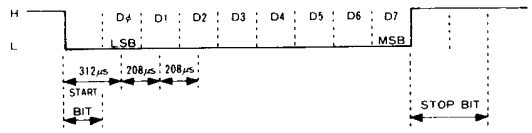
6. CAT SYSTEM COMPUTER CONTROL

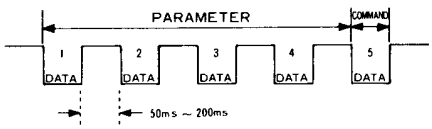
The CAT (Computer Aided Transceiver) System in the FT-747GX allows control of frequency, mode, memory and other settings by the operator's external personal computer.

Serial data is passed at TTL levels (0 and 5V) via SO (serial output) and SI (serial input) pins 2 and 3 of the CAT jack on the rear panel of the transceiver at 4800 bits/sec (CAT jack pinout is shown on page 8). Each byte sent consists of one start bit, 8 data bits (no parity bit) and two stop bits:



Data Format for 1 Character

All commands sent from the computer to the transceiver consist of blocks of five bytes each, with 50 to 200ms between each byte. The last byte sent in each block is the instruction opcode, while the first four bytes of each block are arguments: either parameters for that instruction, or dummy values (required to pad the block out to five bytes):



Data Format for 1 Block (5 Characters)

There are fourteen instruction opcodes for the FT-747GX, listed in the upper table on page 29. Notice that several instructions (UP500K, DN500K and UPDATE) require no parameters. However, every Command Block sent to the 767 must always consist of five bytes.

The CAT control program in the computer must construct the 5-byte block, organizing the parameters, if any, and providing unused (dummy) argument bytes for padding. These will be ignored when such instructions are executed, so they need not be zeroed. The instruction opcode is then placed at the end of the block, and all five bytes are sent to the SI serial input pin of the CAT jack on the transceiver.

EXAMPLE: Set 14.25000 MHz as the current operating frequency;

(1) Build the four argument byte values from the desired frequency by breaking it into 2-digit blocks: technically referred to as "packed decimal" format. Note that a leading zero is always required in the hundreds-of-MHz place (and another in the ten's-of-MHz if below 10 MHz).

0 1 4 2 5 0 0 0

Step (1) 01 42 50 00

Step (2) 00h 05h 42h 01h 0Ah

LSD		MSD	FREQ_SET
Frequency	Parms		Opcode

(2) Now REVERSE the order of these bytes, and add the appropriate instruction byte on the end. The small "h"s following each byte value indicate hexadecimal (base 16) values (which in packed decimal format use the same digits as their decimal equivalents).

(3) Send the five bytes to the transceiver, LSD (least significant digit) first (left-to-right as above).

Notice that there is space for a ten's-of-Hz digit in the frequency parameters, although

is 25 Hz, so ten's-of-Hz digits are converted (in the transceiver) as follows when the command is executed.

Ten's-of-Hz Conversion to 25 Hz Steps:

CAT Parameter for 10's of Hz									
0	1	2	3	4	5	6	7	8	9
00			25		50			75	

Resulting Freq. (ten's & one's of Hz)

Reading Transceiver Status

The UPDATE and the PACING commands allow the computer to obtain, upon request, a report of various transceiver settings via the SO (Serial Output) line. UPDATE causes the transceiver to return 345 bytes of Status Update data, with each byte delayed by the interval selected by the PACING command (0 to 1,275ms in 5ms steps). This delay is initially zero until the PACING command is sent.

The PACING command allows Status Update data to be read and processed by even very slow computers. However, the pacing delay should always be selected to be as fast as your computer will accommodate, to minimize the inconvenience of the delay. Sending 345 bytes requires 790ms with "0"-length delay selected, but over 7 minutes if the maximum delay is selected!.

Status Update Data Organization

Status Update Data is mapped as shown in the lower table on page 29 and described below.

(1) Status Flags (1 byte)

The first byte of the Status Update data is the Status Flag Byte for the current display. Seven bits of this byte are used as flags to indicate the on/off status of the seven elements that appear at the left side of the transceiver display, as follows:

Status Flags

Bit number:

7	6	5	4	3	2	1	0
PRIority Monitoring	reserved (may be 0 or 1)	TX/RX (0 = RX)	VFO/MR (0 = VFO)	VFO-A/B (0 = VF0-A)	CLAR	SPLIT	D LOCK

(unless otherwise indicated, 0=off, 1=on.)

(2) Frequency Block (5 bytes)

After the Status Flags byte is a 5-byte Frequency Block used for the operating frequency. The first byte of this block is reserved, and returns zero (00h). The last four of these bytes hold an 8-digit packed decimal representation of the operating frequency, which is not the same as that used by the FREQ SET command:

Frequency Block

Byte (relative to start of Block)

0	1	2	3	4
00	f_2 f_3	f_4 f_5	f_6 f_7	f_8 f_9

Frequency digits*

Display: f_2 f_3 . f_4 f_5 f_6 . f_7

$f_8 f_9$ = 00, 25, 50 or 75 Hz (not displayed)

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* Compare this with the parameters of the FREQ_SET command:

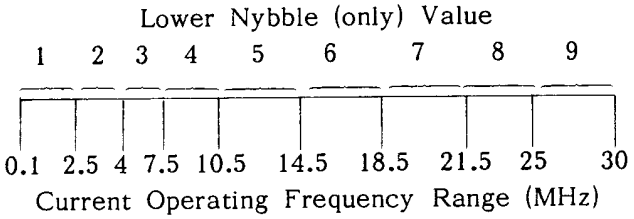
Parameter Byte

1	2	3	4
f_7 f_8	f_5 f_6	f_3 f_4	0 f_2

(3) Band Data (1 byte)

Following the Frequency Block is the Band Data byte, which has the operating frequency range programmed in the lower nybble (four bits). The upper nybble is reserved and the bit values are undetermined, so it must be masked out before decoding the byte:

Band Data



(4) VFO-A (8 bytes)

After the Band Data are eight bytes holding the current data for VFO-A. The first byte is a Status Flags Byte, with the same format as already described for the current display. If currently operating on VFO-A, this byte is the same as the first Status Flags Byte (first byte of the Status Update data).

The next five bytes are the Frequency Block for VFO-A, with the same format as already described in item (1) above.

The last two bytes are reserved, and return indeterminate values (not necessarily zeros).

(5) VFO-B Data (8 bytes)

Following the VFO-A data are eight bytes holding the data for VFO-B, which has the same format as just described for VFO-A.

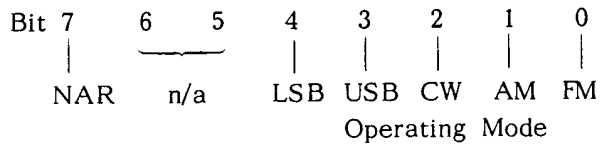
(6) Displayed Memory Number (1 byte)

The byte following the VFO-B data is the binary value of the currently displayed memory number (00 to 13h). Note that this is not packed decimal format.

(7) Current Mode (1 byte)

The next byte has six bits used as a mode bit map, with one or (at most) two bits set to indicate the current (displayed) mode, as follows:

Mode Bit Map



NAR = Narrow IF filter (may be set along with bits 0, 1 or 2).

n/a = Not Assigned. Value undetermined.

(8) Memory Data (8 bytes x 38)

The next 304 bytes of the Status Update Data consists of thirty-eight 8-byte structures:

Memory Data Structure

1-byte Status Flags,
5-byte Frequency Block,
1-byte Mode Bit Map,
1-byte reserved (value undetermined)

Each component in this structure has the same format as already described (items (1), (2) or (7) above). The first twenty structures represent receiver (or simplex) data for memories 00 through 19. The remaining 18 structures represent transmit data for any of memories 00 through 17 that were stored for split operation. Note, however, that if split operation was not stored, the data in the corresponding structure is indeterminate.

(9) The last sixteen bytes of the Status Update data are reserved, and undefined.

INSTRUCTION OPCODES

("xx" indicates padding: any value is acceptable)

Instruction Name	Parameters LSD			MSD	Instr. Opcode(Hex)	Remarks
SPLIT	xx	xx	xx	yy	01h	yy: 00h=Off, 01h=On
MEMORY	xx	xx	xx	mm	02h	Recall Memory No. mm (00h - 13h)
VFO_TO_M	xx	xx	xx	mm	03h	Write VFO to Mem No. mm (00h - 13h)
DLOCK	xx	xx	xx	yy	04h	yy: 00h=Off, 01h=On
A_BVFO	xx	xx	xx	yy	05h	Select VFO-A or -B. yy: 00h=A, 01h=B
M_TO_VFO	xx	xx	xx	mm	06h	Copy Mem No. mm (00h - 13h) to VFO
UP500K	xx	xx	xx	xx	07h	Step Frequency up 500 kHz
DN500K	xx	xx	xx	xx	08h	Step Frequency down 500 kHz
CLAR	xx	xx	xx	yy	09h	yy: 00h=Off, 01h=On
FREQ_SET	f_7f_8	f_5f_6	f_3f_4	$0f_2$	0Ah	f_2-f_8 = seven packed decimal digits*
MODE_SET	xx	xx	xx	zz	0Ch	zz: 00h=LSB, 01h=USB, 02h=CWW, 03h=CWN, 04h=AMW, 05h=AMN, 06h=FMW, 07h=FMN
PACING	xx	xx	xx	pp	0Eh	pp: 00-FFh (Delay Update pp x 5ms/byte)
PTT	xx	xx	xx	yy	0Fh	yy: 00h=Receive, 01h=Transmit
UPDATE	xx	xx	xx	xx	10h	Return Status (345 bytes) on SO line

* see examples in the text

STATUS UPDATE MAP

Location Decimal	Location Hex	Text Ref.	Data Description
0	00h	(1)	Displayed Status Flags (bit-mapped toggle indicators)
1-5	01h-05h	(2)	Displayed Freq. Block (8 packed decimal digits w/two leading zeros)
6	06h	(3)	Current Band Data (one bit set to indicate selected band)
7	07h	(4)	VFO-A Status Flags (same format as Displayed Status Flags)
8-12	08h-0Ch	(4)	VFO-A Frequency Block (same format as Displayed Freq. Block)
13-14	0Dh-0Eh	(4)	reserved (undefined)
15-20	0Fh-16h	(5)	VFO-B (same format as bytes 07h-0Eh)
21	17h	(6)	Displayed Memory No. (binary number between 00 and 13h)
22	18h	(7)	Displayed Mode (bit-mapped mode and IF filter selection)
23-32	19h-20h	(8)	Memory 00 Rx Status Flags, Freq. Block, Mode and one reserved byte
33-40	21h-28h	(8)	Memory 01 Rx " " " " " " " " " ""
.	.		.
.	.		.
177-184	B1h-B8h	(8)	Memory 19 Rx Status Flags, Freq. Block, Mode and one reserved byte
185-192	B9h-C0h	(8)	Memory 00 Tx Status Flags, Freq. Block, Mode and one reserved byte
193-200	C1h-C8h	(8)	Memory 01 Tx " " " " " " " " " ""
.	.		.
.	.		.
321-328	141h-148h	(8)	Memory 17 Tx Status Flags, Freq. Block, Mode and one reserved byte
329-344	149h-158h	(9)	reserved (undefined)