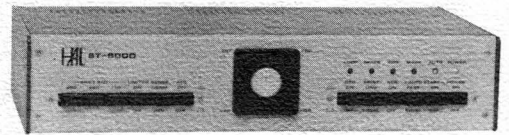


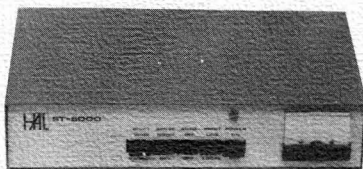
HAL COMMUNICATIONS CORP.



DS3100 ASR



ST6000



ST5000



DS2000

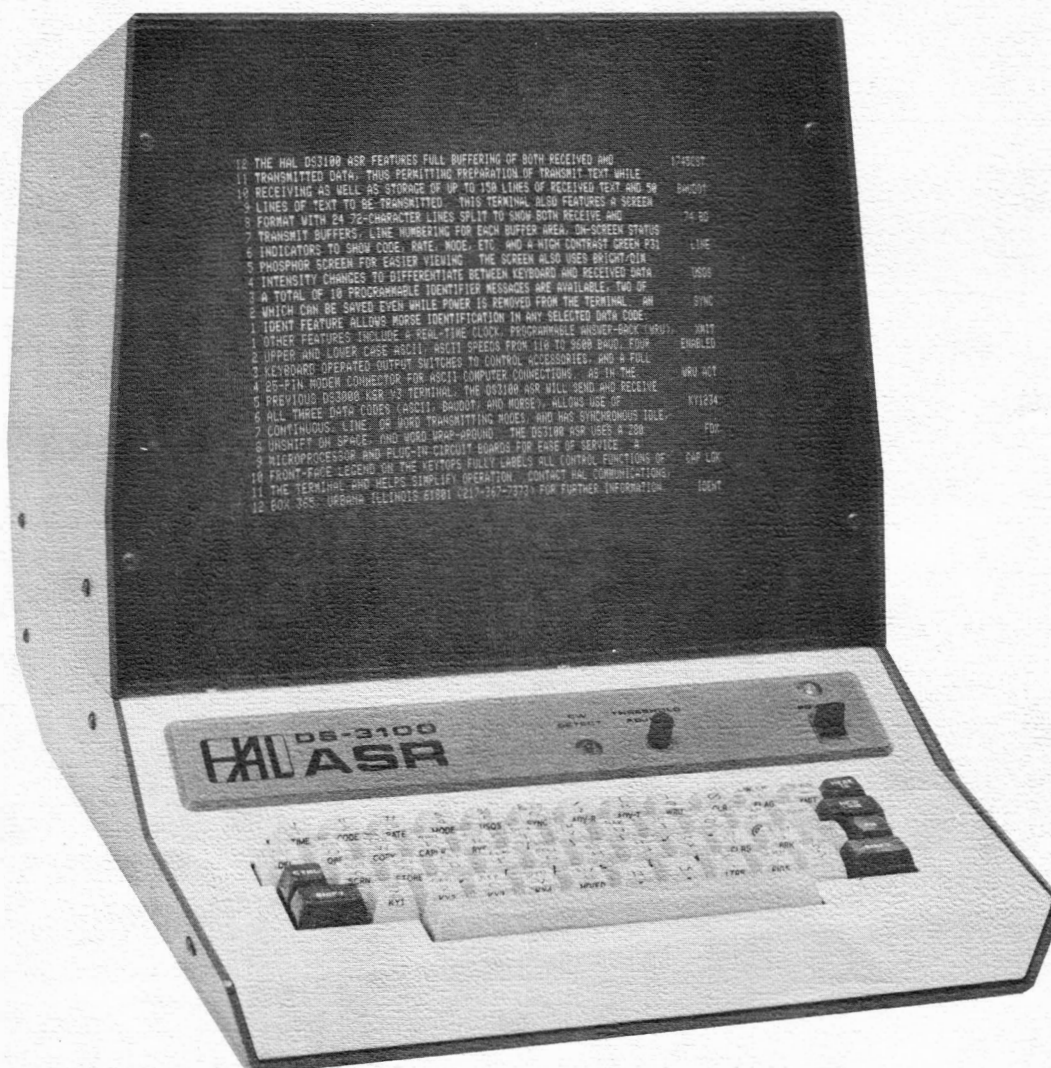
SPRING, 1979

AMATEUR RADIO CATALOG



HAL COMMUNICATIONS CORP.
Box 365
Urbana, Illinois 61801
217-367-7373

DS3100 ASR



AUTOMATIC SEND-RECEIVE TERMINAL

The DS3100 ASR is an electronic communications terminal for transmission and reception of coded communications using either the Baudot or ASCII teleprinter codes or the Continental Morse telegraphy code. The DS3100 is microprocessor controlled and provides many features to assist the operator. In particular, the DS3100 is the *first* multi-code terminal to provide full buffering of received and transmitted text, thus allowing composition of transmit text *while receiving*. This is the so-called "Automatic Send-Receive" (ASR) or "Buffered Send-Receive" (BSR) type of telecommunications terminal. The DS3100 also features programmable identification messages (a total of ten), internal real-time clock, on-screen display of the terminal status, an answer-back system for *all three codes*, and full keyboard control of the terminal as well as many many more conveniences. Particular attention has been given to the display and keyboard design to make for convenient and enjoyable operation. All terminal control functions are clearly marked on the custom triple-legend keytops, and the terminal's operating condition is clearly shown by on-screen *status indicators*. The DS3100 includes a new green P31 phosphor screen for ease of viewing. Try the DS3100 ASR for yourself and enjoy the operating features and convenience.

DS3100 ASR

SPECIFICATIONS

Input/Output:

Baudot: 18-120 ma / 200 V current loop
RS232C voltage levels
ASCII: 18-120 ma / 200 V current loop
RS232C voltage levels
Full 25 pin Modem connection
Morse: 10 v p-p (600 ohm), 800 Hz audio input
Transistor switches to ground to key either negative voltage ("grid-block") or positive voltage ("cathode") circuits simultaneously.

Data Rates:

Baudot: 45, 50, 57, 74, 100 baud (60, 66, 75, 100, 132 wpm)
ASCII: 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 baud (10, 15, 30, 60, 120, 180, 240, 480, 960 cps)
Morse: Receive: automatically track 1 to 199 wpm
Transmit: preset to 1 to 199 wpm in 1 wpm increments

Data Codes:

Baudot: 7.5 Unit code (1 start, 5 data, and 1.5 stop)
A - Z, Ø - 9, .? :\$!&#() , BELL; / " LTRS FIGS CR LF
Space Blank; Automatic FIGS/LTRS and CR/LF inserted as required.
ASCII: 110 baud: 11 unit code (1 start, 8 data, 2 stop)
150 - 9600 baud: 10 unit (1 start, 8 data, 1 stop)
A - Z (upper and lower case or upper case only), Ø - 9, ' " # \$ % & ' () * + , - . / : ; < > = ? @ [] ^ _ ` { | } ~ \ , NUL SOH STX ETX EOT ENQ ACK BEL BS HT LF VT FF CR SO SI DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM SUB ESC FS GS RS US RUB OUT
Morse: Continental Morse Code: A - Z, Ø - 9, .? : / () " AR AS BT ES KN SK

Transmit Modes:

CONT: Continuous mode; characters are transmitted as they are typed.
LINE: Line mode; text is transmitted in complete lines, allowing editing of each line before transmitting.
WORD: Word mode; text is transmitted one word at a time.
ASR: All transmit text up to 50 lines may be precomposed and edited *while receiving* and transmitted at will; reverts to CONT, LINE or WORD modes after all precomposed text is transmitted.
FD/HD: Full-Duplex or Half-Duplex operation; full-duplex allows *simultaneous* active receive and transmit operations.

Display Screen:

Format: 72 characters per line, 24 lines total; 12 lines receive and 12 lines transmit buffer display or all 24 lines receive buffer display. 5 x 7 dot matrix, Green P31 phosphor, 12 inch diagonal measure CRT.

