

Handbook

DS32 Radio Communications Switch

Installation and Configuration

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DS32 Multi Operator – Multi Channel Digital Radio Switch

The DS32 has been especially designed for ease of use and installation. The employment of our own DSP code reduces the number of system components to a minimum, whilst offering you a wide selection of embedded features and signalling protocols.

Construction

The switch consists of one 3u equipment shelf, which will house up to 16 two-port cards. These ports can be configured to function in either operator termination or channel termination mode. In this way the system can consist of one operator and thirty-one channels or any combination of channels and operators up to a maximum of 32 ports.

The system can also be sub equipped to meet reduced capacity requirements. The shelf is mains powered and can be equipped with dual power supplies if required.

System Parameters

Individual card parameters are stored on each card within the shelf, and are shared with all shelf cards upon power-up and each time a card is re-set. This allows each card within the system to hold a virtual “map” of the system architecture giving details of card locations and port functions. This system allows cards to be unplugged from the shelf and re-inserted in a different location but still retain their functionality.

Should a fault occur and a card needs to be exchanged, simply plugging a new card into the shelf and setting it's port parameters (operator or channel) will cause the new configuration of the switch to be loaded into each card on the system.

The initial configuration and operating parameters for the system are entered at system build or system update time by the use of a PC or lap top computer running configuration software.

Inter System Communications

The cards within a DS32 system communicate by using a dual bus system under the control of an arbitration routine in which any system card can act as master controller. Upon system cards detecting the failure of the master controller, they then re-arbitrate to determine which card will act as master controller. This system provides a high level of resilience with a switch having no single point of failure.

System wide broadcast messages enable all operators to be synchronised with system events such as call status, channels in use, call waiting stack etc.

Communication to Operator Consoles

The central equipment shelf communicates to operator consoles using either an RS485 duplex interface or an RS232 interface, the type of interfaced used is selected by link options on the switch card and the operator unit. The type of signalling used and the interface between operators and the switch has been chosen to take advantage of industry standard CAT5 cabling and the ability to take advantage of structured wiring now being installed in most commercial premises. Remote operators can be routed to the switch by the use of voice over IP technology, allowing an operator to be located anywhere on either the internet or an organisations intranet.

Channel Termination

When a card port is configured as a channel termination, the system programmer has the option to specify one of the following embedded protocols:-

Simoco M80 Signalling

Full implementation of the M80 signalling format including 2970 Hz key tone and fsk messaging.

Motorola Signalling

Full implementation of the Motorola dual tone dual level tone-remote signalling standard.

Analogue Control Base Station

Locally situated base stations that require an analogue interface can be driven directly from the DS32 using volt free drivers.

A.W. Base Station Interface

Remotely located analogue base stations can be controlled using the A.W. base control panel which utilises a proprietary line signalling protocol offering full control and supervisory information from the base station.

The above facilities, which are all embedded features, are made possible by the use of bespoke DSP software. This software also enables the encoding and decoding of selective calling (all formats embedded), ffsk supervisory information and ffsk modem for data exchange with compatible mobiles and portable radio terminals.

Operator's Terminal

The basic control system employs a telephone style desktop control unit, which provides the operator with a keypad array, a two line by twenty character display, handset plus headset, external microphone, recording and facilities connectors.

The operators desktop controller also provides an RS232 port used for a call logging printer output or for the addition of PC or touch screen software interface.

Programmable Keys

The operator terminal is driven by either single keystrokes or by using a nested menu facility. The operator can pre-configure a number of frequently used keys in order to provide quick access to popular channels. Access to operator functions is unrestricted, however, further programming functions within the unit are password protected.

System Facilities

These include call stack, emergency calls with unique alert tones, selective calling, ffsk calling, call transfer between operators, GPS location solicit, multiple operator access to the same channel, broadcast facility, system intercom, channel to channel connect and full system wide status information.

Recording Facility

The system provides two audio channels for recording radio and operator traffic. Centralised multi-channel recording can be connected to individual channel and operator termination recording points located at the switch shelf where go and return audio is available. The second recording facility is available at the operator terminal and is intended to be connected to a local recording and re-play device (audio can be re-played through the control unit loudspeaker or headset) and both radio and telephone traffic are made available.

