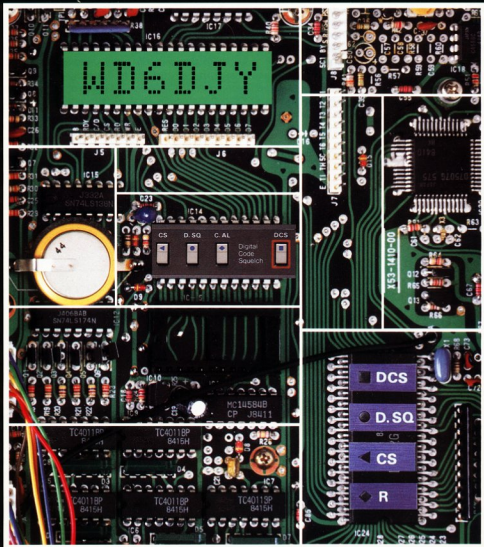


# KENWOOD

## DCS "Digital Code Squelch"



# DCS "Digital Code Squelch"

**TRIO-KENWOOD's new DCS "Digital Code Squelch" is a revolutionary signalling concept for Amateur Radio that utilizes current state-of-the-art technology. This new technology is a major feature of the new TR-2600 A/E, TR-3600 A/E "2-m and 70-cm FM Handheld Transceivers", the TM-211A/E, TM-411A/E "2-m and 70-cm FM Mobile Transceivers", and the TS-711A/E, TS-811A/B/E "2-m and 70-cm All-mode Transceivers". The DCS should not be confused with conventional CTCSS (Continuous Tone Coded Squelch System). DCS uses a 5 digit, digitally coded data string, to open squelch on a receiver that has been programmed to accept this same specific code group. By utilizing a 5 digit code group the operator may choose from 100,000 possible combinations, thus providing increased security. In addition to the 5 digit "access code" the DCS also transmits the operators call sign, in decimal ASCII code. Call signs of a maximum of 6 digits may be entered. By using the optional CD-10 Call Sign Display, the operator may store incoming call signs, for later review or logging.**

## [FEATURES]

### ERROR CORRECTION

The DCS utilizes an error correcting code system that reduces the possibility of errors due to electrical noise, etc.

### 100,000 DIFFERENT 5 DIGIT CODE GROUPS

Convenient keyboard entry of the "access code" is possible with all models equipped with the DCS.

### CAPABLE OF MONITORING MULTIPLE ACCESS CODES

The DCS codes, and call sign data, are stored in separate memory locations within the host unit. This allows the operator to monitor several access code groups at one time. Clubs and nets will find this function useful, as will operators who wish to listen for more than one group at a time.

### AUTOMATIC CALL SIGN TRANSMISSION

A 6 digit Amateur "Call Sign" is entered into the DCS memory using decimal ASCII coding, by use of the front panel keyboard. This call sign is then transmitted in conjunction with the DCS data string each time the P.T.T. switch is depressed or released. By using the optional CD-10 Call Sign Display the operator can automatically store up to 20 different call signs. This feature is useful for unattended monitoring of the radio. Upon return to the station the operator can review the CD-10 memory to determine who tried to contact him during his absence. This function is also useful for logging purposes.

### CONVENIENT REPEATER OPERATION

The DCS uses a mark frequency of 1200 Hz and a space frequency of 1800 Hz which are within the normal speech bandwidth of most repeaters.

## [DCS OPERATING THEORY]

Figure 1 shows the block diagram of the DCS. IC1 is the main CPU for the radio. It controls all input/output functions for both the radio and DCS. IC2 is the DCS CPU. It is controlled by the main CPU, and controls the DCS operation. IC3 is a MSK (Minimum Shift Keying), MODEM (Modulator/Demodulator). It provides an interface for transmission and reception of the DCS data to the main transceiver.

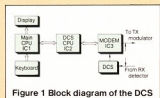


Figure 1 Block diagram of the DCS

### CONTROL SIGNAL

The actual DCS signal is composed of 4 sections as shown in Figure 2. Error correction is provided thru use of the Hageberger method of data encryption.

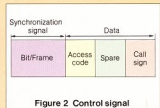


Figure 2 Control signal

1. Bit/frame Synchronizing signal  
This signal is used to distinguish between noise and data signals.
2. Digital Code Data  
This is the 5 digit access code.

### 3. Spare Data

Control signal data reserved for possible future expansion of the DCS capabilities.

### 4. Call Sign Data

A 6 digit alpha-numeric call sign is contained here in decimal ASCII code.

This control signal is transmitted at a Baud rate of 1200 bits/sec. An example of the control signal is shown in figure 3.

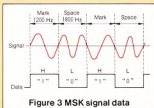


Figure 3 MSK signal data

The time required for transmission of this control signal is approximately 200 milliseconds and should not affect normal communications. Transmit audio is disabled during the period required for the DCS signal to be transmitted, to prevent possible interference to the DCS signal. Figure 4 shows an example of the actual transmitted signal from initial depression of the PTT switch to release of the PTT switch.

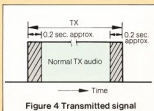


Figure 4 Transmitted signal



**TS-711 A/E, TS-811 A/B/E:**  
2-m and 70-cm All-mode Transceivers.



**TM-211 A/E, TM-411 A/E:**  
2-m and 70-cm FM Mobile Transceivers.

**TR-2600 A/E, TR-3600 A/E:**  
2-m and 70-cm  
FM Handheld Transceivers.

\* These DCS transceiver brochures are available individually for details.

## ACCESS CODE AND CALL SIGN DATA ENTRY

The actual method of entry will vary from unit to unit. Some units enter data digit by digit, while others enter data in small groups. Specific instructions are contained in each transceiver's operating manual. Call sign data is entered using decimal ASCII coding. See table 1.

A : 65	B : 66	C : 67	D : 68
E : 69	F : 70	G : 71	H : 72
I : 73	J : 74	K : 75	L : 76
M : 77	N : 78	O : 79	P : 80
Q : 81	R : 82	S : 83	T : 84
U : 85	V : 86	X : 87	W : 88
Y : 89	Z : 90	space : 32	
0 : 48	1 : 49	2 : 50	3 : 51
4 : 52	5 : 53	6 : 54	7 : 55
8 : 56	9 : 57		

Table 1 Decimal ASCII code table

## CODE SQUELCH OPERATION

Refer to figure 5 for a flow chart of how the DCS operates.

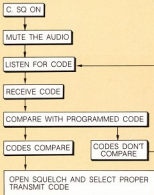


Figure 5 Flow chart

## TRANSMITTER BLOCK TERMS

- Mode of modulation F2 frequency modulating.
- Signal composition.

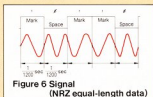


Figure 6 Signal  
(NRZ equal-length data)

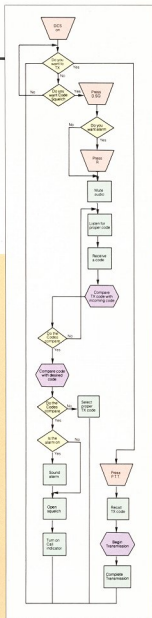
- The DCS signal is a NRZ (Nonreturn-to-Zero) equal-length data string. Mark and space frequencies are 1200 Hz and 1800 Hz (each deviation : within  $\pm 200$  ppm).
  - Code transmission speed is 1200 bits/second ( $\pm 200$  ppm deviation).
- Frequency deviation is from  $\pm 2.5$  kHz to  $\pm 5$  kHz for carrier frequency without modulation.

## [BASIC OPERATION]

- Press the DCS key, to turn on the DCS. The DCS LED indicator should light.
- RX monitoring**  
Squelch will open when the proper code is received.
  - TX operation**  
Depressing the P.T.T. switch causes the DCS access code signal to be transmitted.

### [DCS control]

Code: ..... NRZ equal-length Code  
 Modulation: ..... MSK Modulation  
 Frequency Deviation: .....  $\pm 3.5$  kHz standard ( $\pm 2.5$  kHz  $\sim$   $\pm 5$  kHz)  
 Mark Frequency: ..... 1200 Hz (Deviation:  $\pm 200$  PPM)  
 Space Frequency: ..... 1800 Hz (Deviation:  $\pm 200$  PPM)  
 Code Transmission Speed: ..... 1200 bits/ second (Deviation:  $\pm 200$  PPM)



# CD-10 Call Sign Display



The CD-10 stores the call sign of calling station in its memory and displays it on an LCD display. Call signs of up to 20 of the most recently calling stations are stored, allowing the operator to quickly check for and return any call.

## [Features]

### DCS Decoding

Decodes the digital ASCII call sign data that is a portion of the DCS data string.

### CMOS 8-bit Microprocessor

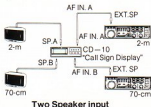
The microprocessor analyzes the call sign data transmitted from the DCS, corrects any data errors due to noise, etc., and displays the incoming call sign in alpha-numeric characters. The microprocessor also controls various switching and memory functions, etc.

### Two Speaker Inputs

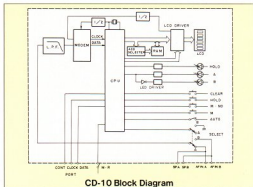
Two speaker input jacks are provided so that the display may be connected to more than one receiver at a time. Speaker selection is provided by a front panel switch.

### Compatible with non DCS receivers

The CD-10 may be used with transceivers that are not equipped for DCS decoding.



Two Speaker input



### LCD Display with 6-digit 5 x 7 Dot-matrix

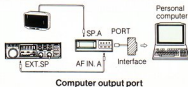
The high visibility display provides a variety of information in addition to the 6 digit call sign.

### Memory Function

Up to 20 different call signs may be stored in the resident memory. Memory backup is provided by a built-in Lithium battery.

### Computer Output Port

A computer output port is provided for interfacing to a personal computer. This port supplies call sign, and memory data in the form of serial output data. This handy function will allow automatic logging, etc.



Computer output port

## [Option]

### AC-10: AC Adaptor

#### [SPECIFICATIONS]

Input voltage	AC 120/220/240 V
Frequency response	50/60 Hz
Output voltage	DC 13.8 V
Output current	200 mA



## CD-10 SPECIFICATIONS

Power Requirement	: 13.8 VDC ± 15%
Operating Temperature	: 0°C - +50°C
Input Impedance	: More than 10 kΩ (output open)
Output Impedance	: 8 Ω (input 8 Ω load)
Input Voltage Range	: 0.1 - 4 V (output 8 Ω load)
Input Signal Frequency	: Mark 1200 Hz Space 1800 Hz Baud Rate 1200 bit/sec

Data Output	: Data = TTL level Clock = TTL level Baud Rate = 3600 bit/sec
Dimensions	: 125 (4.92) W x 40 (1.57) H x 106 (4.17) D mm (inch) (Projections not included)
Weight	: 250 g (0.55 lbs.) approx.

(K.W.M.) 841130 ① B Printed in Japan

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