Text Buffering:

Receive: Up to 150 lines of storage of received text. Screen shows selected 12 (or 24) line segment of buffer with line numbers. In half-duplex, transmitted text is echoed into receive buffer as it is transmitted and displayed with "dim" intensity; full duplex transmit text is not echoed into the receive buffer.
Transmit: Up to 50 lines of transmit text may be precomposed and stored in the transmit buffer. 12 lines of the buffer may be displayed with line numbers and screen position in the buffer may be changed. Transmit buffer may be pre-typed at any time with full edit features; selected lines of receive buffer text may be copied into the transmit buffer.

If you intend to ship the DS3100ASR outside the United States, an export license may be required. Consult the factory for more information.

Programmable Messages:

HERE IS: Up to 10 different, 32 character HERE IS messages may be programmed and inserted into the transmit text as desired. HERE IS programming may include calls to other HERE IS segments, QBF test message, KY switch control and other features. The contents of HERE IS-1 and HERE IS-Ø are permanently saved in the non-volatile EAROM device.
IDENT: IDENT key transmits contents of HERE IS-Ø in Morse code, regardless of the selected terminal code. IDENT may be called from a HERE IS message.
WRU: Up to a 10 character WRU recognition text may be programmed. When the recognition text is received, switch KY1 is activated, HERE IS-1 transmitted, and KY1 deactivated with a delay before and after the HERE IS-1. Reception of the ASCII ENQ (or WRU; ~~ØØØØ1Ø1~~) will also trigger the WRU response. WRU may be used for automatic control of accessories such as tape recorder or transmitter.
EAROM: EAROM (Electrically Alterable Read Only Memory) storage allows semi-permanent storage of critical parameters when power is disconnected. The contents of HERE IS-1, HERE IS-Ø, WRU code message, and terminal CODE, RATE, MODE, USOS, and SYNC status are all stored. Upon power application, the EAROM status and messages are set in the DS3100. The operator may change the parameters or the EAROM storage at will.
TIME: Internal clock keeps time (24 hour format); an additional 16 characters may be programmed to give zone, date, or other information with the time. The TIME can be inserted into the transmit buffer or called from a HERE IS message.

Deluxe Features:

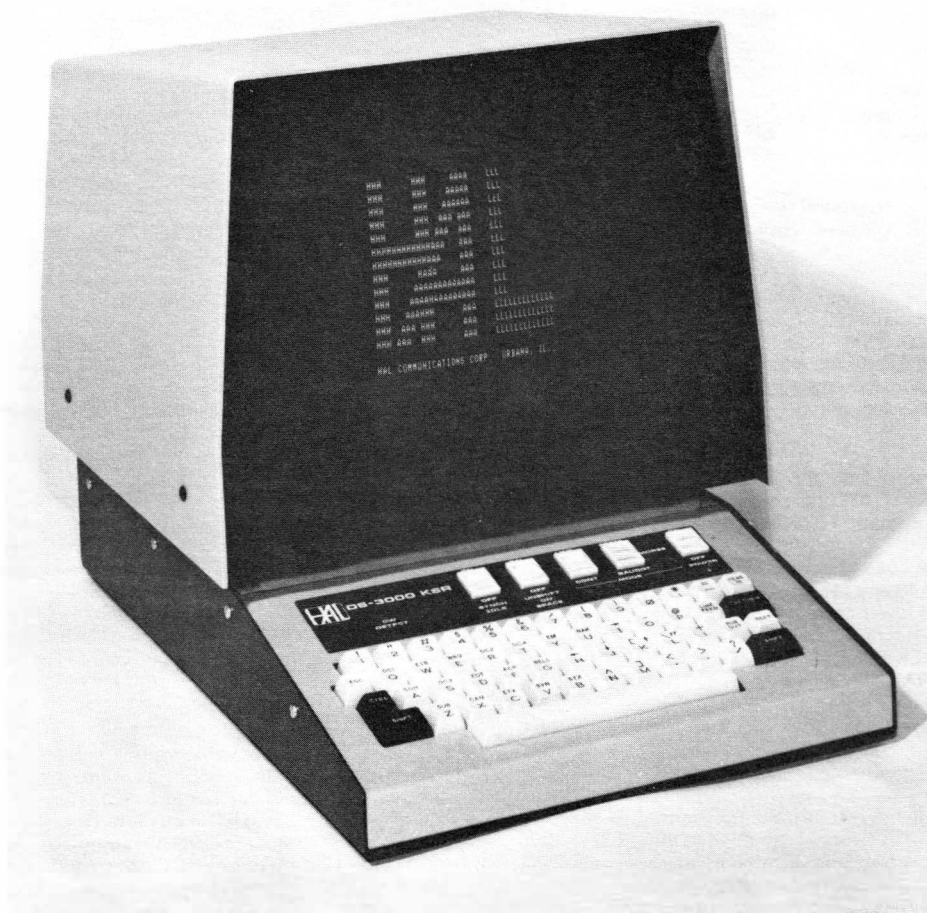
Word wrap-around: Full non-overprint; will not split a word at end of line.
USOS: On Baudot reception, reverts to LTRS case after reception of each SPACE character.
SYNC: Synchronous idle to assist other station's reception. Fills time between transmitted characters with LTRS (11111) in Baudot, NUL (~~ØØØØØØØØ~~) in ASCII, and BT (-----) in Morse.
CAPLK: Allows transmission of only capital letters or of both upper and lower case letters in ASCII code only. Upper or lower case letters are displayed as received.
KOS: Keyboard Operated Switch to control the transmit-receive circuitry of a radio installation.
KY1, KY2, KY3, KY4: Accessory switches that may be turned on or off by keyboard control or included in HERE IS message programs. KY4 is also controlled by the WRU response sequence. KY switches may be used to control external equipment.
Status Indicators: Key parameters or conditions of the DS3100 ASR are shown by 13 on-screen Status Indicator messages. Included are: TIME, CODE, RATE, MODE, USOS, SYNC, XMIT Buffer Status, WRU, KY 1234, FDX/HDX, CAP LK, IDENT, and PROG. The indicators occupy the far right-hand seven screen locations.
Keyboard: Arranged in a standard 52 key ASCII / typewriter format with SHIFT, CTRL, and FN keys. All terminal parameters are keyboard controlled by the FN plus second (or third) key. FN operations are shown by special front face legends on the keytops. Keyboard also features high-reliability key-switches and N-key rollover.
Test Messages: The standard QBF test message (THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK Ø123456789) or alternate code patterns (RYRY in Baudot, U*U*U* in ASCII) may be transmitted with FN keys.

Mechanical Data:

Size: 13.5" W x 20.5" D x 15.25" H; 45 lbs net, 60 lbs ship (34.3 x 51.2 x 39.4 cm; 20.4 kg net, 27.2 kg ship)
Colors: Castle tan and Chocolate Brown with color coordinated keytops and green characters on screen.
Power: 105-130 vac 50/60 Hz; 210-250 vac 50/60 Hz; 70 watts

DS3100 ASR **\$1995.00**

DS 3000 KSR



KEYBOARD SEND-RECEIVE TERMINAL

The DS-3000 KSR is a keyboard-send-receive communications terminal designed primarily for the Amateur Radio operator. Two versions of the DS-3000 are available from HAL. Version 2 is a RTTY/computer terminal capable of communicating in Baudot (5 level) or ASCII (8 level) code. Version 3 is a Morse/RTTY/computer terminal which has all the functions of the Version 2, and also sends and receives Morse code. This, coupled with its editing capability, makes it the most complete and versatile HAM terminal available. RTTY operation is a simple matter of connecting the DS-3000 to a demodulator/keyer and your transceiver. You will be able to copy and transmit RTTY at all standard speeds. And, when ASCII is approved for use by the HAM operator, you're all set. The DS-3000 can be used as a terminal for your microcomputer system. ASCII data rates to 1200 baud are standard. Morse code operation of the Version 3 is particularly convenient. Since this version has its own filter and demodulator section for Morse code, simply connect to the audio output of your receiver. Connect another cable to your transmitter key jack and you are set to go in Morse mode. The terminal has full editing capability in all modes of operation. The entire screen may be loaded and edited before transmission. Or, you may prefer to transmit a line at a time, a word at a time, or character by character. In all modes of operation, the sending rate is selected by the operator through the keyboard. Keyboard selection also determines the reception rate in Baudot and ASCII modes. In Morse reception, however, the Version 3 terminal automatically tracks the incoming signal to determine its speed. The DS-3000 takes advantage of the 8080A microprocessor for control of modes and editing functions. The DS-3000 terminals from HAL bring you in one package a degree of versatility never before seen in the Amateur Radio world.

