



VX-1700
CAT OPERATION
REFERENCE BOOK

VERTEX STANDARD CO., LTD.

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

OVERVIEW

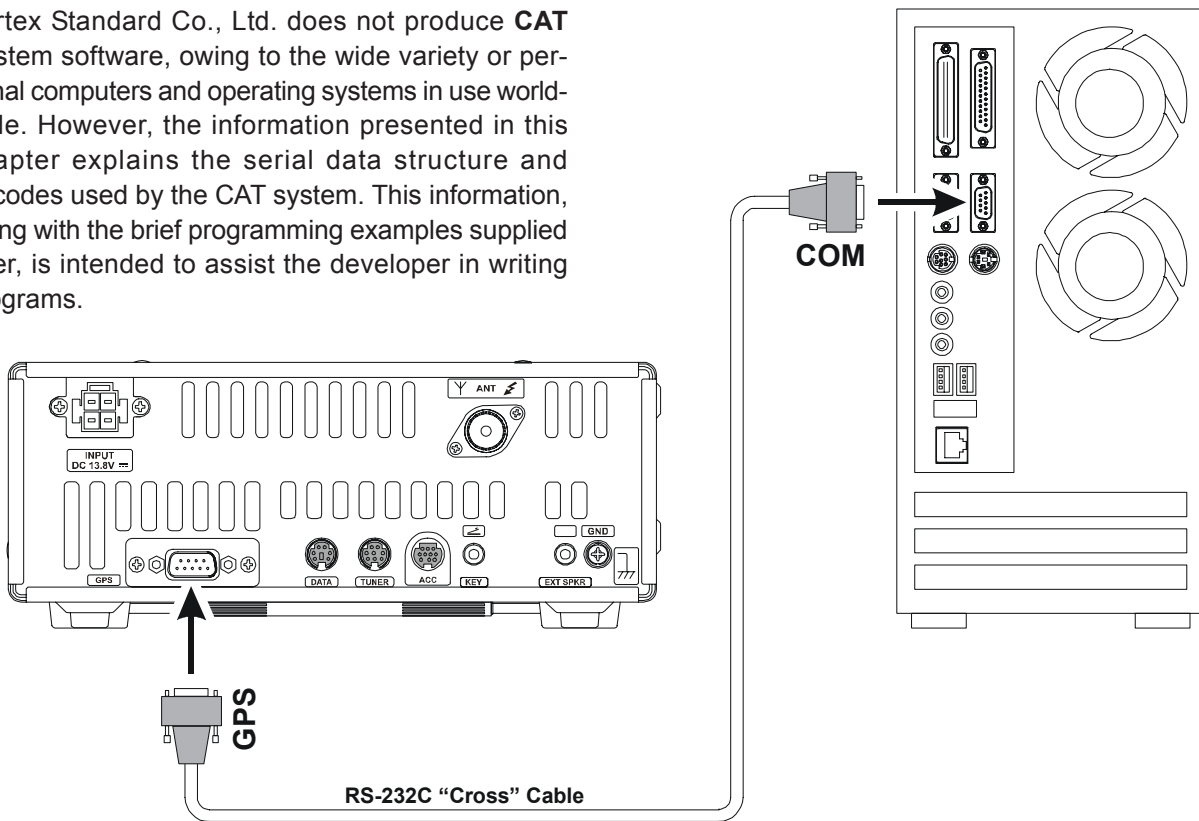
The **CAT** (Computer Aided Transceiver) System in the **VX-1700** provides control of frequency, memory, and other settings using an external personal computer. This allows multiple control keystrokes to be fully automated as a single mouse click or keystroke operation on the computer keyboard.

To use computer control of your **VX-1700** transceiver, a D-SUB 9-pin **cross cable** ("null modem") will be required for connection of the **VX-1700** transceiver to your computer's serial ("COM") port. Be sure that the serial cable has the proper gender and number of pins (some COM ports used a 9-pin rather than a 25-pin configuration). If the computer uses a custom connector, you may have to construct the serial cable; in this case, refer to the technical documentation supplied with your computer for correct connections. The illustration below shows an example of CAT system connections.

Vertex Standard Co., Ltd. does not produce **CAT** System software, owing to the wide variety of personal computers and operating systems in use world-wide. However, the information presented in this chapter explains the serial data structure and opcodes used by the CAT system. This information, along with the brief programming examples supplied later, is intended to assist the developer in writing programs.

NOTE

- The **CAT** system protocol is available from Lot 028 or later products.
- When the SELCALL or ALE function is activating, you cannot use the CAT system protocol.
- When using the CAT system protocol, it is necessary for you to change the DIP switch setting of the **VX-1700**.



CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

VX-1700 MODIFICATION

1. Turn off the **VX-1700** by pressing and holding the **[POWER]** switch of the **VX-1700** for one second, then turn off the External DC Power Supply.
2. Disconnect the DC Cable from the **DC INPUT** Jack on the **VX-1700** rear panel, and then disconnect all cables from the **VX-1700**.
3. Referring to Figure 1, remove the four screws from the side of the transceiver (two screws for each side), along with four screws affixing the bottom case; remove the bottom case.
4. Referring to Figure 2, slide the **S4002** and **S4003** switches to the “**A**” position.
5. Replace the bottom case with its eight screws.
6. Connect the all cables to the transceiver.

IMPORTANT NOTE

- Please be careful to avoid short-circuit to any metal object.
- Be careful to prevent injury from any sharp corners.
- Please practice standard grounding techniques and do not touch semiconductor components unnecessarily to avoid breakage or damage by static electricity etc.

NOTE

Do not forget to return the **S4002** and **S4003** switches into the “**B**” side when using the GPS.

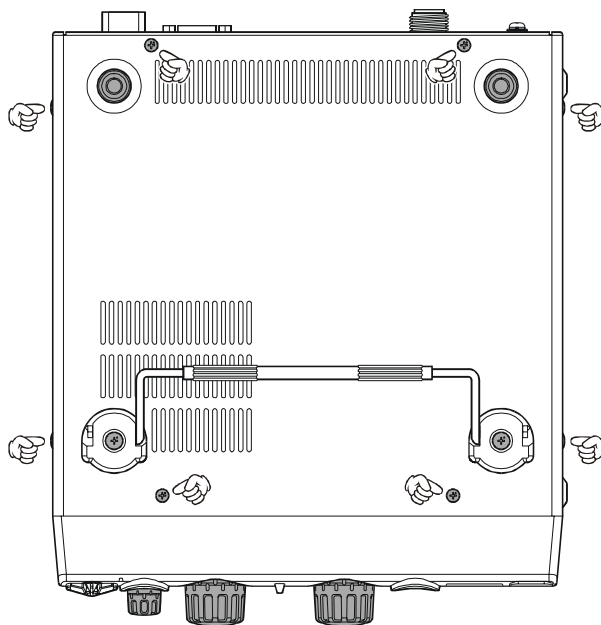


Figure 1

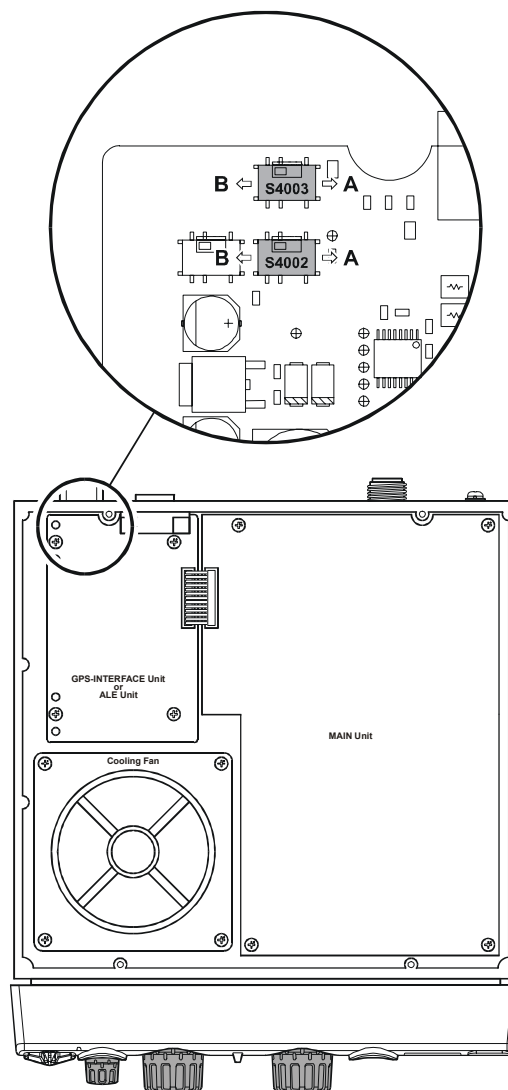


Figure 1

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

CAT DATA PROTOCOL

Serial data is passed at RS-232 levels via the **SI** (Serial Input) and **SO** (Serial Output) pins of the **GPS** jack (pins 2 and 3, respectively) on the rear panel of the transceiver. The serial data format is 4800 bits/second; each byte sent consists of one start bit, 8 data bits, no parity, and two stop bits (4800, N, 8, 2).