Expansion of the System Capacity

The basic system consists of a 3u shelf, which will accommodate up to sixteen two port cards and two power supplies. The minimum configuration is a single two port card that will enable one operator to control one radio base station. However it is envisaged that the minimum configuration will be two cards (four ports). The maximum capacity of a system can be increased to 64 ports with the addition of a second switch shelf.

Technical Specification

Configuration

Maximum number of ports	64
Maximum number of channels	63
Maximum number of operators	63
Maximum number of power units	4
Selective calling	Yes
FFSK data signalling	Yes
System call stacks	Yes
Operator intercom facility	Yes
System talk through option	Yes
Inter channel connect facility	Yes
Soft key functionality	Yes
Central audio recording facility	Yes
Local operator recording and re-play facility	Yes
Common headset functionality	Yes
Operation with best signal selector (voting)	Yes
Alpha tagging of channels	Yes
Alpha tagging of operators	Yes
Alpha tagging of Selcall identities	Yes
Alpha tagging of Selcall status	Yes
Built in test equipment	Yes
Use of industry standard cables and connectors	Yes
Utilises building structured wiring	Yes
Voice over IP operator interface option	Yes
System upgrade via flash	Yes
Desk top PTT	Yes
Optional Footswitch PTT	Yes
Headset option	Yes

Power Supply 90 to 264 volts AC 50 to 60 Hz

Dimensions System Shelf 3u 19 inch shelf

System Audio Levels

All system audio levels are adjusted by the use of digital potentiometers using the configuration software and are retained in non-volatile memory.

Landline interface	4 wire
Line output levels	-2 to -22 dBm
Line input levels	-2 to -22 dBm
Record levels	-10 dBm
Auxiliary port levels	-10dBm

System Configuration

A DS32 system consists of the main switch shelf equipped with one or more power supplies and one or more two-port audio interface cards. Each audio interface card can be configured as, either two operator ports; two channel ports or one channel and one operator port.

Ports on the DS32 are numbered from 00 at the bottom port of the card in the left hand slot, to 31 located at the top port of the 16th card in the shelf. Note that cards do not have to be placed in consecutive slots from the left hand side of the shelf, they can be located in any of the sixteen available positions.

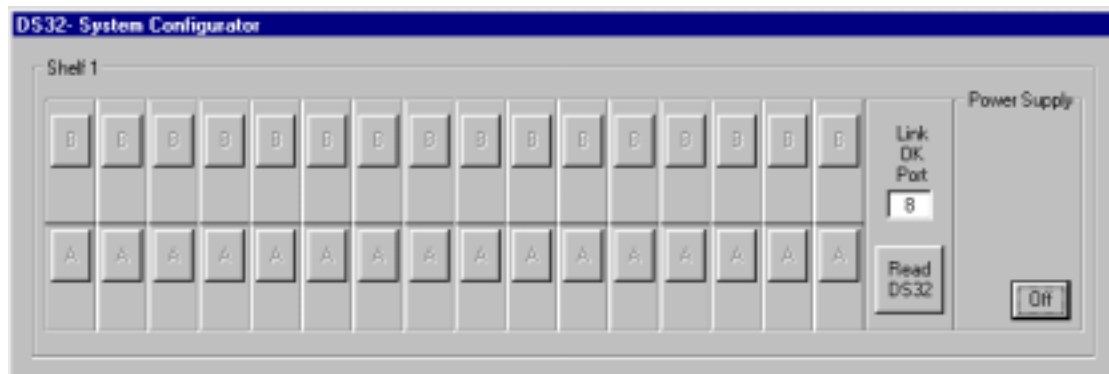
The Configuration of a system that determines the number of operators and channels within the system is carried out using the DS32Con software.

This software is supplied on a floppy disk as an executable file suitable for running under the windows operating environment (windows 98 and above). Communications with the switch is established by the use of a programming cable connected from the Com1 port of the PC to any channel port on the switch system.

