' key. Below is shown the 'Password Access' screen and follow-on screen once a successful password has been entered:



Figure 11: Password Access screen

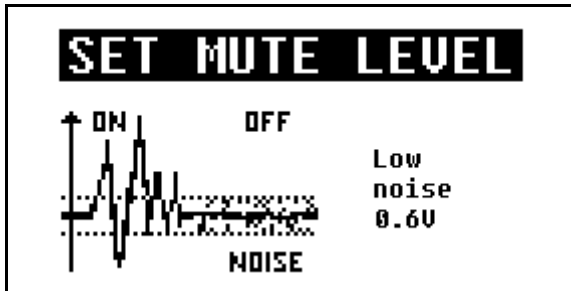


Figure 12: Set Mute Level Low

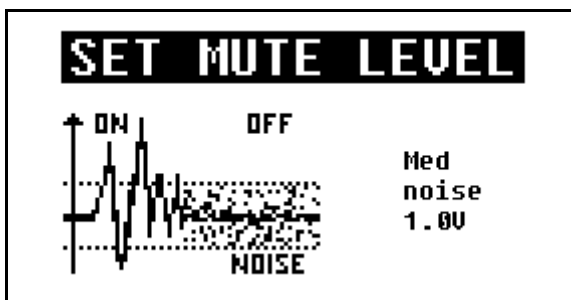


Figure 13: Set Mute Level Medium

4. About Menu

The 'About' menu show Austdac Logo and information on the product model and software version. To exit, either press 'Menu' or 'Enter keys.

The following screen will be displayed:



Figure 14: About Menu logo

After a further two second the following information will be displayed:

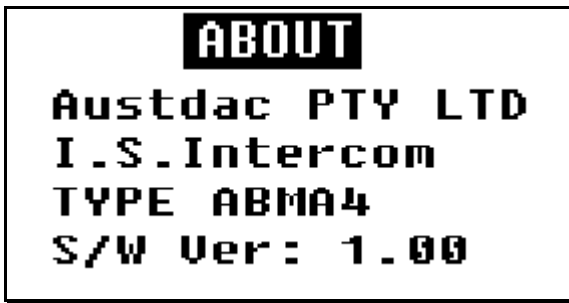


Figure 15: About Menu Information

6. INSTALLATION AND CONNECTIONS

Cable Shielding

From “PRE-START ALARM AND COMMUNICATIONS SYSTEM TYPE PSACS1” user manual (20-079-12) the following system cables are used: G2000 and G2000B both have a foil and drain wire and cable CABL25 has no shielding at all. The cable is a very important part in the system as it carries all the signals and distributes power to all the system components. Of the conductors, two are larger in cross sectional area than the other two. The two larger cross sectional area conductors are used to distribute power to the system components while the smaller conductors are used to convey signals between the various system components. The smaller conductors are the ones that have a foil sheath in the G2000 and G2000B cables. The connection of foil sheath and drain wire is critical for correct installation. You must either use the shield cable correctly with the ABMA4 R-Line (Common line) terminated with a shield drain wire at each ABMA4 or not use a shield foil/drain wire at all, which is the Austdac default method. The shield is not passed through and is left floating as depicted in the electrically simplified figure 16 below:

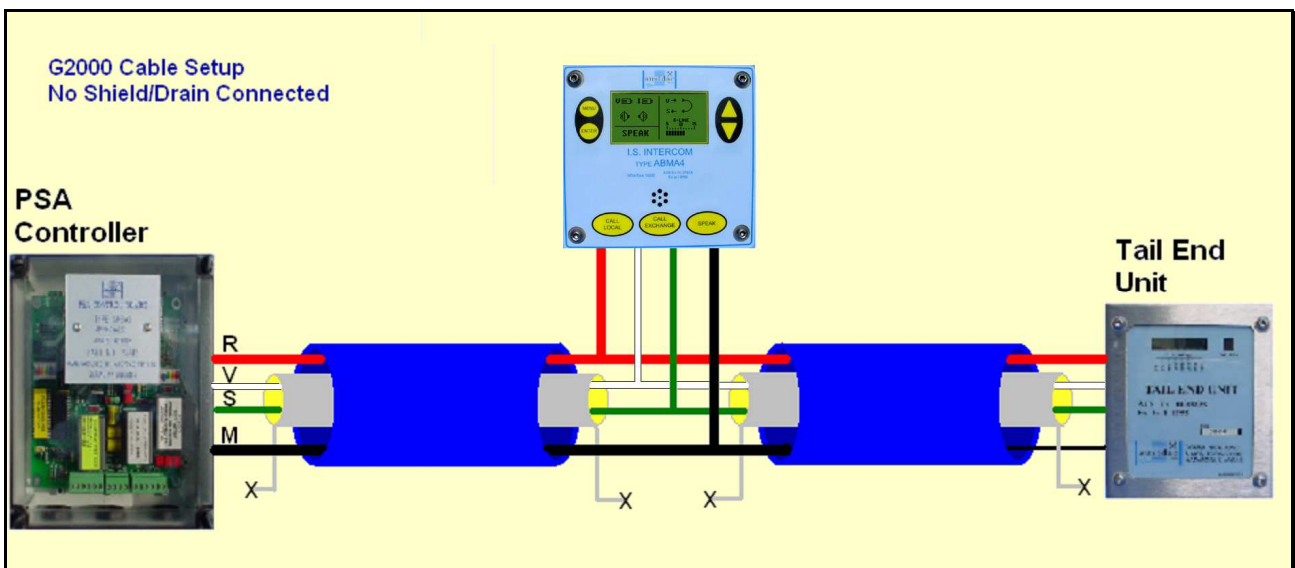


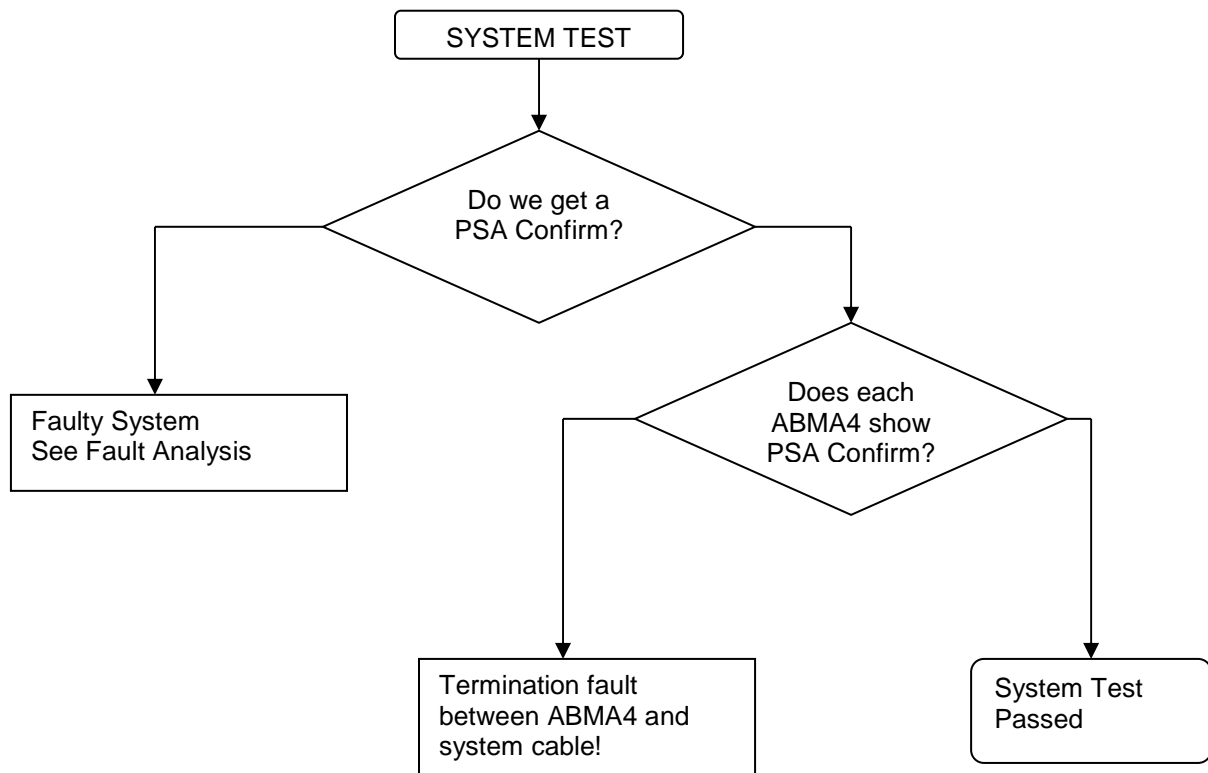
Figure 16: Simplified Un-Shielded Circuit

If the shield is passed through from one cable to another between ABMA4 terminations and is not terminated at the R-Line then this is electrically noisier than having no shield at all. The coupling between shield and the V and S cores has the effect of giving alternative PSA signal paths that can cause the PSA Controller and ABMA4s to receive false confirmations on tail end units.

7. SYSTEM TEST AND FAULT FINDING

The ABMA4 has a graphical display that can aid in fault finding along with the PSA Controller and End Unit. The primary system test and fault analysis occurs when the PSA Controller gets a confirmation from the end unit. The TEU (tail end unit) returns a signal via the S-Line and the user can hear a 'hee'-'haw'. If the user only hears a 'hee' or single tone pair then PSA Controller has not got a confirmation. The ABMA4 helps by displaying the system cable status by showing the R-Line, V-Line and S-Line states.

In Generic Display mode (see Generic Display Description section) you can view the R-Line voltage bar-graph and the PSA Loop status at a glance. Alternatively you can go into 'Menu Setting' to the 'Comms Line' menu and get more information on R-Line digital reading and the time the 'Last PSA occurred'. Below is a flow diagram of a System Test.



Flow Diagram Description

Following the right hand side of the diagram, you need to have a PSA confirmation from the controller and each of the ABMA4's has a PSA Loop to confirm status to get a System Test Passed. You should check that the 'Last PSA Confirm' time is correct by going into 'Comms Line' menu (see Configuration Menu Description and Fault Analysis below). If you get a PSA confirm from the controller but a ABMA4 unit doesn't show PSA Loop confirmation then fault is not in the system cable but between this cable and the unit itself (i.e. V and S lines crossed or cut etc..).

If you do not get a PSA confirmation from the controller, then you need to read the section on Fault Analysis.

Fault Analysis

Fault Analysis of the system looks at the PSA Loop graphic of the ABMA4 to work out where on the line is a fault. Possible reasons that a PSA controller does not receive a confirmation are as follows:

1. End Unit is not connected or has not enough volts (cable too long or too many units or system has be used heavily and now all units are drawing maximum current).
2. There is break in the V-line between the PSA Controller and TEU
3. There is break in the S-line between the PSA Controller and TEU
4. There is break in the R-line or M-line between the PSA Controller and the TEU

5. There is a combination of the three above

Analysis 1: Tail End Unit Is Not Connected

Shown below is an example of how to interpret the graphical interface on a group of ABMA4's when a TEU is faulty.

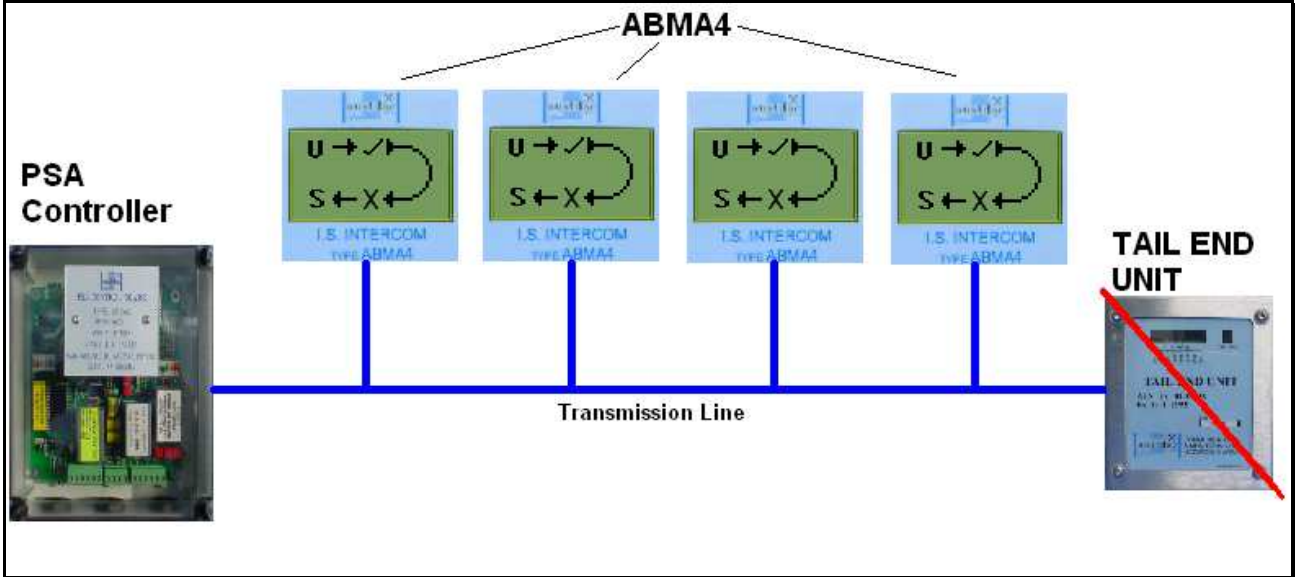


Figure 17: TEU Fault Example

The example above has a cut down view of four ABMA4s and an enlarged PSA Loop Icon for easier readability. The reasons for TEU not working are that it has been installed incorrectly, the cable too long or that it is mixing with an old BMA intercom (i.e. such as LEGACY INTERCOMS DAC TYPE STAGE II which don't have any current limiting) so that if the system is heavily used the current usage goes up and line voltage drops.

Analysis 2: There is a break in the V-line

The examples below show the enlarged PSA Loop Icon at varying states depending on where the V-line has been broken/cut.

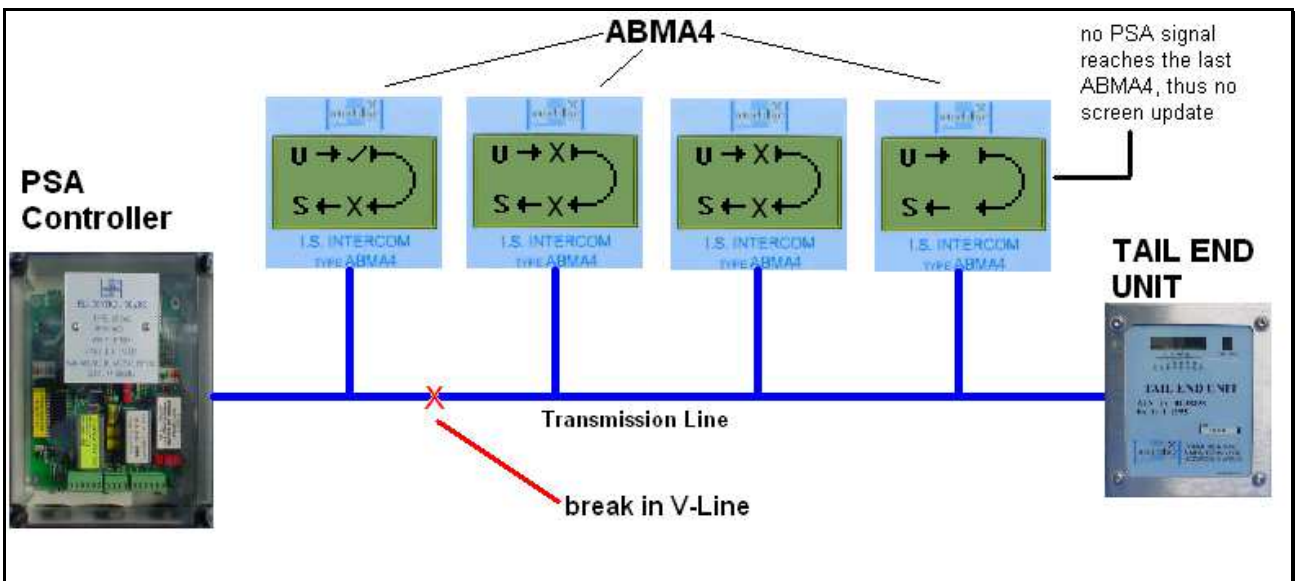


Figure 18: V-Line break at the front

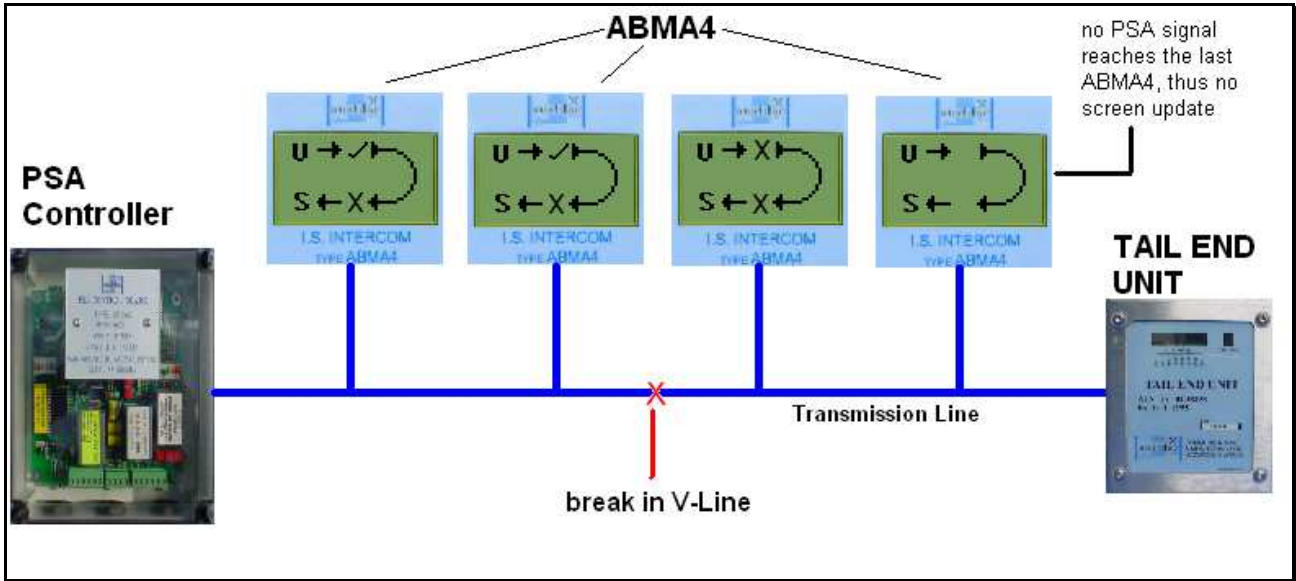


Figure 19: V-Line break in the middle

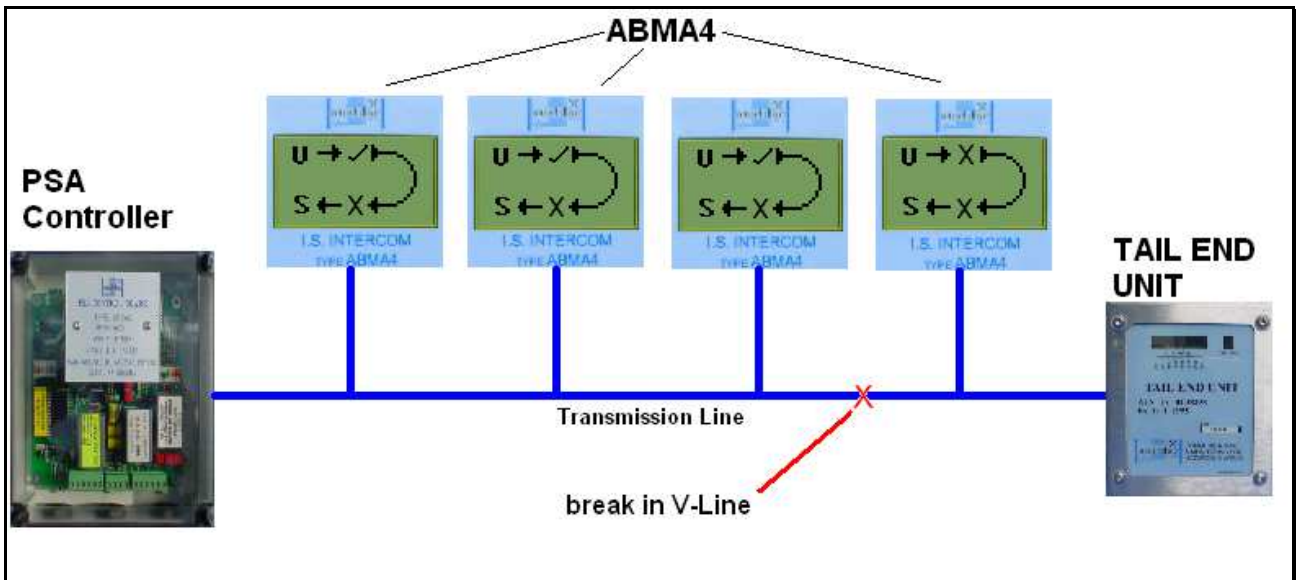


Figure 20: V-Line break at the end

The V-Line carries the PSA tones and a break in this line means that you will only get a 'hee' sound and the PSA controller will not get a confirmation. This should be your primary method of determining if the system OK or not.

The example above shows how the ABMA4 graphical display can help determine where the V-Line break has occurred. Note this is the most difficult to detect and analyse as the signal may not reach the end ABMA4 unit. The easiest analysis would involve just a walk down the system cable and a look at each generic display (i.e. wakeup each unit with a menu key press) to work out where the V-Line tick (✓) changes to a cross (×). Then the break will occur between these units. Unfortunately, because of the nature of system cable and installation history, how each ABMA4 interprets the V-Line signal after the cable break is indeterminate. If a cable is a 'clean' electrical (i.e. good shielding and correctly wired) then units after the V-Line break will not display any PSA Loop status. They will not have updated their display and the PSA Loop will have blanks (see figures on the end ABMA4 in figures 18 and 19).

If a system cable has electrical coupling between wires (no shielding and default installation) then the unit after the V-Line break will update the PSA Loop Icon with two crosses (×) as shown in the figures above. The crosses (×) indicate that there was a PSA signal detected but the level is weak enough to be assumed to be decoupling noise. The last and most likely occurrence is a combination of both, where some units have two crosses (×) and some units have blanks (or no valid confirmation).

You may have a break in the S-Line as well but until the TEU can return the signal (i.e. V-Line is OK) you have no way of analysing this scenario. A possible pit-fall in analysis of the ABMA4 graphical display is that you have a system working and then a fault occurs. The problem arises because the display will only show a PSA loop status from the last received PSA and if the V-Line is cut then the ABMA4s that do not have any V-Line signal **do not update**. So they will display two ticks (✓)! You must remember (see fault flow diagram) that a fault occurred because you did not get a confirmation from the PSA Controller. You can also check the 'Comms Line' menu (see Configuration Menu section above) to see when the last confirm occurred. The ABMA4 unit that has two ticks will have an old confirm time displayed. An alternative method to overcome the problem of the generic screen displaying two ticks is to reset all the ABMA4 along the system cable by turning off the PSA Controller for ten (10) minutes. This will reset all ABMA4s to show PSA Loop with blanks or un-initialized state. Then when you do the analysis you will only get cross (×) or blanks in the PSA loop icon.

Analysis 3: There is break in S-line

The examples below show an enlarged PSA Loop Icon at varying states depending on where the S-line has been broken/cut.

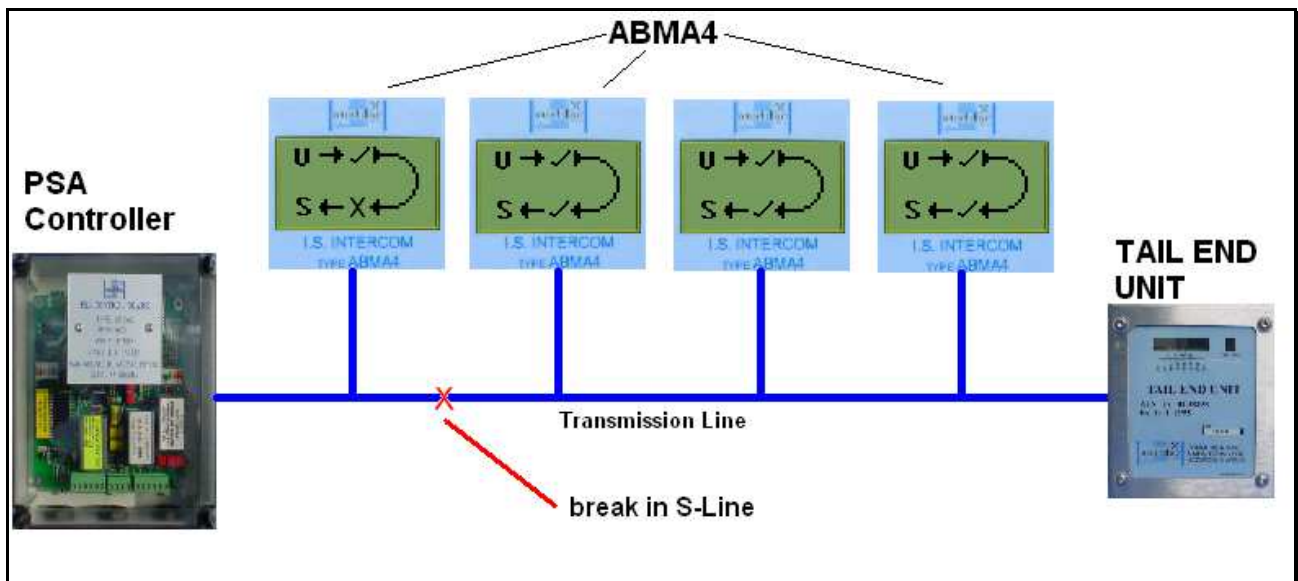


Figure 21: S-Line break at the front

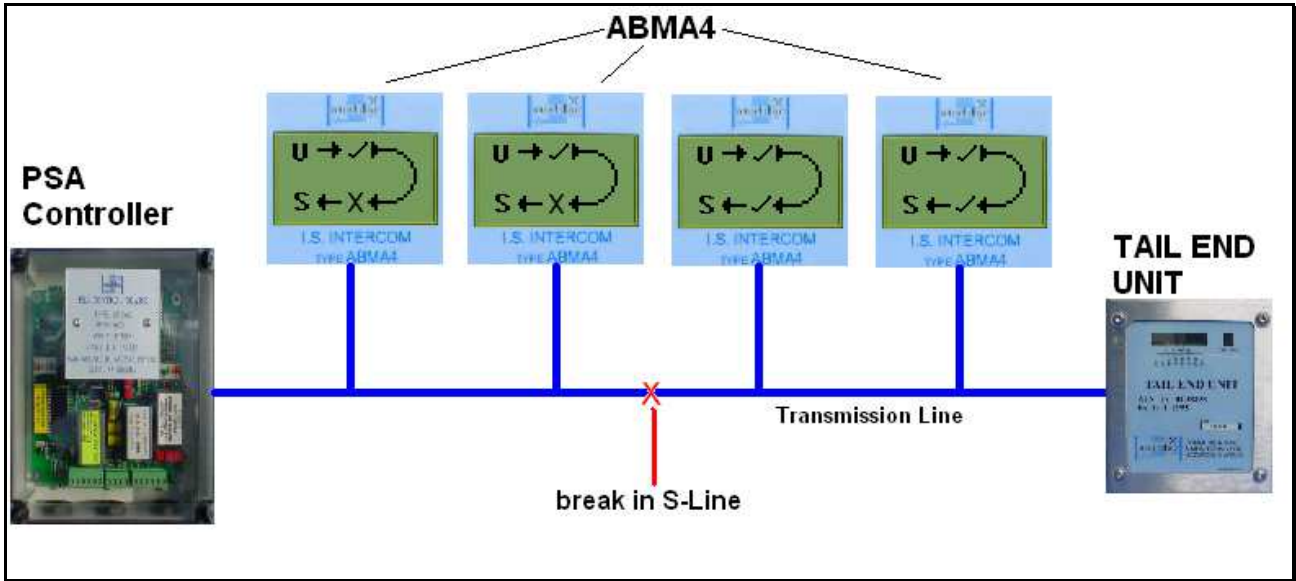


Figure 22: S-Line break in the middle

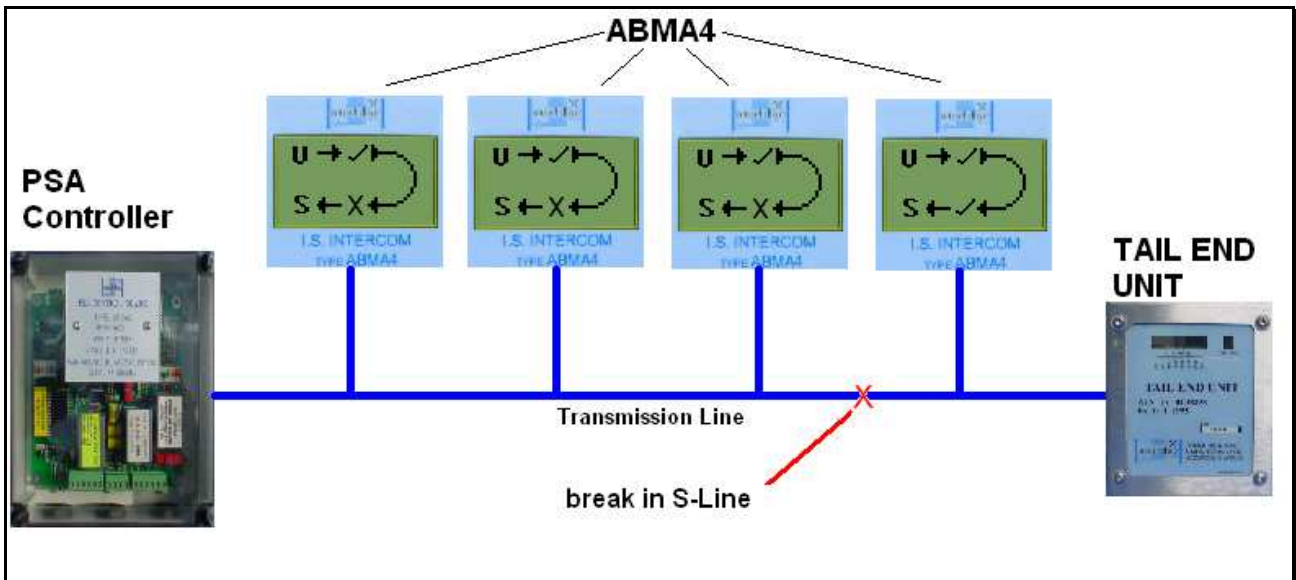


Figure 23: S-Line break at the end

The S-Line carries the return PSA tones back from the TEU. A break in this line means you should get only a 'hee' after the break and the PSA controller will not get a confirmation. Repeating, this should be your primary method of determining if the system OK or not.