CAT DATA (ONE BYTE, SENT LEFT-TO-RIGHT)

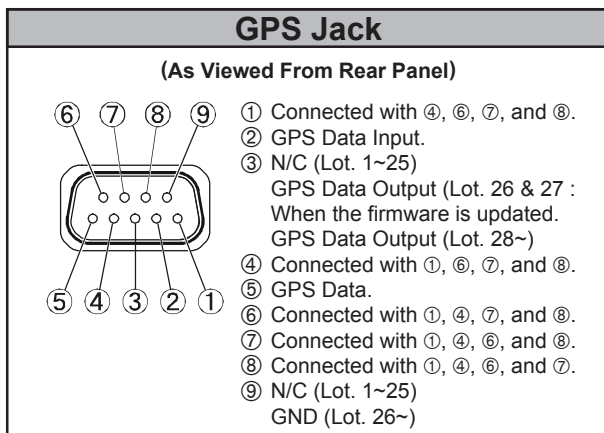
START BIT	0	1	2	3	4	5	6	7	STOP BIT	STOP BIT
-----------	---	---	---	---	---	---	---	---	----------	----------

All commands sent to the transceiver must consist of blocks or five bytes each, with up to 200 ms between each byte. The last byte sent in each block is the instruction opcode, while the first four bytes or each block are arguments: either parameters for that instruction, or dummy values (to pad the block out to five bytes).

5-BYTE COMMAND BLOCK (SENT LEFT-TO-RIGHT)

BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5
ARGUMENT	ARGUMENT	ARGUMENT	ARGUMENT	COMMAND OPCODE

There are 15 instruction opcodes for the VX-1700. Notice that several instructions require no specific parameters, but every command block sent to the transceiver must consist of five bytes.



The CAT control program in the computer must construct the five-byte block by selecting the appropriate instruction opcode, organizing the parameters, if any, and providing unused (dummy) argument bytes for padding (dummy bytes may have any value). The resulting five bytes are then sent, opcode last, to the **SI** (Serial Input) pin of the **GPS** jack on the rear panel of the transceiver.

Example: Tune to 14.250.0MHz:

- First, determine the opcode for the desired instruction (see the CAT command table). These opcodes should be stored in the program so they can be looked up when the user requests the corresponding command. In this case, the instruction is "Set Receive & Transmit Frequency" so the opcode is "0Ah" (small "h" letters following each byte value indicate hexadecimal (base 16) Values).
- Build the four argument byte values from the desired frequency by breaking it into 2-digit blocks (reversed BCD "packed decimal" format). Note that a leading zero is always required in the "hundreds-of-MHz" place (and another in the "tens-of-MHz" place, if below 10 MHz).

BYTE 1		BYTE 2		BYTE 3		BYTE 4	
00		50		42		01	
0	0	5	0	4	2	0	1
100's Hz	10's Hz	10's kHz	1's kHz	1's MHz	100's kHz	100's MHz	10's MHz

- The resulting 5-byte block should look like this (again, in hexadecimal format):

BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5
00	50	42	01	0Ah
DATA/ARGUMENT BYTES				OPCODE

- Send these five bytes to the transceiver (Sent Left-to-Right: **00 50 42 01 0Ah**).

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

CAT COMMANDS

Legend: Send all commands in REVERSE order form that shown! Commands that duplicate a front panel button are named with all caps. Parameter variables are named to reflect their format: eg., "CH" indicates a memory number, from "01h" to "C8h" (1 to 200 decimal). "-" indicates a padding byte. Value is unimportant, but it must be present to pad the block out to exactly five bytes.

COMMAND	OPCODE (Hex)	PARAMETER BYTES				PARAMETER DESCRIPTION
		1	2	3	4	
Memory Recall	02	CH	-	-	-	CH = 01h to C8h 01h: Memory Channel "1", C8h: Memory Channel "200"
Memory Write Memory Hide	03	CH	P2	-	-	P2 = 00: Write the current VFO data to the Memory Channel P2 = 01: Hide the Memory Channel CH = 01h to C8h
Recalls Last-used VFO	05	-	-	-	-	
Set Receive & Transmit Frequency	0A	F1	F2	F3	F4	F1 ~ F4: Frequency Digits (BCD format) Example: 01 23 45 67 = 12.3456 MHz F4 F3 F2 F1
Set Transmit (only) Frequency	8A	F1	F2	F3	F4	F1 ~ F4: Frequency Digits (BCD format) Example: 01 23 45 67 = 12.3456 MHz F4 F3 F2 F1
MODE	0C	M	-	-	-	M = 00: J3E (LSB), 01: J3E (USB), 02: A1A (CW-W), 03: A1A (CW-N), 04: AM (A3E), 08: J2B (LSB-W), 09: J2B (USB-W), 0D: H3E (2182 MHz MODE), 0E: J2B (LSB-N), 0F: J2B (USB-N)
PTT	0F	T	-	-	-	T = 00: Transmitter "off", 01: Transmitter "on"
VFO RX→TX	85	-	-	-	-	Copy the current VFO receiving frequency to the transmit frequency
Step Operation Frequency	8E	D	-	-	-	D = 00: 1 Step Up, 01: 1 Step Down
TX Power Set (Low)	18	-	-	-	-	
TX Power Set (Mid)	28	-	-	-	-	
TX Power Set (Hi)	48	-	-	-	-	
Status Update	10	U	-	-	-	U = 00: Not used, 01: Memory Number, U = 02: Operating Data, 03: VFO Data See Next page for details
Read Meter	F7	-	-	-	-	See Next page for details
Read Flags	FA	-	-	-	-	See Next page for details

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

DATA RETURNED FROM VX-1700

The **VX-1700** returns the "00h" command when the **VX-1700** accepts a command, and returns the "F0h" command when the **VX-1700** does not accept a command via the **SO** (Serial Output) pin of the **GPS** jack on the rear panel of the transceiver.

Furthermore, the following three commands report the various operational and internally-stored settings of **VX-1700**.

STATUS UPDATE COMMAND (10h)

Returns the portion of the RAM table according to the receiving parameter (U).

U = 01 (Memory Number: 1-byte)

Returns the defining current operating memory channel number (01h ~ C8h).

U = 02 (Operating Data: 19-byte)

Returns the defining current operating conditions in the current VFO or memory.

This 19-byte data consists of 1-byte current indicating memory channel number, followed by two 9-byte transmitter and receiver data (described at the right) for either the VFO or Memory currently in use.

19-BYTE DATA FORMAT

1-BYTE	9-BYTE	9-BYTE
MEMORY DATA	RX DATA (VFO OR MR)	TX DATA (VFO OR MR)

1-BYTE MEMORY DATA ASSIGNMENT

BYTE	9-BYTE DATA ASSIGNMENT
0	Not Used
1	Not Used
2	Not Used
3	Not Used
4	Not Used
5	Semi Duplex Memory Channel
6	Alpha Numeric Channel
7	Erased Memory Channel

U = 03 (VFO Data: 9-byte x 2)

Returns the defining current VFO's transmitter and receiver data.

18-BYTE DATA FORMAT

9-BYTE	9-BYTE
VFO RX DATA	VFO TX DATA

9-BYTE VFO (TX & RX) DATA ASSIGNMENT

BYTE	9-BYTE DATA ASSIGNMENT
0	Band Data (BPF Selection)
1	Frequency Data
2	
3	
4	
5	Not Used
6	Mode Data
7	Not Used
8	Not Used

BAND Data (Byte "0"): The 0.03 ~ 30 MHz transceiver operating range is divided into 10 bands, represented in hexadecimal format in the table at the right.

HEX CODE	BAND
00	0.03 - 1.8 MHz
01	1.8 - 2.5 MHz
02	2.5 - 4.0 MHz
03	4.0 - 7.5 MHz
04	7.5 - 10.5 MHz
05	10.5 - 14.5 MHz
06	14.5 - 18.5 MHz
07	18.5 - 21.5 MHz
08	21.5 - 25.5 MHz
09	21.5 - 30.0 MHz

Frequency Data (Byte "1" - "4"): The 4-byte frequency data is comprised of eight fields, from MSB to LSB. For example, a binary value of 0000 0000 0001 0101 1011 1110 0110 1000 is 15BE68 (HEX) = 14.250.00 MHz as follows:

OPERATING FREQUENCY 9-BYTE							
BYTE 1		BYTE 2		BYTE 3		BYTE 4	
Field 1 MSB	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8 LSB
0000	0000	0001	0101	1011	1110	0110	1000
0	0	1	5	B	E	6	8
0015BE68 (HEX) = 1,425,000 = 14.250.00 MHz							

MODE Data (Byte "6"): The mode data is represented in hexadecimal format in the table at the right.

HEX CODE	MODE
00	J3E (LSB)
01	J3E (USB)
02	A1A-W
03	A1A-N
04	A3E
05	J2B

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

DATA RETURNED FROM VX-1700

READ METER COMMAND (F7h)

Returns the meter deflection (00h ~ FFh) repeated in four bytes, followed by one extra "padding" byte (F7h), as follows.

METER BYTE (00h - FFh)	METER BYTE (00h - FFh)	METER BYTE (00h - FFh)	METER BYTE (00h - FFh)	PADDING BYTE (F7h)

During reception, the signal strength deflection is returned. During transmission, the power output level deflection is returned.

READ FLAGS COMMAND (FAh)

Returns only the first three bytes (the Status Flags) from the RAM table, plus two extra "padding" bytes (06h and 04h).

FLAG BYTE 1	FLAG BYTE 2	FLAG BYTE 3	PADDING BYTE (06h)	PADDING BYTE (04h)

The three bytes are treated as 12 one-bit flag fields: a function is enabled (on) if a bit is "1", and disabled (off) if a bit is "0". Most of the functions represented by these flags correspond to the radio display.

First Flag Byte

BIT	DESCRIPTION
0	LOCK is activated. ("LOCK" icon will be illuminated.)
1	Not Used
2	Not Used
3	Not Used
4	Not Used
5	Memory Mode ("MEM" icon will be illuminated.)
6	Not Used
7	VFO Mode ("VFO" icon will be illuminated.)

Second Flag Byte

BIT	DESCRIPTION
0	PTT line closed by CAT command.
1	Scanning, Priority, or Dual Watch is "paused".
2	Scanning, Priority, or Dual Watch is "enabled".
3	J2B filter: "Narrow" selected.
4	A1A filter: "Narrow" selected.
5	J2B operation selected "USB".
6	Not Used
7	Not Used

Third Flag Byte

BIT	DESCRIPTION
0	Not Used
1	TX output selected "10 W".
2	Not Used
3	Not Used
4	Not Used
5	Antenna Tuner working. ("TUNER" icon will be illuminated.)
6	Not Used
7	Transmission in progress. (PTT closed.)

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

CODING EXAMPLES

Although Vertex Standard Co., Ltd. cannot offer to provide complete CAT control programs (owing to the wide variety of incompatible computers used by our customers). We present here with a few examples of critical CAT I/O functions, in BASIC. Note that not all forms or BASIC may support some of the commands, in which case alternate algorithms may need to be developed in order to duplicate the functions of those shown.

SENDING A COMMAND

After "opening" the computer's serial port for 4800 baud, 8 data bits, two stop bits, and no parity as I/O device #2, any CAT command may be sent. The instruction opcode is sent last, with the first (MSB) parameter sent just before it, and the LSB parameter (or dummies) sent first. The parameters are sent in reverse order from that in which they appear in the "CAT Commands" table. Note also that, in the following examples, we are sending zeroes as dummy bytes, although this is not necessary. If you decide to send commands through a five-byte array, the values or the dummy parameters need not be cleared.

The following command could, for example, be used to set the frequency of the display to 14.250.0 MHz:

```
PRINT #2,  
CHR$(&H00);CHR$(&H50);CHR$(&H42);CHR$(&H01);  
CHR$(&HA);
```

Notice here that the BCD values can be sent just by preceding the decimal digits with "&H" in this example. However, in an actual program, you may prefer to convert the decimal frequency variable in the program to an ASCII string, and then convert the string to characters through a lookup table. If you send a parameter that is out of range for the intended function, or not among the specified legal values for that function, the **VX-1700** should do nothing. Therefore, you may wish to alternate your sending of commands or command groups with a Read Flags or an Update command, allowing the transceiver to let the computer know if everything sent so far has been accepted and acted upon as expected.

Bear in mind that some commands specify "binary" (as opposed to BCD-formatted) parameters. You can send binary parameters without going through the character/hex string conversion process. For example, the CH parameter in the Command table is binary. You could have the **VX-1700** recall Memory Channel "1-29" as follows:

```
PRINT #2,  
CHR$(0);CHR$(0);CHR$(0);CHR$(29);CHR$(2);
```

READING RETURNED DATA

The reading process is easily done through a loop, storing incoming data into an array, which can then be processed after all expected bytes have been read into the array. To read the meter:

```
FOR I = 1 TO 5  
MDATA(I)=ASC(INPUT$(1,#2))  
NEXT I
```

Recall from above that the meter data consists of four identical bytes, followed by a "padding" byte, so we really only need to see one byte to get all of the information this command offers. Nevertheless, we must read all five bytes (or 1, 18, 19, in the case of the Update data). After reading all of the data, we can select the bytes of interest to us from the array (MDATA, in the above example).

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

NOTE



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