DS32Con.exe

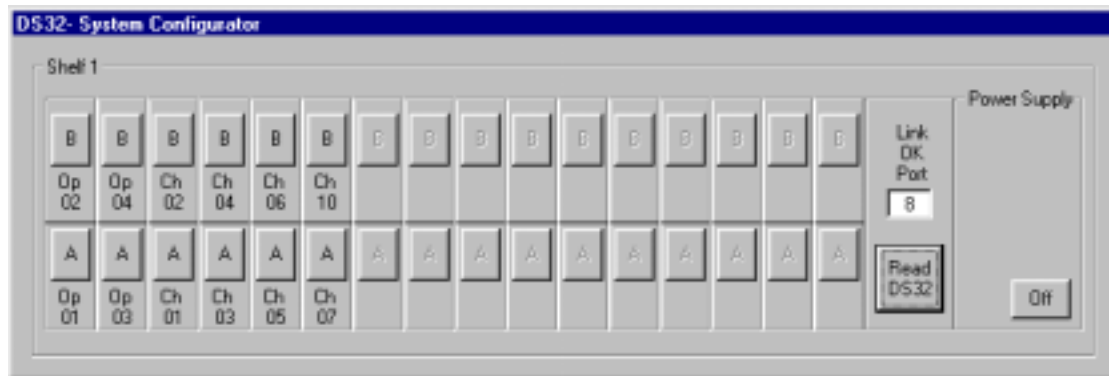
Upon starting the software you are presented with a graphical representation of the switch showing a single shelf with 16 cards that are currently disabled.

If the software is communicating with the DS32 switch, the “Link OK” message will be enabled and an indication of the port number that you are connected to will be shown in the Port window. The read DS32 button will also be enabled.



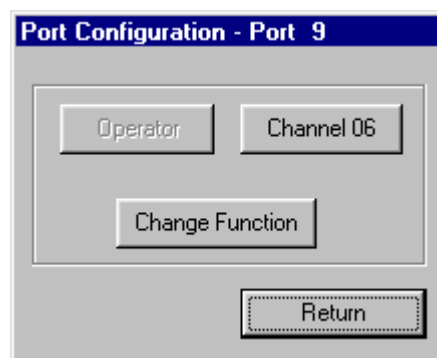
Click on the “Read DS 32” button to download the present configuration from the DS32 switch.

Following a successful download the screen will give a visual representation of the present switch configuration.



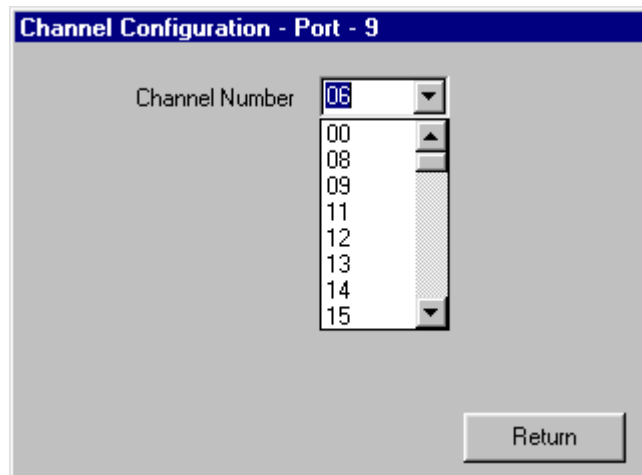
From this screen you can see the configuration of operator and channel ports within the switch and also the number of cards that are present. If a port has not been configured then the text below the port button will show “XX”.

Clicking on a port button (operator or channel) will allow you to change the configuration for that port.



This screen gives you the option to change the function of the port (from channel 06 to an operator port) or to change the channel number.

To change the channel number click on the Channel button.



From this screen you can select a new channel number for the port. As you can see only those channels available for use are offered for your selection. This ensures that channel numbers are not repeated on the system. If two ports do have the same channel number then the green LED will be illuminated on each port with the same channel number indicating a possible problem.

Clicking on the new channel number and the return button will re-configure the port and allocate it a new channel number.

Note that channel and operator numbers do not have to run consecutively and can be located at any position within the shelf. For ease of maintenance however it is recommended that a structured approach to channel and operator numbering and planning is carried out.

