



## DCS88 Manual



This paper describes the features, hardware setup, operation, control, and specifications of the DCS88.

The DCS88 transmits digital audio in real time on a CobraNet<sup>®</sup> Ethernet computer network or two DCS88s can be used in a stand-alone configuration, where both will transmit and receive 8 audio channels. With less than a 5-millisecond latency (delay), live audio performance and mix can be distributed through Ethernet networks with no audible delay.

In Ethernet or standalone, the maximum cable length is 100 meters for CAT-5 type wire. For greater distances, Ethernet switches or fiber optic cables with media converters can be used. A working knowledge of Ethernet switches and hubs is assumed when incorporating the DCS88 into a network. For further information on CobraNet, please refer to Peak Audio's website [www.peakaudio.com](http://www.peakaudio.com). For information on Ethernet, there are numerous publications available.

[\(Please refer to the block diagram.\)](#)

The DCS88 is comprised of 3 circuit boards, CM-1 board, Digital board and Analog board.

The CM-1 board is the digital engine of the DCS88 and contains numerous features, beyond for the scope of this paper. In essence, the CM-1 board interfaces Ethernet with the digital audio outputs ( I<sup>2</sup>C form ) fed from Whirlwind's Digital board.

The Digital board contains the computer control hardware and software for interface to the CM-1 board, control of the analog audio circuitry, the Analog to Digital (A/D) converters and the Digital to Analog (D/A) converters with the output line drivers.

The Analog board contains the mic preamps, VC's, phantom power and headroom indicators. The interface from Analog board to Digital board is line level balanced audio.

#### **POWER REQUIREMENT:**

The DCS88 is powered remotely through the connected CAT-5 cable. Powering the DCS88 always must be done with CAT-5 cable through one of Whirlwind's DCSP series power supplies into one of the two Ethernet RJ45 jacks.

#### **THE DCS88 FEATURES:**

- 8 mic or line level, balanced inputs and 8 line level, balanced outputs.
- Remotely powered via the CAT-5 cable up to 100 meters.
- Employs many configuration methods for redundancy and fail safe protocols.
- Input VOLUME and MIC/LINE controls are via front panel, through wired Whirlwind DCS88 remote(s) or controlled via a network operator using Whirlwind's PC Control Application.
- Hardwired remote controls in wall mount or tabletop enclosures.
- Four flash memory locations allow save and recall of three presets and the fourth backs up current settings.
- Lock out feature for both front panel and remotes.
- Completely software updateable via network.
- 24 bit or 20 bit operations on Analog to Digital (A/D) and Digital to Analog (D/A) converters for high-resolution audio or to maximize channels per bundle.
- Wide input and output level range will interface with most types of audio equipment.
- Phantom power automatically applied to inputs set to mic mode.
- Two DCS88s in a stand-alone configuration can create an 8 X 8 snake with input level adjustability at either end.
- CROSSWIRED CONTROL MODE allows control of unit at “far” end of cable or bundle assignment.

- SIGNAL/CLIP LEDs on all channels provide instant visual setup and confirmation of audio signals.
- LEDs for monitoring of proper network operation.
- Address wheels for setting input and output bundle assignments.

### **ADDRESS WHEELS:**

There are 4 - sixteen position ADDRESS rotary switches under the metal cover plate on the front of the DCS88. These can be adjusted with a small flat blade screwdriver. These switches set the CobraNet audio transmit and receive “bundles”. There are 2 types of bundles:

Multicast : transmits/receives audio to all CobraNet devices

Unicast : transmits/receives audio to a specific receive/transmit bundle assignment.

The two address wheels on the leftmost side are labeled TX ADDRESS and the two rightmost are labeled RX ADDRESS. TX address is the bundle on which the DCS88 will transmit; RX address is the bundle on which the DCS88 will receive the digital audio information. With the TX and RX wheels set identically, the inputs loop their signal through to the unit's outputs.

With the DCS88 not in hardware lockout, the unit will read and use the address wheel setting upon power up, or any time the address wheels are changed. With either of the 2 hardware lockouts on, (see dipswitch #5 and Advanced Mode function #8) the DCS88 will ignore any changes to the address wheels.