DS 3000 KSR

SPECIFICATIONS

Input Signal:

18-120 ma loop current (200 VDC max)
RS-232C voltage levels
Audio voltage, nominal 10v p-p (Version 3)

Speed (Baudot):

60 WPM (45 baud)
66 WPM (50 baud)
75 WPM (57 baud)
100 WPM (74 baud)
132 WPM (100 baud)

Output Signal:

Loop current keying
RS-232C voltage levels
Cathode or grid-block Morse keying (Version 3)

Video Output:

520 lines, non-interlaced (624 optional)
15.625 KHz line rate
1.0v p-p composite video
Negative sync
75 ohms output impedance
6.1 MHz peak video bandwidth

Keyboard:

Standard 52-key ASCII format
Shift and control keys
N-key rollover
Quick Brown Fox test message key
Programmable character string

Cabinet Size: 14.5H x 19.5D x 13.5W (inches); 36.8H x 49.5D x 34.3W (cm)

Cabinet Finish: Textured blue bottom and sides, beige top; Monitor housing beige.

Weight: 34 lbs (15.42 kg) net; 41 lbs (18.59 kg) shipping

Power: 105-125 VAC (standard) or 210-250 VAC, 50-60 Hz, 70 Watts

Input Impedance:

Loop current circuit 20 ohms or less
Voltage circuit 120 ohms or greater
600 ohms unbalanced audio (Version 3)

Data Rate (ASCII):

110 baud (10 CPS)
150 baud (15 CPS)
300 baud (30 CPS)
600 baud (60 CPS)
1200 baud (120 CPS)

Morse Speed (Version 3):

1-180 WPM

Data Rate Stability:

Crystal controlled to $\pm 1\%$

Data Format:

Baudot - 7.5 unit code
ASCII - 10 or 11 unit code

Display:

16 lines of 72 characters per line
5 x 7 dot matrix characters
12 inch diagonal CRT

Sidetone:

Audible tone when bell code is received
Sidetone audio in Morse send mode

If you intend to ship the DS-3000 terminal outside the United States, an export license may be required. Consult the factory for more information.

DS-3000 KSR Version 3. **\$1425.**

DS-3000 KSR Version 2 (no Morse) **\$1195.**

In an effort to better serve our customers, HAL is instituting a board-swap repair policy for all currently manufactured items. This policy will cover both warranty and non-warranty repairs, but does not cover the ST-6, ST-5, or any board with a diode matrix program area. Warranty repairs are made at no charge. Non-warranty repairs can be made at a charge of \$50.00 per unit. To take advantage of this policy, first notify the factory of the problem and receive return authorization. Ship the unit prepaid to HAL. This new policy does not cover equipment damaged by lightning, abuse, or natural disaster.

WHEN OUR CUSTOMERS TALK . . . WE LISTEN !

The DS2000 KSR is a compact and low cost communications terminal for transmission and reception of Baudot, ASCII, and Morse codes (Morse receive optional). The terminal features a 72 character line by 24 line display format, two 32 character programmable "Here Is" messages, and CW identification at the touch of a key. A terminal status line keeps the operator aware of data rate, data code, and other terminal conditions. Text is transmitted one word at a time and editing is possible anywhere in the line being composed. All terminal functions are controlled by a combination of a control key and a key from the top row of the keyboard. Other deluxe features of the DS2000 KSR such as unshift-on-space, keyboard operated switch, and QBF and RY test messages have been incorporated for simplified operation. An optional Morse receive board (MR2000) is available for reception of Morse code at rates from 1-175 WPM and is customer installable allowing purchase at a later time. An optional 9 inch diagonal measure video monitor is also available.

DS 2000 KSR

SPECIFICATIONS

Input/Output:

Baudot: 18-120 ma, 200 vdc (max.) current loop
ASCII: 18-120 ma, 200 vdc (max.) current loop
Morse: Transmit = transistor switches to ground to key either negative voltage ("grid-block"), or positive voltage ("cathode") circuits.
Receive = (with optional Morse receive board)
10v p-p (600 ohm), 800 Hz audio input.

Data Rates:

Baudot: 45, 50, 57, 74, 100 baud (60, 66, 75, 100, 132 wpm).
ASCII: 110, 300 baud (10, 30 characters per second)
Morse: Transmit = settable to within 1 wpm, 1 to 175 wpm.
Receive = automatically track 1 to 175 wpm (with optional Morse receive board).

Data Codes:

Baudot: 7.5 Unit code (1 start, 5 data, 1.5 stop)
A - Z, Ø - 9, -?:\$!&#()_.BELL;/"LTRS FIGS CR LF space blank; Automatic FIGS/LTRS and CR/LF inserted as required.
ASCII: 110 baud, 11 unit code (1 start, 8 data, 2 stop)
300 baud, 10 unit code (1 start, 8 data, 1 stop)
A - Z (upper case only), Ø - 9, !"#\$%&'()*+,-./:;<>=?
@[^_` \, NUL SOH STX ETX EOT ENQ ACK BEL BS HT LF VT FF CR SO SI DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM SUB ESC FS GS RS US RUB OUT.
Morse: Continental Morse Code: A - Z, Ø - 9, -?:\$!&#()_.AR AS BT ES KN SK.

Transmit Mode:

WORD: Text is transmitted one word at a time. The word is transmitted when the first character of the following word is typed or after a RETURN at the end of a line.
Editing: Two cursors on the display show relative position of transmitted signal from DS2000 (or received signal when receiving) and position of keyboard entry. Keyboard cursor may be re-positioned for error correction to any place on the current line that has not yet been transmitted.

Video Output:

Format: 72 characters per line, 24 lines total.
5 x 7 dot matrix pattern
Electrical: 75 ohm, 1.0 volt p-p, compatible with EIA RS-170 standards; Peak video bandwidth = 6.1 MHz; UHF, SO-239 type connector.

Programmable Features:

HERE IS: Two separate and programmable HERE IS messages with up to 32 characters per message.
IDENT: Sends contents of HERE IS-1 in Morse code, regardless of code terminal may be using.

Deluxe Features:

USOS: On Baudot reception, reverts to LTRS case after reception of each SPACE character.
SYNC: Synchronous idle to assist other station's reception. Fills time between characters with LTRS (11111) in Baudot, NUL (00000000) in ASCII, and BT (—•••—) in Morse.
KOS: Keyboard Operated Switch to control the transmit-receive circuitry of a radio station.
Status Line: The current terminal operating parameters can be displayed at any time on the top line of the display.
Keyboard: Standard 52 key ASCII arrangement with SHIFT and CTRL; terminal controls are made with CTRL key plus one of top row of keys—all control features are clearly labeled.
Test Messages: The standard QBF test message (THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK Ø12345 5689) or alternate code patterns (RYRY ... in Baudot, U*U*... in ASCII).

Mechanical Data:

Size: 14.1" W x 9.25" D x 4.35" H; 6 lbs net, 10 lbs shipping (35.8 x 23.5 x 11.1 cm; 2.73 kg net, 4.55 kg shipping)
Colors: Textured blue bottom, beige top.
Power: 105-130 vac 50/60 Hz; 210-250 vac 50/60 Hz; 20 watts

Options:

Display
Monitor: ESM-914 Recommended; 9" diagonal measure screen.
Morse Receive: MR 2000 Morse receive option circuit board. Plugs into socket on main circuit board of DS2000. Has audio filter, detection, and processing circuitry to allow reception of Morse code audio (800 Hz tones). Audio input connections and a threshold adjust control are accessible from rear of DS2000 cabinet after installation. A new set of ROM devices are included with the option.

DS2000 KSR \$449.00
MR2000 Morse receive option \$149.00
ESM-914 Video monitor \$150.00

A written copy of the applicable warranty may be obtained free of charge upon request

Specifications subject to change without notice.

ANSWERS TO OFTEN-ASKED

"WHY WORK RTTY?"