Setting operator numbers on the switch uses the same procedure as setting channel numbers.

Once that the switch has been configured click on the "Off" button to exit the program.

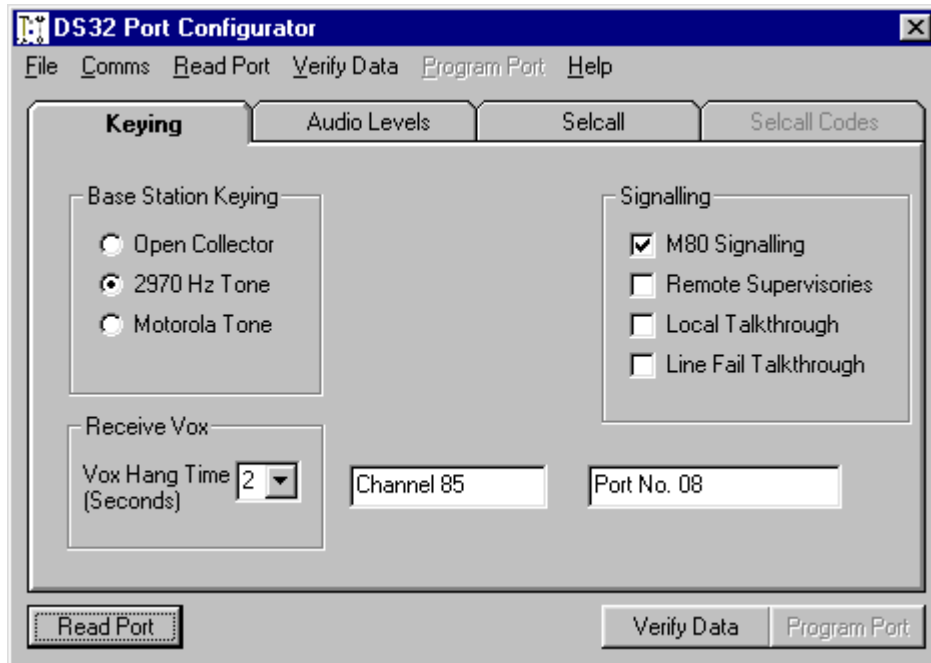
Configuring Individual Channel Ports

Where a DS32 port is to be used for connection to a radio base station the signalling parameters for the port is set by the use of the DS32 port configuration software DS32 Configurator.exe.

This software again runs on a PC using Windows 98 and above operating system, and also communicates with the switch using a serial port and the programming cable.

The DS32 port configuration software can only configure the channel port that the programming lead is connected to.

Upon starting the software, the main screen shows the channel and the port that the PC is connected to.



Note that the channel number shown indicates the racks internal numbering scheme as follows:-

Operator ports are numbered from 00 hex to 3F hex

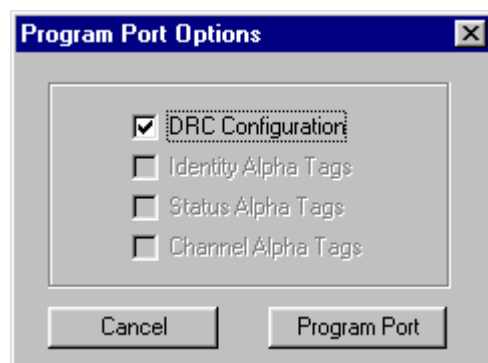
Channel Ports are numbered from 80 hex to BF hex

To download the connected port configuration, click on the “Read Port” button and follow the on screen instructions.

Once the configuration has been downloaded, you are able to alter the ports keying parameters, audio levels and Selcall signalling parameters, by use of the tabs on the main screen.

Once the configuration has been set to the required parameters for the appropriate port then click on the “Verify Data” button, which will check certain parameters, to ensure that they conform to some basic internal rules and if correct will then enable the “Program Port” button.

Clicking the “Program Port” button will then show a confirmation screen



Click on the “Program Port” Button to confirm your requirement to program the port and the software will download your new parameters to the Channel Port.

Note, it is not necessary to set the parameters for the operator ports, as these are set automatically when the port is configured as an operator.