Position 00 is off. The other settings are listed in the following table:

Switch 1	Switch 2	Bundle Assignment
0	0	0 (None)
0	1-F	1-15 (Multicast)
1-F	0-F	272-511 (Unicast)

When using the DCS88 in 24 bit mode channels 1-7 will be on the first bundle number set by the address wheels and the 8<sup>th</sup> channel will be on the next higher bundle number. This is true for transmit and receive. Other DCS88 units cannot be set to this 2<sup>nd</sup> bundle being used for channel 8 and must skip to the next higher

**CROSSWIRED CONTROL MODE:**

The CROSSWIRED CONTROL MODE switch is for use with two DCS88s in a stand-alone situation with a crosswired cable, or when paired in a unique bundle assignment on an Ethernet hub or switch. In LOCAL INPUTS mode, the CHANNEL SELECT, MIC LINE select and VOLUME are active for that unit. In REMOTE INPUTS mode the CHANNEL SELECT, MIC LINE select and VOLUME controls operate the inputs for the unit at the far end of the crosswired cable, hub, or switch using serial bridging of CobraNet. Pushing the CROSSWIRED CONTROL MODE switch changes what the local hardware controls. A solid color (not blinking) red LED (LOCAL INPUTS) or green LED (REMOTE INPUTS) indicates the status. When a unit is being controlled remotely through the serial bridge the green REMOTE INPUTS LED blinks, indicating that the unit is being changed by another source. It is possible for 2 people to control one unit and have the LOCAL INPUTS LED on solid and REMOTE INPUTS LED blinking.

**STATUS LEDS:**

There are 4 Network status LEDs on the DCS88 front panel. These LEDs indicate network conditions and use “flags” generated by the CM-1 board.

Status LED	LED color	Description
FAULT	RED	Indicates an error has occurred on the network. Some examples are bad cables, faulty hardware or bad data.
COND	RED	Indicates that this unit is the CONDUCTOR. Only one unit per network is the conductor, which sends out pulses used by all other units to synchronize their timing. Which unit becomes the conductor varies at power up.
LINK	GREEN	Indicates the DCS88 is LINKED to other equipment.
IN USE	GREEN	Indicates the DCS88 is transmitting and receiving data to/from another unit on the network.

**DIP SWITCHES:**

There are 8 dipswitches on the right side of the DCS88, which set various functions on the unit. The switches can be set at any time when the unit is on.

The up position is on.

Dipswitch #	1	2, 3	4	5	6	7, 8
Function	Remote Enable/Disable	Zone Selection for Remotes	Crosswired Control Mode Enable/Disable	Front Panel Enable/Disable	20/24 Bit Width	Stereo/Mono Channel Linking

### 1: Remote Enable

When this switch is in the on position, the remotes work normally; changes to the remotes mic/line, level, and near/far settings are reflected on the DCS88. When this switch is in the off position, the remotes do not control anything and go completely dark.

### 2-3: Zone Selection for Remotes

These two switches select four different addressing modes for the remotes. When using a DCS88 with multiple zones or rooms, this prevents accidental changes to audio from one room by another. Remotes must be set to different addresses.

Switch State	Description	
off - off	“Any remote controls any channel.” The remote's CHANNEL SELECT directly selects the channel to be controlled. There is no mapping involving the remote's address by the master.	
off - on	“Channels divided by four.” The DCS88 uses both the remote's address and channel encoder value to determine what channel to control. The DCS88 divides the remote address space by 4 to service 4 rooms, each with 2 remotes. Remotes for the first room would use address 0...7, the second room's remotes use address 8-15, third room uses 16-23, fourth uses 24-31. Within each of these rooms, each remote's address is further used to specify which channel that remote can control.	
	Address	Allows the remote to set audio channels
	0	First remote 1 and 2
	1	First remote 3 and 4
	2	First remote 5 and 6
	3	First remote 7 and 8
	4	Second remote 1 and 2