RTTY is one of those quickly growing "specialized" forms of amateur communications. The attraction to its devotees is probably a mixture of the magic of modern digital communications coupled with the convenience of written rather than coded or voice communications. If you participate in the popular autostart nets, it's not even necessary to be home when receiving a RTTY message—the printer or display will record the text for you to read at your convenience. RTTY is very popular among "rag-chewers" and "engineers" alike; in fact, you get to do a bit of both. The rapid growth of digital electronics has carried over to both RTTY and the new home computer hobby. ASCII communications between ham computers lacks only final FCC approval. If your "bag" is chasing DX, what could be more satisfying than a DXCC certificate for all RTTY? There are several DX RTTY contests sponsored every year with heavy participation. So, rather than ask "Why?" ask "How?"

"WHAT DO I NEED TO WORK RTTY?"

A ham RTTY station needs a transmitter, receiver, and antenna just like any RF communications system, in addition to some "special boxes" to make the RTTY part work. Some considerations for the equipment are outlined below:

1. RECEIVER - TRANSMITTER

The RTTY receiver and transmitter (or transceiver) should be stable, well calibrated, and capable of *EXTENDED TRANSMITTER OPERATION*. When you are transmitting RTTY, the full carrier is on for longer periods of time than for CW or SSB voice. So, check your manual and manufacturer for RTTY specifications and, if in doubt, reduce transmitter power somewhat. For HF work, a good SSB rig in LSB mode works well with RTTY tones (more on tones, later). Most VHF-FM transmitters work with RTTY, but avoid overloading the transmitter as mentioned above.

2. ANTENNA

A good antenna will buy you the same benefits in RTTY as it does in other modes. One caution though, the traps on some antennas may not handle as much power in continuous RTTY operation as they do for CW or SSB voice. This can especially be true of trap yagi antennas for the HF bands.

3. RTTY DEMODULATOR

The demodulator connects to the receiver audio output and converts the RTTY tones to keying pulses. The quality of your printed signal is determined more by demodulator performance than by any other portion of the system. Demodulators come in all shapes, sizes, and prices. HAL offers the feature-packed ST-6000 with active filters, scope, autostart, anti-space, ATC, DTH, and KOS, as well as the lower cost ST-5000. The popular ST-5 and ST-6 parts kits are also still available for the skilled technician.

4. TONE KEYER

The tone keyer circuitry converts the keying pulses from your keyboard into audio tones to drive the transmitter. Since this circuitry is closely related to that of the demodulator, both are supplied in the same cabinet in all HAL demodulators.

5. TERMINAL

The terminal is the device that prints or displays the received signals while allowing you to type your transmitted message. The terminal is sometimes divided into a keyboard and a printer or display section. The terminal can be as simple as an old surplus TTY machine or as exotic as the microprocessor controlled HAL DS3100 ASR terminal. An important feature of HAL Communications terminals is that **ALL HAL RTTY EQUIPMENT IS LOOP COMPATIBLE WITH TTY MACHINES**. This means that you can add HAL electronic equipment to your RTTY system at any time. The advantages of the HAL electronic terminals are many; ranging from lack of noise and oil (keeps the XYL happy and your nerves soothed) to automatic operator features such as real-time editing of typing errors, programmable identification message, and automatic carriage return/line feed operations. Also, the speed of the electronic terminal is easily changed with a front-panel switch. Machines require an expensive gear box or a manual change of gears to change speed. HAL offers the DS3100 ASR and the new DS2000 KSR terminals as well as the popular DS-3000 KSR, RVD-1005, and the DKB-2010. The DS3100 ASR, DS2000 KSR, and the DS-3000 KSR all work the standard ASCII computer code as well as the normal amateur BAUDOT code.

"HOW DO I HOOK IT UP?"

Probably the most frightening thing to the RTTY beginner is the thought of all those wires that must be connected to make it work. A particularly complicated RTTY station can have a real "rats-nest" of wires, but it didn't start that way. Make connections in a logical and step-by-step manner and all will work well. All transceivers are slightly different, but, in general, you will have to make these connections:

1. GROUNDING

Before making any other connections, decide approximately where your equipment will be located and run short, low-inductance ground wires (shield braid recommended) between the cabinet grounds of all equipment **AND MACHINES**. Do not defeat the AC safety ground on the HAL power cords; run separate RF grounds in addition to the AC safety ground. **LACK OF ADEQUATE RF AND SAFETY GROUNDS CAUSES MORE PROBLEMS IN RTTY INSTALLATION THAN ANY OTHER SOURCE.**

2. RECEIVER TO DEMODULATOR

Use shielded cable to connect a 500 ohm audio output of the receiver to the demodulator audio input jack. If you do not have a 500 ohm output, the 4-8 ohm speaker output will work, but not as well; a speaker to 500 ohm line transformer would be a good part to add when possible.

3. TONE KEYER TO TRANSMITTER

Use shielded cable to connect the tone keyer output of the demodulator to the transmitter audio input. Often, a rear-panel "phone-patch" or "auxiliary" input is provided. If not, connect directly to the microphone connector.

4. DEMODULATOR TO TERMINAL

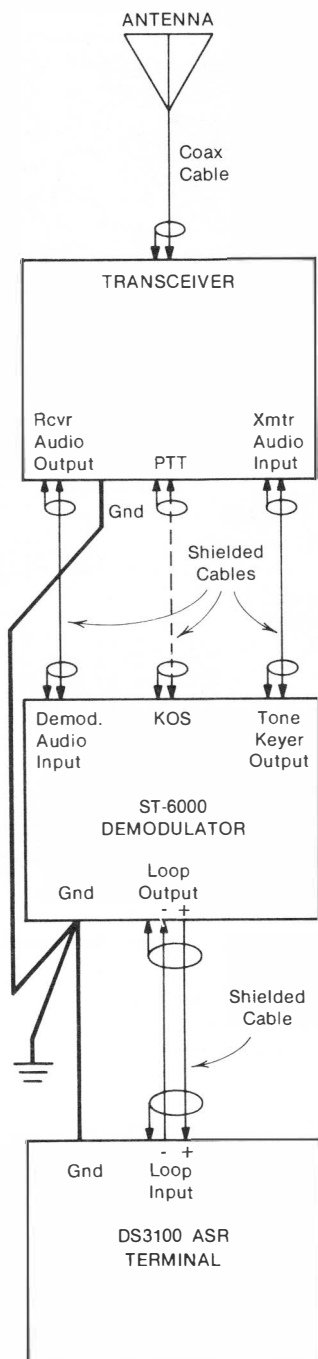
Use shielded cable to connect the terminal to the demodulator. Use the current loop connection for each. When connecting to a solid-state terminal, be sure to observe the proper polarity as indicated in the operator's manuals. Be extremely careful when wiring the loop circuit—potentially lethal voltages are present when the equipment is turned on (200 VDC @ 60 ma). Also, be sure that no part of the loop circuit is connected to chassis ground in machines or other equipment. All RTTY equipment is connected in series when the current loop output is used.

5. CONTROL CIRCUITS

Since the control requirements differ with manufacturer, study your transceiver manual carefully to determine how to control the transmit-receive function. Usually, you can control the push-to-talk (PTT) line through a pin on the microphone connector, a front panel switch, or a rear panel accessory connector. Initially, try to manually switch between transmit and receive until you are familiar with RTTY operation. Eventually, you will probably want to take advantage of the automatic Keyboard Operated Switch (KOS) feature of the DS3100 ASR and ST-6000. KOS is the RTTY equivalent to VOX; typing on the keyboard puts you into transmit mode. If you pause long enough, the KOS "drops-out" putting you back into receive mode. KOS is particularly convenient for short exchanges.

"WHAT IS THIS MARK AND SPACE BUSINESS?"

The RTTY signal from the terminal is a series of pulses. The amateur BAUDOT RTTY signal has 7 possible pulses for each character typed or printed, each transmitted one-after-another (serial). Each pulse can be either "ON" (current flow in the RTTY loop) which is called "MARK" or "OFF" (no current flow), the "SPACE" condition. To keep decoders synchronized, the first pulse of a character, the START pulse, is always a SPACE (current off); the last pulse, the STOP pulse, is always a MARK (current on). The 2nd through the 6th pulses can be either MARK or SPACE, depending upon the coding required for a character. The START and all 5 data pulses are the same length; the STOP pulse may be either equal to or longer than the others. The so-called computer ASCII code uses START and STOP pulses but has eight instead of five intermediate data pulses, thus allowing a greater number of characters to be encoded. Although all machines and HAL electronic terminals use pulses, the MARK and SPACE pulse conditions are converted into MARK and SPACE audio tones for easy radio transmission.



QUESTIONS ABOUT RTTY

"WHAT IS THE DIFFERENCE BETWEEN FSK AND AFSK?"

Transmitting RTTY signals via radio could be done like Morse code with on-off keying of the transmitter carrier. However, the interference received during off-times would give badly distorted printout. Rather, HF RTTY is transmitted with Frequency Shift Keying (FSK) so that the mark pulse condition corresponds to one radio frequency and the space to another. Amateur radio convention has it that the mark radio frequency is higher than space and that the separation or "shift" of the signal is standardized at 170 Hz or 850 Hz. (425 Hz shift is also used by commercial RTTY stations.) Most present-day amateur RTTY stations use 170 Hz shift exclusively. The FSK signal is received with the BFO turned on, giving two audio frequency tones for the mark and space conditions. The audio tones are, in turn, detected in the demodulator and the resulting pulses drive the display or printer. Note that changing the transmitter or receiver frequency (on purpose or through frequency drift) will change the audio output frequency to the demodulator. The HF system is therefore quite drift sensitive. Present HF equipment frequency stabilities are quite adequate for FSK RTTY, but it is only very recently that VHF equipment was available with similar stability. Therefore, VHF RTTY has traditionally been transmitted by first keying audio tones with the RTTY pulses and then using these tones as the audio modulation of an AM or FM VHF transmitter. This is called AFSK for Audio Frequency Shift Keying. Current amateur convention is to make the mark audio frequency lower than the space frequency by the amount of the shift. Since the RTTY data is audio modulation of the carrier, frequency drift of either transmitter or receiver is a lot less critical. The audio frequency of the tones transmitted is set to be the same as those in the receive demodulator.

The required radio frequency shift keying can be done in two different ways: shift the frequency of a transmitter oscillator directly with the RTTY pulses or use a SSB transmitter with audio tones. Direct FSK keying circuits are described in most amateur journals and are generally simple, but require modification of the equipment; generation of FSK with a SSB transmitter is as follows: If a Lower Sideband Transmitter (LSB) is driven with a 2125 Hz audio tone, the RF output of the transmitter will be at a frequency 2125 Hz *BELOW* the suppressed carrier frequency. A properly adjusted LSB transmitter will have *NO OTHER* output frequencies. If the input tone is changed to 2295 Hz (170 Hz shift), the RF frequency is now 2295 Hz *BELOW* the carrier frequency. Thus, audio tones into the LSB transmitter have produced FSK carriers out of the transmitter. Note that, because the LSB mode was used, the 2125 Hz standard mark tone for VHF AFSK has become the higher radio frequency. Thus, the same demodulator and tone keyer can be used for both VHF AFSK and HF FSK operation. Often, this use of audio tones with a SSB transmitter is mistakenly called "HF AFSK"—actually the resulting output is true FSK, IF the SSB transmitter has no spurious outputs (such as carrier or unwanted side-band). Most HF RTTY amateur radio stations use audio tones with a SSB transmitter. Although "standard" audio tones for VHF amateur operation have long been 2125 Hz for mark and 2975 Hz for space (850 Hz shift), limited audio frequency response of HF SSB transmitters and receivers has recently given rise to a second set of "standard" tones at lower frequencies ("Low-tones").

"HOW ABOUT HIGH- VS LOW-TONES?"

Historically, demodulator tones were set to 2125 Hz for mark and 2975 Hz for space reception of 850 Hz shift. When transmitter stability improved, 170 Hz shift was used and the space frequency changed to 2295 Hz (mark remained at 2125 Hz). These three tones were, and still are, a standard for U.S. Amateur RTTY. However, in the early 1960's, virtually all commercially available transmitters and receivers became filter-type SSB equipment with audio pass-band limited to speech frequencies, sometimes as narrow as 2.1 kHz (300 to 2400 Hz). Obviously, the 2975 Hz (850 Hz shift Space) tone will not pass-through such a filter and 850 Hz shift with these tones is not possible (although the 170 Hz shift is). Therefore, either the SSB equipment must be modified or different, lower-frequency tones must be used if 850 Hz RTTY shift is desired. Both approaches have their advantages and both are currently in use. The so-called "LOW-TONE" standard sets mark at 1275 Hz and space at 1475 Hz (170 Hz shift) or 2125 Hz (850 Hz shift), conforming to the European IARU standard. So, there are now two sets of "standard" tones, LOW and HIGH (as well as a myriad of others), all of which work *INTERCHANGEABLY* on HF RTTY. However, since the actual audio tone is transmitted for VHF AFSK operation, the two sets are *NOT COMPATIBLE IN VHF AFSK* applications. Current U.S. Amateur operation uses the HIGH TONES for VHF. Thus, to use a

demodulator and keyer for both HF and VHF operation, it should be set-up for HIGH-TONE operation. Conversely, you may wish to have separate stations for HF and VHF, simplifying the cabling, and providing simultaneous monitor/operation capability, as well as resolving the tone problem. The HAL ST-6000 and ST-5000 Demodulators are available for either HIGH or LOW-TONE operation.

"WHAT FREQUENCIES DO I USE FOR RTTY?"

HF RTTY Operation has evolved to heavy operation on the 80 and 20 meter bands (CW segments) with sporadic operation on other HF bands. 80 meter RTTY stations tend to operate between 3600 and 3650 kHz and 20 meter stations between 14.075 and 14.100 MHz. 170 Hz shift is used almost exclusively with mark being the higher radio frequency. 60 wpm (45 baud) is the most popular RTTY speed, but 100 wpm (74 baud) is gaining in popularity.

VHF RTTY operation in most areas is concentrated on 2 meter FM with 146.700 MHz being the popular operating frequency. Virtually all stations are now using the "High-tones," usually with 170 Hz shift. As with HF RTTY, 60 wpm (45 baud) is most popular on VHF. Some areas now have RTTY-only repeaters on 146.10/146.70 MHz.

"WHO DO I TALK TO ON RTTY?"

RTTY enthusiasts run the full range of ages and interests, but tend to be technically inclined. The typical RTTY'er is always modifying his station, likes to talk, and usually has more ideas than you have printer paper (or display screen)! Some operators are good typists; most aren't. The DS3100 ASR letters-fill and editing modes make even a poor typist look good. Recently, the home computer hobby has become quite popular with RTTY people and you may find a lot of help in debugging your programs if that's your interest. There are an increasing number of DX stations on RTTY.

"HOW MUCH DOES IT COST?"

RTTY is like any other hobby—it can cost as much or as little as you want it to. If you buy used machines and build kits or your own designs, the total RTTY cost can be quite low. Conversely, the DS3100 ASR and ST-6000 offer an *ULTIMATE* RTTY station that is expensive. Because all of the HAL RTTY products are current loop compatible, you can add devices as your interests (and pocketbook) indicate. For the beginner, HAL has the following recommendations:

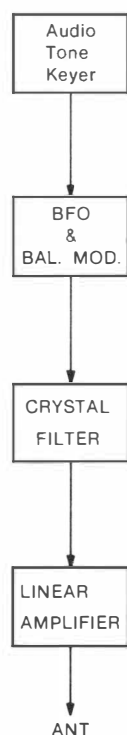
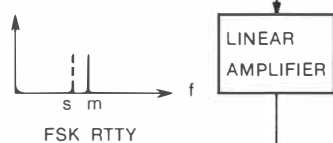
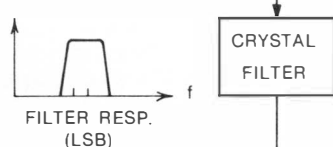
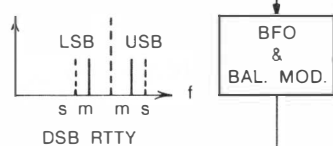
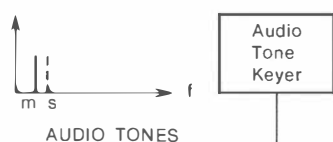
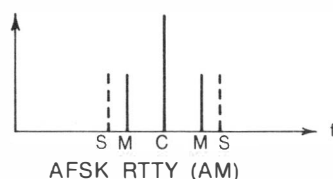
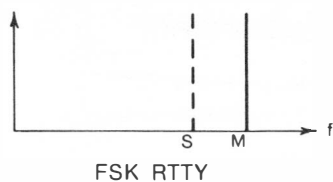
1. DEMODULATOR

Assuming you already have a good transceiver and antenna, your first major RTTY purchase should be a good demodulator. The HAL ST-5000 makes a particularly good, cost-effective unit. If you select a high-tone ST-5000, it will be usable for either VHF or HF (170 Shift) RTTY operation; if you are only interested in HF RTTY (for short-wave-listening to press stations, for example), the low-tone unit may be a better choice. Conversely, you may wish to "jump-in" and get the ST-6000 from the first. Either way, put high priority on a *GOOD* demodulator.

2. TERMINAL

You can spend very little or a lot on the terminal. A surplus machine can often be acquired at a hamfest for little cash investment. However, by the time you figure out how it works, fix it, and buy parts and manuals the total cost may not be so low. If you do, you'd better be prepared with tools, oil, and patience. Newer machines require less work, but also cost more. On a feature-for-feature basis, either the

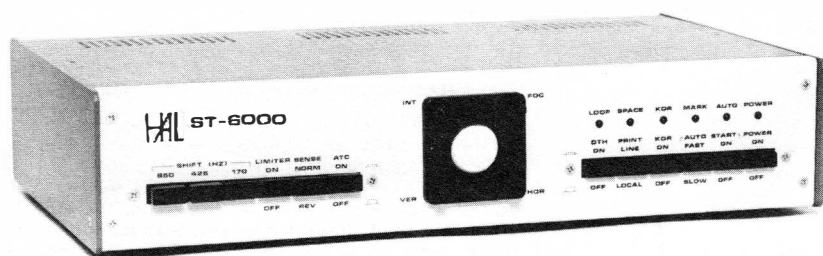
new DS2000 KSR, DS3100 ASR, or DS-3000 KSR are more cost effective than other terminals presently available. Certainly a "solid" beginner's RTTY station would be the DS2000 KSR and ST-5000. Some money-saving packaged "SYSTEMS" are offered for a limited time on the back page of this catalog.



HAL COMMUNICATIONS CORP.

Box 365
Urbana, Illinois 61801
217-367-7373

ST-6000 RTTY Demodulator



TOP OF THE LINE RTTY DEMODULATOR

Connect the ST-6000 between your transceiver and a HAL DS-3000 KSR terminal and join in the fun of amateur RTTY. The ST-6000 provides outstanding recovery of HF RTTY signals, despite noise, interference, or weak signals. Deluxe features of the ST-6000 include a multi-pole active filter front-end, wide dynamic range limiter, either FM (hardlimiting) or AM reception, active filter discriminator and low-pass filters, and internal crystal-controlled AFSK tone keyer. The ATC (Automatic Threshold Control) and DTH (Decision Threshold Hysteresis) features minimize effects of selective fading and multi-path distortion of the RTTY signal. The ST-6000, available with either "Low" or "High" frequency tone sets, receives and transmits 170, 425, and 850 Hz shifts. Other features include internal loop supply, KOS (Keyboard Operated Switch) circuit, autostart, antispacer, optional oscilloscope tuning indicator, and a rear panel with I/O connections for super-flexible interfacing to all data handling equipment. All in all, the ST-6000 is everything you could want in a demodulator.

SPECIFICATIONS

Electrical

Input Data and Rate: Serial Baudot or ASCII code, up to 110 baud.

Input Impedance: 600 ohms, balanced, transformer coupled.

Output Signals: 60 ma @ 175 VDC loop or low-level RS-232C.

Note: An auxiliary loop keyer is available to key a second loop with an external loop supply.

Miscellaneous Output:

Discriminator output to external scope, pre-autostart and post-autostart data, keyboard operated switch (KOS), printer motor AC power.

Autostart Response Time: Slow, 3.5 sec. Fast, 1.5 sec.

Printer motor Dropout Time: 20 sec. $\pm$ 10 sec.

Tuning Indicator: From panel meter, or 1" scope.

Keyboard Operated Switch (KOS):

Transistor switch to actuate external circuits
Rated + 25 VDC, 500 ma.

Frequency of "Low-tone" pairs.

Shift:	850 Hz	425 Hz	170 Hz
Mark:	1275 Hz	1275 Hz	1275 Hz
Space:	2125 Hz	1700 Hz	1445 Hz

Frequency of "High-tone" pairs.

Shift:	850 Hz	425 Hz	170 Hz
Mark:	2125 Hz	2125 Hz	2125 Hz
Space:	2975 Hz	2550 Hz	2295 Hz

Audio Tone Keyer

Input Signal: Dry contacts, EIA-RS-232C levels, or internal current loop, CW ID hand key.

Output Signal:

Levels: variable from -40 dbm to 0 dbm

Impedance: 600 ohm nominal, balanced.

Distortion: All harmonics below the 9th harmonic are greater than 40 db down.

Stability: Crystal controlled to $\pm$ 0.5%

Physical

Cabinet Finish: Castle tan front and rear panel.

Textured chocolate brown top, bottom and side panels.

Cabinet Style: Table or 19" rack mount.

Size: Table: 3.50 H $\times$ 9 D $\times$ 17 W (inches)

8.9 H $\times$ 22.8 D $\times$ 43.2 W (cm)

Rack: 3.50 H $\times$ 9 D $\times$ 19 W (inches)

8.9 H $\times$ 22.8 D $\times$ 43.3 W (cm)

Weight: 12.0 lbs (5.45 kg) net, 15.0 lbs. (6.82 kg) shipping.

Power: 105-125 VAC (210-250 VAC optional)

50-60 Hz, 20 Watts.

ST-6000 (scope) \$595.00

ST-6000 (meter) \$495.00

(Specify table or rack, meter or scope, and high- or low-tones when ordering.)

ST-5000 RTTY Demodulator

BIG RTTY PERFORMANCE FROM A SMALL DEMODULATOR



The HAL ST-5000 Demodulator provides excellent, reliable RTTY performance on both HF and VHF bands. Features such as a hard limiting front end, active discriminator, and active detector make this unit a big value. Wide and narrow shift (850 hz and 170 hz), normal or reverse sense, autostart, self-contained high voltage loop supply, and an audio tone keyer are standard. Connect the ST-5000 to your transceiver and your HAL keyboard and video display and take part in the growing world of coded communication.

SPECIFICATIONS

Input Data and Rate: Serial Baudot or ASCII code, up to 110 baud.

Input Signal: Audio tones in range 1200-3000 Hz.

Input Impedance: 600 ohms, unbalanced.

Output Signals: 60 ma, 175 VDC loop or low-level RS-232C.

Discriminator output to external scope, printer motor AC power, remote standby line.

Autostart Response Time: 2 to 4 seconds

Printer Motor Dropout Time: 20 to 40 seconds

Tuning Indicator: Front panel meter

Frequency of "High-tone" pairs

Shift:	850 Hz	170 Hz
Mark:	2125 Hz	2125 Hz
Space:	2975 Hz	2295 Hz

Frequency of "Low-tone" pairs

Shift:	850 Hz	170 Hz
Mark:	1275 Hz	1275 Hz
Space:	2125 Hz	1445 Hz

Tone Keyer Output (Phase coherent audio tones)

Levels: -32 dbm (20 mv nominal), variable from -40 dbm to 0 dbm by internal control.

Impedance: 600 ohm, unbalanced.

Distortion: All harmonics below the 9th harmonic are greater than 30 db down.

The tone keyer is equipped for the same tone pairs as the demodulator.

Cabinet Finish: Light beige bottom, front, and rear panel. Textured blue top and side panels.

Cabinet Style: Table mount.

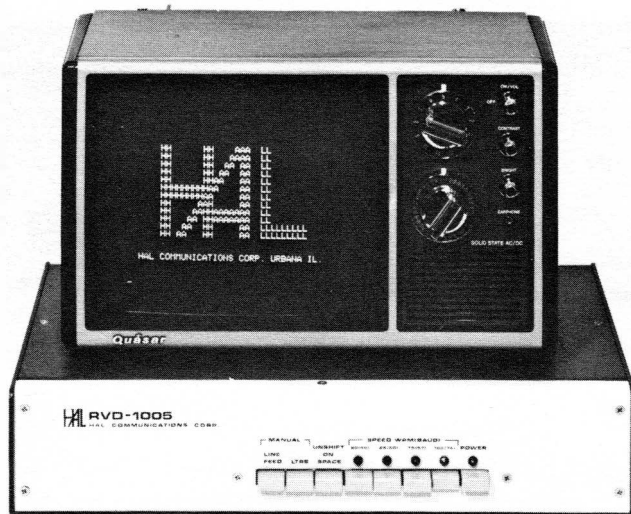
Size: 2.75H x 8D x 12W (inches)
7,0H x 20,3D x 30,5W (cm)

Weight: 6.0 lbs. (2,73 kg) net, 9.0 lbs. (4,10 kg) shipping.

Power: 105-125 VAC (210-250 VAC optional) 50-60 Hz 20 watts.

ST-5000. \$225.00

RVD-1005 Visual Display Unit



COPY ALL STANDARD RTTY SPEEDS

Whether you are an active Amateur RTTY operator or an SWL, you can enjoy silent reliable RTTY copy. The RVD-1005 features *4 Switch-Selectable Speeds*, *Automatic CR/LF*, and *Unshift-On-Space*, offering the benefits of reliable, solid-state reception of BAUDOT RTTY signals for minimum cost. The RVD can be used with either a TV monitor or standard TV set (requires power transformer and video connection). It's also easy to connect to other TTY equipment through a current loop or RS-232 data circuit. Connect the RVD-1005 to the HAL ST-5000 or ST-6000 demodulator and your radio receiver and join the world of coded communications.

SPECIFICATIONS

Electrical

Input Data Form: Serial Baudot (5 level) code

Input Data Signal— Voltage or current sensing

Voltage compatible with RS-232B

Mark: -5 to -15 VDC

Space: +5 to +15 VDC

Impedance: 120 ohms or greater

Current Sensing

Mark: 18-80 ma

Space: 0 - 2 ma

Impedance: 20 ohms or less

Isolation to case: 10 megohms or greater

Input Data Rate:

60 WPM (45 baud)

66 WPM (50 baud)

75 WPM (57 baud)

100 WPM (74 baud)

Data Rate Stability: Crystal Controlled to $\pm .05\%$

Video Output— RS-170 Standard Video

Lines Per Frame: 525, 2:1 Interlace

Line and Field Rate: 15.750 KHz, 60 Hz

Timing: Crystal Controlled to $\pm 0.1\%$

Composite Video: 1.0 v p-p

Sense: Negative Sync

Output Impedance: 75 ohms

Peak Video Bandwidth: 3.1 MHz

Display

Display Capacity: 1000 characters

Character Format: 5 x 7 dot matrix

Page Format: 25 lines, 40 characters per line

Characters Displayed: 26 Alphabetic

10 Numeric

16 Punctuation

Physical

Cabinet Finish: Light gray front and rear panels;

Textured dark gray top, bottom, and sides.

Cabinet Style: Table or Rack Mount

Size: Table: 3.5 H x 9 D x 17 W (inches)

8,9 H x 22,9 D x 43,2 W (cm)

Rack: 3.5 H x 9 D x 19 W (inches)

8,9 H x 22,9 D x 48,3 W (cm)

Weight: 7.5 lbs. (3,4 kg) net, 11 lbs. (5,0 kg) shipping

Power: 105-125 VAC (210-250 VAC optional)

50-60 Hz 25 watts

RVD-2110 Monitor/TV

The RVD-2110 monitor/TV is a solid state set with 38 square inch (9 inch diagonal measure) picture and BNC connector for video input. It operates from 120 VAC or 12 VDC.

RVD-1005 **\$395.00**
(specify Table or Rack)

RVD-2110 **\$150.00**

DKB-2010 Dual Mode Keyboard

**TRANSMIT EITHER
CW or RTTY**



Connect the DKB-2010 to your transceiver and send perfect CW from 8 to 60 wpm. Connect it to your RTTY equipment and enjoy the benefits of reliable, solid-state BAUDOT operation. Combined with the RVD-1005 Visual Display Unit and the ST-5000 Demodulator, the DKB-2010 with your transceiver completes an ideal but reasonably priced RTTY station. In addition to transmitting either BAUDOT or MORSE, the DKB features built-in HERE IS identification message, four speeds of RTTY, four weights of CW, internal sidetone oscillator and RTTY bell, and a 128 key output buffer. The DKB-2010 is compatible with either GRID-BLOCK or CATHODE CW keying circuits and can be used in either current loop or RS-232 RTTY circuits. The DKB is an ideal teaching aid in a MORSE code class.

SPECIFICATIONS

MORSE MODE

Output: Grid-block or Cathode
± 150V @ 150 ma maximum
Speeds: Variable over 8-60 wpm
Weight: (Dot-to-space ratio)
Heavy (5:3), Normal (1:1)
Light (3:5), Very Light (1:7)
Sidetone: Internal oscillator and speaker; front volume control, rear audio output connector.
Keys: 36 Alphanumeric, 9 Punctuation, 5 Special (SK, AS, AR, KN, BT), Shift, Tune, Error, Space, CQ, AUX, HERE IS

RTTY MODE

Output: Transistor Switch
+ 250V @ 80 ma maximum
Speeds: 60 wpm (45 baud)
66 wpm (50 baud)
75 wpm (57 baud)
100 wpm (74 baud)
Accuracy: Crystal Controlled @ ± .05%
Format: 1 unit start, 5 units data, 1.5 units stop pulses.
Keys: 36 Alphanumeric, 14 Punctuation, Bell, CR, LF, LTRS, FIGS, Break, Space, Shift, CQ, AUX, HERE IS, and QBF (Quick Brown Fox . . .) Test Message.
Case Shift: Automatic LTRS or FIGS codes generated as required.

GENERAL

Programmable Keys: CQ, AUX, HERE IS
N-Key Rollover: New key can be depressed before releasing previous key.
Buffer Memory: Stores up to 3 characters if entry rate exceeds output rate. Optional 128 key buffer (128-EMO)
End-of-Line: Pilot lamp and tone "beep" after 64th character is sent.
Cabinet Size: 5 High × 9 Deep × 13.5 Wide (inches); 12.7H × 22.9D × 34.3W (centimeters)
Cabinet Finish: Light gray front panel, Textured dark gray bottom, side, and rear panels
Weight: 6 lbs (2.73 kg) net; 12 lbs (5.5 kg) shipping
Power: 105-125 VAC (standard) or 210-250 VAC, 50-60 Hz, 20 Watts

OPTION

128-EMO: 128 Key buffer memory; installs inside DKB-2010 cabinet; pilot lamp indicates buffer storage (dim half full or greater, bright = full).

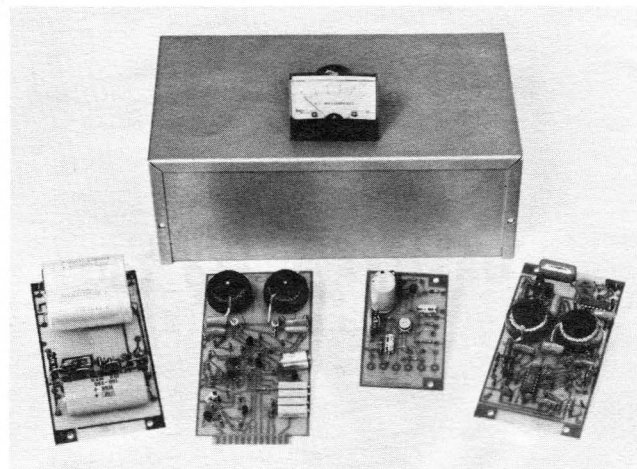
DKB-2010 **\$395.00**
(Specify CQ, AUX, & HERE IS text)

EMO-128 Buffer **\$ 85.00**

HAL PARTS KITS



ST-6K



ST-5K

For the experienced technician, HAL still offers the popular ST-6 and ST-5 demodulators in "kit" form. The units are offered in two attractive packages; the ST-6K package that includes the demodulator, cabinet, crystal tone keyer (former XTK-100), and discriminators for all three shifts (170-425-850 Hz). The ST-6 features input bandpass filters, wide-dynamic range limiter, balanced discriminator, active low-pass filter, ATC, autostart, and antispacer. The tone keyer of the ST-6K is crystal controlled assuring accurate tone frequencies at all times. The ST-6 cabinet is pre-screened and drilled. The ST-5K package includes the demodulator, autostart (former ST-5AS), audio tone keyer (former AK-1), and Bud 2110 Minibox for use as a cabinet. The ST-5K package features a wide-dynamic range limiter stage, balanced discriminator, solid-state loop switch, autostart, tuning meter, and the popular AK-1 AFSK oscillator. An unscreened and undrilled Bud 2110 Minibox is provided for you to tailor to your requirements. The ST-5K represents the lowest cost RTTY demodulator available today.

SPECIFICATIONS

ST-6K

Input Level: 1.0 mV RMS minimum (FM)
50 mV RMS minimum (AM)
3.5 V RMS maximum

Input Impedance: 600 ohms, unbalanced

Input Frequencies: 2000-3000 Hz

Discriminator Frequencies:
Shift: 170 425 850 Hz
Mark: 2125 2125 2125 Hz
Space: 2295 2550 2975 Hz

Maximum Data Rate: 75 baud (100 wpm)

Autostart Response: "Slow" — 3.5 sec.
"Fast" — 1.5 sec.

Motor Control Time: Dropout in 30 ± 10 sec

Tuning Indicator: Front panel meter,
Provision for external scope

AFSK Tones: Same as discriminator (170 and 850 Hz Shift)

Output: Internal 60 ma/175 volt dc loop circuit and keyer transistor.
Low-level, RS-232 compatible data output.

Power: 105-125 or 210-250 vac, 50-60 Hz, 25 Watts

Cabinet: Two-tone gray in rack or table style

Size: 3.5H × 12D × 17W (19W for rack) inches
8.9H × 30.5D × 43.2W (48.3W for rack) cm

Weight: 14 lbs (6.4 kg) net; 16 lbs (7.3 kg) shipping

ST-5K

Input Level: 1.0 mV minimum
3.5 V maximum

Input Impedance: 600 ohms, unbalanced

Input Frequencies: 2000-3000 Hz

Discriminator Frequencies:
Shift: 170 850 Hz
Mark: 2125 2125 Hz
Space: 2295 2975 Hz

Autostart Response: 2-4 sec.

Motor Dropout: 20-40 sec.

Tuning Indicator: Meter, Connector for External Scope

AFSK Tones: Same as Discriminator

Output: Internal 60 ma/175 vdc loop circuit and keyer transistor.
Low-level, RS-232 Compatible

Power: 120/240 vac, 50-60 Hz, 14 Watts

Cabinet: Bud 2110 Minibox (undrilled)
Gray Hammertone, unscreened

Size: 10 × 6 × 3.5 inches
25.4 × 15.2 × 8.9 cm

Weight: 7 lbs (3.2 kg) net; 8 lbs (3.6 kg) shipping

ST-6K Kit \$275.00 ST-5K Kit \$125.00
(Specify table or rack cabinet)

NOTE: HAL Parts Kits are intended for the experienced amateur technician. The kits do NOT include step-by-step instructions and the ST-5 Minibox is NOT screened OR drilled. The kits do, however, offer outstanding dollar savings as well as proven performance.

ORDER BLANK

SOLD TO:

SHIP TO (If different)

NAME _____

ADDRESS _____

CITY _____ STATE _____

COUNTRY _____ ZIP _____

PHONE # _____

QUAN.	EQUIPMENT	PRICE, EA.	TOTAL AMOUNT
	DS3100 ASR Terminal (Baudot, ASCII, and Morse)	\$1995.00	
	DS3000 KSR V3 Terminal (Baudot, ASCII, and Morse)	\$1425.00	
	DS3000 KSR V2 Terminal (Baudot and ASCII ONLY)	\$1195.00	
	DS2000 KSR Terminal (Baudot and ASCII, TX Morse)	\$ 449.00	
	Options: ESM-914 Display Monitor	\$ 150.00	
	MR2000 Morse Receive Board	\$ 149.00	
	ST6000 Demodulator Table Mount ☐ Rack Mount ☐		
	With Tuning Meter Low-Tone ☐ High-Tone ☐	\$ 495.00	
	With Tuning Scope Low-Tone ☐ High-Tone ☐	\$ 595.00	
	ST5000 Demodulator Low-Tone ☐ High-Tone ☐	\$ 225.00	
	RVD1005 Visual Display Table Mount ☐ Rack Mount ☐	\$ 395.00	
	Option: RVD2110 9" Quasar TV Set (HAL Modified)	\$ 150.00	
	DKB2010 Keyboard (TX Baudot and Morse)	\$ 395.00	
	AUX KEY _____ HERE IS _____		
	Option: EMO-128 (128 Character Buffer)	\$ 85.00	
	ST-6K Demodulator Parts Kit Table ☐ Rack ☐	\$ 275.00	
	ST-5K Demodulator Parts Kit	\$ 125.00	
	Other:		
	Other:		
	Please specify: 110 VAC ☐ 220 VAC ☐ 50 Hz ☐ 60 Hz ☐		

Shipping Included in Price:

UPS Regular Delivery ☐
Parcel Post ☐

Extra Charge Shipping:

UPS Blue Label ☐
Air Mail ☐
AIR Freight ☐
COD ☐ UPS ☐ PP ☐
Other ☐

Total Amount of Goods:

\$

System No. _____ Discount:

\$

Sub-total:

\$

5% Sales Tax (ILL Only):

\$

Special Shipping:

\$

Total This Order:

\$

PAYMENT: (Make all checks to HAL COMMUNICATIONS CORP.)

☐ Personal Check No. _____ for \$ _____

☐ Money Order or Cashier's Check

NOTE: SYSTEM PRICES APPLY ONLY TO CASH WITH ORDER

☐ COD

☐ VISA/BAC No. _____ Eff. Dates _____ to _____

☐ M/C No. _____ Interbank _____ Eff. Dates _____ to _____

Mail Order to:

HAL COMMUNICATIONS CORP.
Box 365
Urbana, Illinois 61801

LIMITED TIME SYSTEM PRICES ON HAL EQUIPMENT

SYSTEM 1

DS3100 ASR \$1995.00
ST6000 Demodulator (Scope) \$ 595.00
Regular HAL Price \$2590.00

SYSTEM 1 Price \$2500.00
(Save \$90.00)

SYSTEM 2

DS3000 KSR V.3 \$1425.00
ST6000 Demodulator (Scope) \$ 595.00
Regular HAL Price \$2020.00

SYSTEM 2 Price \$1985.00
(Save \$35.00)

SYSTEM 3

DS2000 KSR \$449.00
MR2000 Morse RCV Option \$149.00
ESM-914 Monitor \$150.00
ST5000 Demodulator \$225.00
Regular HAL Price \$973.00

SYSTEM 3 Price \$950.00
(Save \$23.00)

RULES FOR SYSTEM ORDERS

1. The total System must be ordered at the same time.
2. System prices do not apply to orders placed prior to this announcement.
3. System prices apply only to the equipment combinations listed above.
4. System prices apply only to cash with order sales. Discounts do not apply to COD or charge card purchases.
5. This offer expires June 30, 1979, and will not apply to orders received after that date.
6. System prices apply to orders shipped to continental U.S.A. addresses only.
7. HAL Communications Corp. reserves the right to change the terms of this offer.



HAL COMMUNICATIONS CORP.

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Urbana, Illinois 61801
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FIRST CLASS MAIL

HERE IS YOUR NEW HAL COMMUNICATIONS CATALOG!