System Installation

DS32 Shelf Installation

The DS32 shelf is supplied for installation in a communications rack or a single shelf cabinet, the shelf conforms to the 19 inch equipment racking standard and can be mounted in many racks that are produced by several manufacturers.

Ensure that the DS32 shelf is securely located within the cabinet or rack, and that suitable ventilation is provided above and below the shelf to allow for free air flow cooling (normally 1 u space above and below the shelf).

Power to the shelf is connected through a euro style connector on the rear panel of the DS32 switch shelf. The internal DS32 power supply operates from mains voltages of 90 to 264 volts AC with a frequency of 50 to 60 Hz, therefore ensure that the mains supply falls within these parameters.

Operator Connections

Connections between the DS32 shelf and individual operator units is through the use of industry standard CAT5 cabling. An RJ 45 socket is provided at each port of the switch, this can be connected directly to the RJ45 socket located at the rear of the operator console.

The CAT5 cable carries audio and data signalling between the operator unit and the switch, no additional connections are required. Note that the operator unit has its own power supply and its power is not derived from the switch.

Once connected to the switch each operator unit will communicate with the switch to determine their individual operator numbers. This number is displayed on the operator display to indicate correct communications has been established; the display then reverts to the normal operating screen.

The RJ45 connector that plugs into the operator port on the switch cannot be removed without the use of a small screwdriver to prise the retaining clip; this prevents accidental removal of the RJ45 plug and operator cable.

Channel Connections

Connections between the DS32 shelf and individual radio base stations is established through the RJ45 port connections on the front of the DS32 shelf.

An eight way cable with suitable RJ45 connector is required for connection to the port, the pin outs for the connector are as follows:-

Pin No.	Function	Comments
1	Line out 1	600 ohm
2	Line out 2	600 ohm
3	Line In 1	600 ohm
4	Serial Data In	
5	Serial Data Out	
6	Line Input 2	600 ohm
7	PTT Output	Open Collector
8	Ground	System Ground

For connection to private circuits to a radio base station Line out 1 and 2 are the outgoing (Transmit) pair and Line in 1 and 2 are the incoming (Receive) pair. On the cable supplied with the shelf for Base station interfacing these cables are the following:-

Line out (Transmit)	Grey and Brown wires
Line in (Receive)	Black and Yellow wires

Tape Record Outputs

The DS32 switch has facilities for recording the audio present on each port (operator and channel) the record connections for the ports are located on a Krone connection at the rear of the switch shelf.

The nominal audio levels for the tape outputs are – 10 dBm.

The record output is a single pair for each port and combines both incoming and outgoing audio for the port (transmit and receive).

Multicore cables can be used to connect the record outputs to a multi-channel tape recording device

Setting System Levels

System levels within the DS32 are set using the Port configuration software, all levels are set using digital potentiometers and their operating values are stored in non volatile memory.

The normal operating range of the input and output levels can be varied from -2 dBm to -20 dBm.

Setting Channel Port levels

The procedure for setting input and output levels for a channel port is straightforward, and is based on the fact that the tape output level is set internally within the two port card to -10 dBm.

Receive Level Setting

To set the port input level the following procedure is adopted:-

1. Set the audio input to the port to the required peak input level (nominally set to -10 dBm at factory test)
2. Monitor the output level at the appropriate port tape output using a level meter terminated in 600 ohm.
3. Reduce the audio input to be 10 dB below the peak input level.
4. Adjust the Input level of the port using the DS32 configuration software until a level of -20 dBm is noted at the tape output.
5. Increase the input level to peak levels and check that the tape output level increases to -10 dBm ± 1 dB
6. Increase the input level by a further 10 dB and note that the tape level output does not increase by more than 1 dB.

Receive levels are now set correctly.

Transmit Level Setting

1. Using the DS 32 configuration software set the port parameters to have open collector keying and local talk-through.
2. Using a control position set talk-through to "on" at the appropriate channel.
3. With the audio generator still connected to the channel input as in the Receive level setting, set the input to be 10 dB below peak levels.
4. Check the talk-through audio levels on the port line output connections using a level meter set to 600 ohm termination.
5. Using the DS32 configuration software set the port output level until a level of 10 dB below the required peak output is achieved. (peak output is nominally set at – 10 dBm on factory test).
6. Increase the line input level to peak input level and check that line output rises to peak levels.
7. Remove all test equipment, turn off talkthrough on the channel and set the channel parameters to the required settings for the base station to be used.