	<table><tr><td>4</td><td>Second remote 1 and 2</td></tr><tr><td>5</td><td>Second remote 3 and 4</td></tr><tr><td>6</td><td>Second remote 5 and 6</td></tr><tr><td>1</td><td>Second remote 7 and 8</td></tr></table> <p>This pattern repeats for the other three rooms. Room 2's first four address would be for the first remote, second four addresses for second remote. etc</p>	4	Second remote 1 and 2	5	Second remote 3 and 4	6	Second remote 5 and 6	1	Second remote 7 and 8										
4	Second remote 1 and 2																		
5	Second remote 3 and 4																		
6	Second remote 5 and 6																		
1	Second remote 7 and 8																		
<i>on - off</i>	<p><i>“Channels divided by two.”</i> The DCS88 divides the remote address space by 2 to service 2 rooms, each with 4 remotes. Within each of these rooms, the remote's address is further used to specify which audio channel the remote can control.</p> <table><tr><th>Address</th><th>Allows the remote to set audio channels</th></tr><tr><td>0</td><td>First remote Ch. 1-4</td></tr><tr><td>1</td><td>First remote Ch. 5-8</td></tr><tr><td>2</td><td>Second remote Ch. 1-4</td></tr><tr><td>3</td><td>Second remote Ch. 5-8</td></tr><tr><td>4</td><td>Third remote Ch. 1-4</td></tr><tr><td>5</td><td>Third remote Ch. 5-8</td></tr><tr><td>6</td><td>Fourth remote Ch. 1-4</td></tr><tr><td>7</td><td>Fourth remote Ch. 5-8</td></tr></table> <p>This pattern repeats for the other remote group (address 8-16).</p>	Address	Allows the remote to set audio channels	0	First remote Ch. 1-4	1	First remote Ch. 5-8	2	Second remote Ch. 1-4	3	Second remote Ch. 5-8	4	Third remote Ch. 1-4	5	Third remote Ch. 5-8	6	Fourth remote Ch. 1-4	7	Fourth remote Ch. 5-8
Address	Allows the remote to set audio channels																		
0	First remote Ch. 1-4																		
1	First remote Ch. 5-8																		
2	Second remote Ch. 1-4																		
3	Second remote Ch. 5-8																		
4	Third remote Ch. 1-4																		
5	Third remote Ch. 5-8																		
6	Fourth remote Ch. 1-4																		
7	Fourth remote Ch. 5-8																		
<i>on - on</i>	<p><i>“Remote's address is channel number.”</i></p> <p>The remote's channel number is ignored. Instead the remote's address is used to select the channel number that is being controlled. The master takes the remote's address modulo the number of channels to determine the channel number. Using the DCS88 and current remotes as an example:</p> <p>Remote Address 0 Controls Channel 1 Remote Address 1 Controls Channel 2 Remote Address 2 Controls Channel 3</p>																		

	Etc,
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#### 4: Crosswired Control Mode Enable/Disable

When this switch is in the on position, CROSSWIRED CONTROL MODE switch (on the front panel and indicated with red and green LEDs) selects which DCS88 is being controlled. When the switch is in the off position, the front panel CROSSWIRED CONTROL MODE switch does nothing and the associated LEDs do not light on the DCS88 or any remotes. CROSSWIRED CONTROL MODE is only to be used with two DCS88s hooked up with a crosswired cable or set to corresponding TX and RX addresses.

#### 5: Front Panel Enable/Disable

When the switch is in the on position, the front-panel controls (switches, pot, and CHANNEL SELECT) on the DCS88 are enabled and work as expected. When the switch is in the off position, these front-panel controls do nothing. When the front panel is disabled, all front panel headroom and network status LEDs still work. The TX and RX address wheels are also disabled with this feature and the DCS88 will save the TX and RX bundle address setting when front panel is disabled. When the front panel is re-enabled the DCS88 will change the bundle TX and RX address ONLY after movement is detected on the address wheels.

#### 6: 20/24 Bit Width

When the switch is in the off position, the DCS88 is configured to use 20-bit audio. When the switch is in the on position, the DCS88 uses 24-bit audio. The CobraNet standard only contains enough space in a bundle for eight 20-bit audio streams. When the user selects 24-bit audio, the eighth channel must be placed in a separate bundle. The bundle number is one (n+1) more than the base bundle the other seven streams are contained in.

The DCS88 uses the same scheme used in the QSC Rave bundle assignments (see [peakaudio.com/CobraNet/RaveRotarySwitch.html](http://peakaudio.com/CobraNet/RaveRotarySwitch.html)). This presents a incompatibility when using 24-bit audio with bundle assignment 15 and 511, where the n+1 bundle number changes from uni-cast to multi cast. (The eighth audio channel will be put into bundle 16 and 512 respectively.) When using 24 bit, one MUST use transmit and receive bundle numbers that are at least 2 numbers apart if the transmit bundle is less than the receive bundle. Failure to observe this causes packet collisions and intermittent loss of connection.

#### 7,8: Stereo/Mono Channel Linking

Adjacent input channels in the DCS88 can be linked together to allow control of stereo input pairs. The two switches dedicated for Channel Linking result in the following four possible combinations:

<i>off - off</i>	There is no channel linking.
<i>off - on</i>	Channels 1-2 are linked, the rest are independent.

<i>off - on</i>	Channels 1-2 are linked, the rest are independent.
<i>on - off</i>	Channels 1-2, and 5-6 are linked, the rest are independent.
<i>on - on</i>	Channels 1-2, 3-4, 5-6, 7-8 are linked.

When channels are linked, setting the CHANNEL SELECT to either of the two linked channels allows stereo adjustment using VOLUME control.

### **AUDIO SECTION:**

Balanced audio inputs and outputs are connected to the DCS88 via plug-in Phoenix screw type terminal blocks located on the right side of the unit. The plugs (4 supplied) handle 4 channels each and allow quick solderless connection and routing flexibility.

The MIC/LINE button, CHANNEL SELECT and VOLUME controls are used to adjust the input volume for the 8 input channels.

To set an input's level:

Rotate the CHANNEL SELECT knob to select the channel to be adjusted.

Select mic or line mode with the MIC/LINE switch.

Rotate the VOLUME control until the MIC/LINE LEDs stop flashing\*. This indicates that you have reached the position of the current gain setting and the VOLUME pot is now active.

Rotate the VOLUME control to the new level.

Return the CHANNEL SELECT knob to the off position.

\*Moving the VOLUME control when the CHANNEL SELECT is OFF or set to a different channel or adjusting the VOLUME via a remote or another unit in FAR mode or via the PC Control Application can cause the VOLUME control to be in a different physical position from the actual VOLUME setting. To avoid accidental feedback (too much gain) or other abrupt audio volume changes when a channel is selected for adjustment, the MIC/LINE LEDs will flash and the VOLUME control will not engage until it is adjusted to match the actual gain setting. At that point, it will stop flashing and remain steady, indicating that the VOLUME control is now active.

The DCS88 will "time out" after 30 seconds of inactivity and stop flashing the MIC/LINE LEDs so as not to be confused as a warning. After the timeout however, if control movement is detected and the VOLUME control's physical position still does not correspond to its actual setting, the unit will again start flashing the MIC/LINE LEDs (until the pot is adjusted to the actual level or another timeout occurs). If the unit's physical VOLUME position is adjusted to the match its actual position, the VOLUME control will be active for that channel all the time until one of the above conditions happens.



active for that channel and not changing the CHANNEL SELECT or MIC/LINE settings.

In MIC mode, the audio inputs can be boosted by 62dB and phantom power is applied to the input terminals. In LINE mode, phantom power is switched off for that channel. When changing the MIC/LINE setting, the DCS88 will mute the audio signal (for that channel only) for a brief time (3.3 seconds) while the circuits change. The muting interval uses one timer in the DCS88. If other MIC/LINE settings are changed before the 3.3 seconds have elapsed, the timer will reset and the audio will return 3.3 seconds after the last mic to line transition has occurred. The VOLUME control adjusts the gain of a VCA after the input circuits and before the A/D converters. The VOLUME control has a range of -50 to +30dBm and has an audio taper feel from the 9 o'clock to 3 o'clock position. This range allows easy adjustment of the audio with approximately a 3dB change for each of the o'clock positions.

The SIGNAL/CLIP LEDs display the input and output levels. They allow for quick visual setup on the inputs and confirm signal on the outputs. The thresholds of the LEDs are set so the green LED illuminates when the audio signal is 18dB below clipping, and the red LED illuminates 3dB below clipping. To optimize the input level into the A/D converters, levels should be adjusted so the green LED lights all the time with audio. To further increase performance (lowering noise and distortion), set the input level so that the red LED flashes but only on the audio peaks. If the RED led is illuminating steadily, reduce the input level. As with all digital equipment, it is important to never clip the A/D converter.

Line outputs on the DCS88 have 6dBm of gain after the D/A converter. The maximum level at the analog outputs of the DCS88 is +10dBm balanced, capable of driving most audio equipment.

When controlling a remote DCS88 in a two unit CROSSWIRED CONTROL MODE, the eight output SIGNAL/CLIP LEDs mirror the inputs on the remote box and therefore can be used to set the remote unit's input levels.

### **REMOTE CONTROLS:**

There are two RJ45 connectors on the DCS88 for remote controls and protocol translators. This interface uses RS-485 protocol to transmit and receive Whirlwind Asynchronous Remote Protocol (WARP). The RJ45 connector on the side of the DCS88 is intended for hookup to the wall mount models and the RJ45 connector on the front panel of the DCS88 is intended for the tabletop model remote. The remotes are powered thru the RJ45 cable and operate with 5VDC power at 50mA maximum. A single wall mount remote can be connected up to 500 feet total length from the DCS88. In a daisy-chained configuration with multiple remotes, the chart below lists some common cable lengths that may be used.

(Lengths in Meters)

<b>Length from DCS88 to Remote 1</b>	<b>Length from Remote 1 to Remote 2</b>	<b>Length from Remote 2 to Remote 3</b>	<b>Length from Remote 3 to Remote 4</b>
30	50	75	100
100	20	20	20
10	75	80	80
30	170	90	
100	300		

A separate remote hub unit allows up to eight remote controls to be configured in a star topology with greater cable lengths.

There are 3 remote controls available for the DCS88:

The eight channel tabletop (DCSRT8) version has a sloped enclosure with the same control surface as the DCS88 and is connected via CAT-5 cable.

Two wallplate versions are available in either eight channel (DCSRW8) or single channel (DCSRW1) models. Each can be mounted in a standard single gang wall plate (not included). The eight channel versions include the CHANNEL SELECT, VOLUME and MIC/LINE select controls only. The single channel version features the VOLUME control only and the channel it controls is assigned with jumpers on its circuit board. Both wallplate models have two RJ45 connectors for daisy chain style hook up.

The DCS88 will provide power for up to 4 remotes without need for an external power source. Remotes have internal jumpers for setting their address, can be configured for selective audio channels and provide stereo/mono grouping when set up and used in conjunction with the ZONE SELECTION FOR REMOTES dipswitches on the DCS88. Up to 8 remotes can be configured per DCS88 with certain audio channels available at one or more remotes. This allows the DCS88 to service 2 and 4 rooms with stereo/mono sends and returns.

All remotes can be “hot patched” to the DCS88 unit.

### **ADVANCED MODE:**

Advanced Mode allows users to store and recall presets in memory, manage front panel and remote lockouts, turn Auto-Store on or off and determine what version of software the DCS88 is using.

#### To place the DCS88 into Advanced Mode:

Rotate the CHANNEL SELECT control to the off position (12 o'clock). Press and hold the MIC/LINE and CROSSWIRED CONTROL MODE buttons simultaneously for 2 seconds. The unit will acknowledge entering Advanced Mode by blinking of the four-network status LEDs.

#### To switch the DCS88 out of Advanced Mode:

Rotate the CHANNEL SELECT control to the off position (12 o'clock). Press and hold the MIC/LINE and CROSSWIRED CONTROL MODE buttons simultaneously for 2 seconds. The unit will acknowledge leaving Advanced Mode by stopping the blinking of the four-network status LEDs.

The DCS88 will “time out” and exit Advanced Mode off automatically if no changes have been made in Advanced Mode for a period of one minute.

In Advanced Mode the CHANNEL SELECT control operates these features:

#### Positions 1-4, Memory Access:

Memory locations #1-3 are user memories. Memory location #4 is the Auto-Store memory location. With Auto-Store on, the settings on the DCS88 are saved (into preset #4) after five minutes of control inactivity. Preset #4 is read every time the unit is powered up.

To store or recall memory presets:

Rotate the CHANNEL SELECT control to desired memory location number (1 – 4).

To store: Press and hold the MIC/LINE button for 2 seconds. The red MIC LED will flash 3 times to indicate that the settings have been saved.

To recall: Press and hold the CROSSWIRED CONTROL MODE button for 2 seconds. The green REMOTE LED will flash 3 times to indicate that the settings have been recalled.

#### Position 5, Firmware Version:

This position is used to indicate the firmware version of both the DCS88 and the CM-1 module. In this position, the MIC/LINE and CROSSWIRED CONTROL MODE LEDs are used to indicate the version.

#### DCS88 Firmware Version:

Press the MIC/LINE button. The MIC LED (red) will blink once to alert the user that the first digit of the version number is about to be displayed. The LINE LED (green) will then blink for 0.5 seconds at a time and the number of blinks indicates the digit minus 1; 1 blink=0, 2 blinks=1, 3 blinks=2, etc. Between each digit there will be a 1 second pause to indicate the end of one digit's blink code and the beginning of the next.

#### CM-1 Firmware Version

Press the CROSSWIRED CONTROL MODE button. The LOCAL LED will blink once to alert the user that the first digit of the version number is about to be displayed. The REMOTE LED will then blink for 0.5 seconds at a time and the number of blinks indicates the digit minus 1; 1 blink=0, 2 blinks=1, 3 blinks=2, etc. Between each digit there will be a 1 second pause to indicate the end of one digit's blink code and the beginning of the next.

#### Position 6, Auto-Store

Select this position to control Auto-Store on and off. When Auto-Store is set to on, the green LINE LED will illuminate. When Auto-Store is set to off, the red MIC LED will illuminate. The MIC/LINE switch toggles Auto-Store on and off. With Auto-Store on, the DCS88 will store VOLUME and MIC/LINE settings for all 8 inputs into memory location #4 after five minutes of control inactivity. This means that the DCS88 must be left untouched for 5 minutes before it stores the settings. Using Advanced Mode and storing current settings into memory location #4 can do an immediate write to Auto-Store. Memory location #4 is always read and used when the DCS88 is powered up. Auto-Store is set ON in the factory defaults.

#### Position 7, Remote On/Off:

This function allows the operator to enable or disable access by remote controls via the RJ45 remote jacks. This will only work if DCS88 REMOTE ENABLE/DISABLE dipswitch #1 is in the "On" position.

To access this function, place the DCS88 in Advanced Mode and rotate the CHANNEL SELECT control to channel #7. Each press of the MIC/LINE button toggles the remote access feature on and off. Status is indicated by the MIC/LINE LEDs: green LED=ON, red LED=OFF.

#### Position 8, Front Panel Hardware On/Off:

This function allows the operator to enable or disable the front panel controls, including the address wheels. This will only work if DCS88 REMOTE FRONT PANEL ENABLE/DISABLE dipswitch #5 is in the "On" position.

To access this function, place the DCS88 in Advanced Mode and rotate the CHANNEL SELECT control to channel #8. Each press of the MIC/LINE button toggles the front panel controls on and off. Status is indicated by the MIC/LINE LEDs: green LED=ON, red LED=OFF.

**PROTOCOL TRANSLATOR:**

The Protocol Translator is an optional accessory that allows interface between WARP protocol and Crestron or AMX systems. It features an RJ45 jack for connection to and for application of power from the DCS88. A DB9 connector is provided for connection to the AMX/Crestron system. A separate WARP protocol paper describes this function. The Protocol Translator should be used at address number 16 and greater so it will not interfere with the remote control units.

**ANALOG SPECIFICATIONS:**

Frequency Response	25 – 16kHz, +/- 2dBv
Total Harmonic Distortion +noise	< .05 % at 1kHz, typical .03%
Total Gain	Line Mode: +30dBv Mic Mode: +62dBv
Gain of Microphone Preamp	+32dBv
Gain of Channel Volume	+30dBv
Range of level pot	-50 to +30dBv
Maximum Input level	+18dBv
Input Impedance	Line Mode: 8700 Ohms balanced Mic Mode: 1300 Ohms balanced
Maximum output level	+10dBv
Output Impedance	100 Ohms
Noise at unity gain	< -75dBv, typical -79dBv
Noise at 32dBv of gain, mic mode	< -74.5dBv typical -78.5dBv
Isolation between input channels	> 100dBv
Isolation between output channels	> 100dBv
Clip LED threshold	-18dB for SIGNAL LED -3dB for CLIP LED
Phantom Power	+48VDC
Power consumption	.511A, all channels driven into clip
Stereo Separation	> 100dBv