The example above shows how the ABMA4 graphical display can help determine where the S-Line break has occurred. This method is easier to analyse than the V-Line break because all ABMA4 units will have updated screens. The method of detection is just a matter of walking between the TEU and PSA Controller and determining where a tick (✓) changes to a cross (X) on the S-Line. As shown in the figures above, a break occurs between a unit with a tick (✓) and unit with a cross (X). Note the ABMA4 will be in sleep mode and will need waking up by pressing the 'menu' key to show the display.

Analysis 4: There is a break in the R-line or M-line

Again as in the analysis above, if there is a break in the R-line (common line) the return PSA tones back from the TEU will not happen. You will only get a 'hee' sound after the break and the PSA controller will not get a confirmation. Again, this should be your primary method of determining if the system OK or not.

The examples below show an enlarged R-Line bar-graph Icon at varying states depending on where the R-line has been broken/cut.

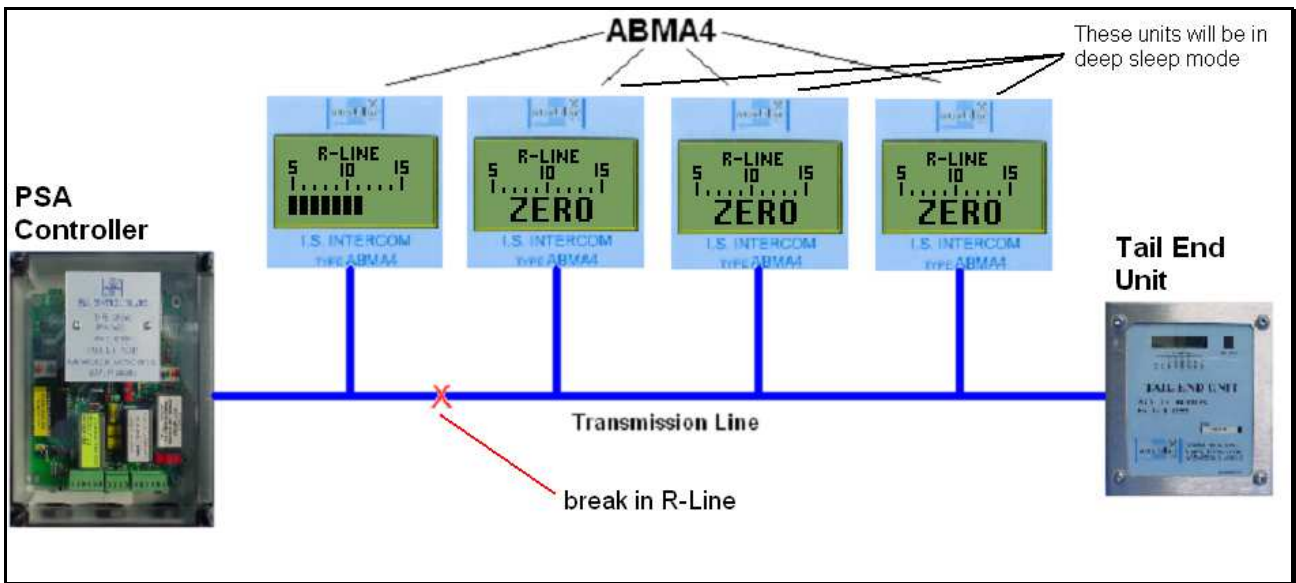


Figure 24: R-Line break at the front

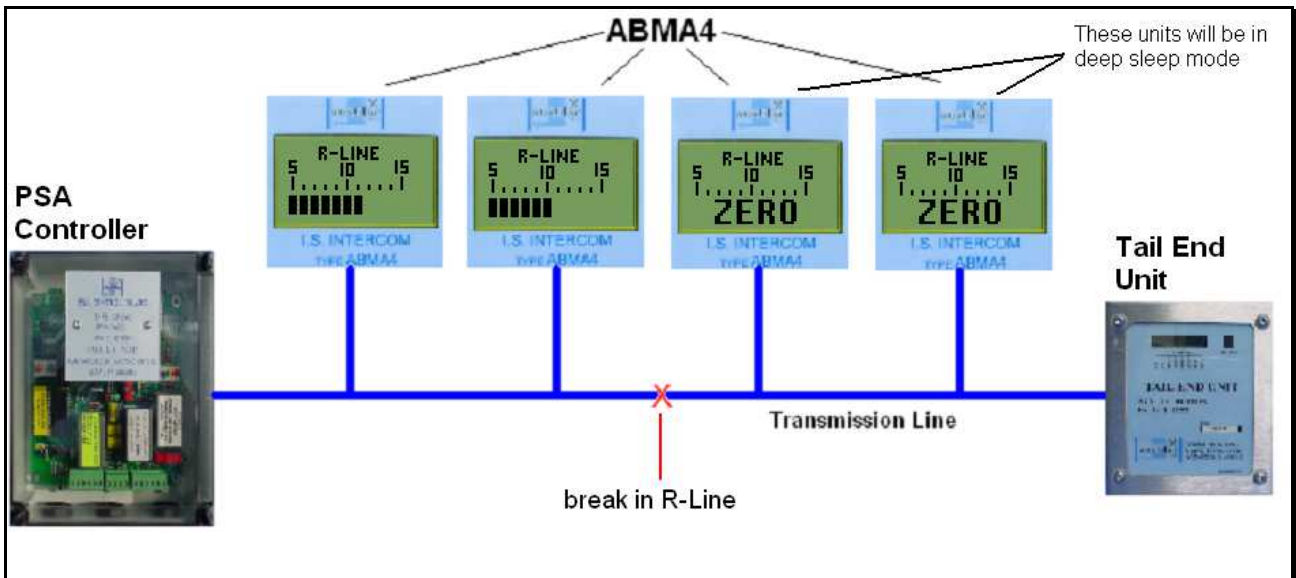


Figure 25: R-Line break in middle

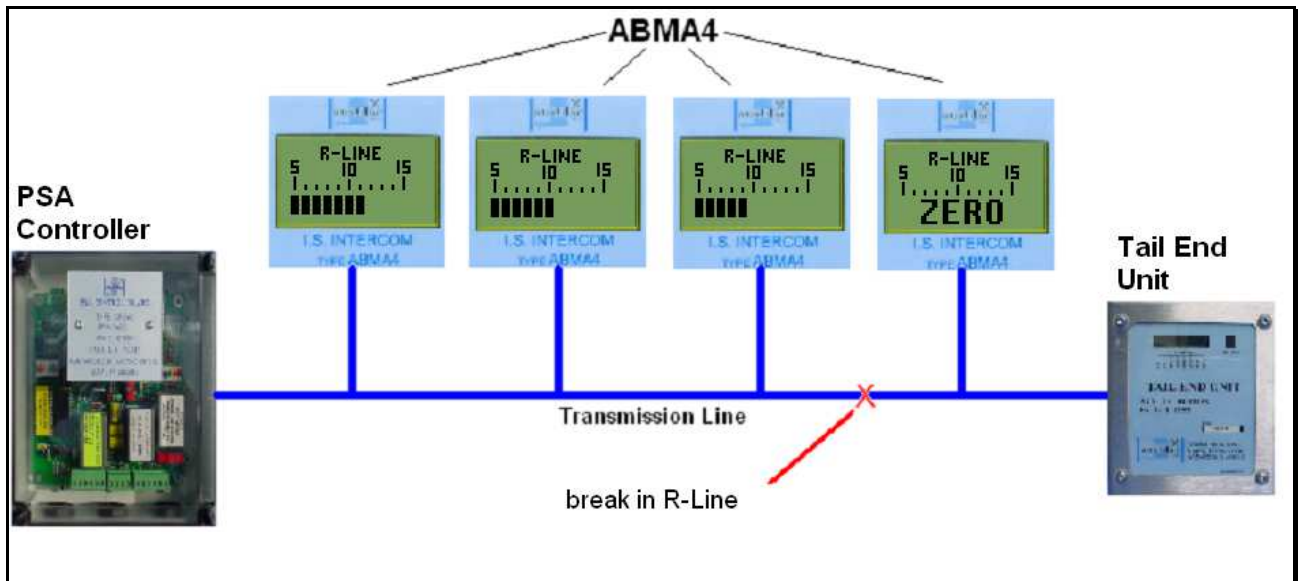


Figure 26: R-Line break at end

The analysis of the R-Line break is the same as the analysis of voltage drop along the system cable. As you walk along the system, the units (waking them up using the 'Menu' key) will have reduced R-Line voltage depending on the length of system cable and the number of ABMA or BMA you have on the system. The ABMA4 will go into deep sleep mode if the voltage is very low or zero. You can still take the R-Line voltage reading by waking the unit up by pressing and holding the 'Menu' key for three seconds (see Background Operation section above). If you would like more accuracy reading than the bar-graph (± 0.5) you can go into the 'Comms Line' menu (see Configuration Menu section).

Analysis 5: There is combination of the three above

Using the graphical display on the ABMA4 you can work out which units can see a V-Line, an S-Line and/or an R/M-Line. From this you can analyze the state of the system cable.

8. HANDSET

In special cases an ABMA4 can have a handset attached, in this case the front panel microphone will be disabled and only handset microphone will work.

9. CERTIFICATION

The intercom type ABMA4 has been certified for use as part of the Pre-Start Alarm and Communication System type PSACS1. The ABMA4 may be used within any PSACS1 system in accordance with the rules set forth in certificate AUS Ex 02.3829X and Austdac system certification drawing 20-035-19.

END OF DOCUMENT