Transmit levels are now set correctly

It should be noted that the levels are set at 10 db below peak levels as there are audio limiters employed within the channel card, which could affect the results if the levels are set at Peak levels.

Setting Operator Port Levels

Operator port levels are set to a peak level of –10 dBm at factory test and generally should not need changing, however if the levels do need to be adjusted then a similar procedure to that used on setting channel levels is employed.

To ensure correct system levels the test tone is input at the auxiliary port of the DRC-32 controller as per the instructions in the DRC installation instructions, ensure that the controller is setting the correct level to line (nominally –10 dBm) then adjust the operator port card using the tape record output level as in the channel port receive settings.

Switch Indicators

As a visual indication that the switch is functioning correctly, three LED's have been installed adjacent to each port RJ45 connector. Also a green LED is located on each power supply, this indicates that the power supply is working correctly.

The Port indicators main function is to show the correct operation of the switch, this can be seen by the heartbeat LED's for each card (the bottom red LED) flickering as the switch performs routine housekeeping tasks. Looking at the front of the switch you should see the heartbeat LED's ripple across all cards in the system from left to right.

If the green LED is illuminate on one or more ports this indicated that these ports have got the same channel or operator number and that they will need to be configured using the switch configuration software to remove the error.

Should the Red LED's be permanently illuminated this indicates that the port is no longer communicating with the switch and the card will need thorough checking and returning to the manufacturer for re-test.

Servicing Policy

Power Supply Modules

The DS32 Power modules are a switched mode device and only suitably qualified personnel should attempt maintenance and repair of these units.

Tests of the units are limited to ensuring that the power indication LED is illuminated and that the output voltage is correctly set to +8 Volts DC +/- 0.2 volts.

Adjustment of the output voltage can be made using the small trimmer located under the front panel of the power module. This will necessitate the removal of the front panel by first removing the handle and then the two screws securing the panel to the power module.

Two Port Switch Cards

The DS32 switch consists of cards that are not suitable for on site repair and any card deemed to be faulty or require checking should be returned to the manufacturer for testing and repair if necessary.

Basic tests can be carried out on the card to ensure that audio levels are set correctly as per the level setting procedure and also that the card has been configured correctly. These should be carried out prior to declaring the card faulty.

A fixed price repair policy operates for the DS32 switch cards, providing that the card is serviceable and not beyond repair. The manufacturer reserves the right to reject any card that it feels is damaged beyond repair.

Warranty Statement

Subject to the conditions listed below, A.W. Communications warrant that equipment supplied by A.W. Communications will be free from defects in design material and workmanship for a period of 12 months from the date of delivery to its Customers. Any such defect notified to us within 12 months of delivery will be repaired or the equipment replaced (at our discretion).

The above warranty is subject to the following conditions: -

1. We shall be under no liability in respect of any defect in the equipment arising from any drawing, design or specification supplied by the customer.
2. We shall be under no liability in respect of any defect arising from fair wear and tear, improper use, wilful damage, negligence, abnormal working conditions, failure to follow our instructions (whether oral or in writing), misuse or alteration, incorrect installation or repair of the equipment without our approval.
3. The above warranty does not extend to materials, parts or equipment not manufactured by ourselves, in respect of which the customer shall only be entitled to the benefit of any such warranty or guarantees as is given by the manufacturer to us.
4. We will repair or replace equipment under this warranty provided we receive notification of the defect within 5 days of the occurrence of any fault, that you return the equipment at your risk and expense immediately on receiving our request to do so and that the equipment is returned with all appropriate identification labels and serial numbers intact.

System Records

To assist with ongoing repair and maintenance, it is advisable to keep a record of the configuration of the DS32 switch.

As an aid memoir the tables on the following pages can be used to record the important settings from the DS32 switch configuration.

Notes: