



35 South Service Road • Plainview, NY 11803
TEL: 516 694-6700 • FAX: 516 694-6715

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CIRCUIT TECHNOLOGY

APPLICATION NOTE #106

CT2525/6/7 Series

CT7005/6 Series

UNDERSTANDING AND USE OF THE BIT WORD

Point of Contact:
John Vanchieri
Tel: (516) 752-2484

The CT252X contains a 16-bit register, called the Built-In-Test (BIT) Word, which records message error and terminal status information supplementary to that given by the RT Status Word. This paper describes the BIT Word contents and indicates how the information may be used.

The BIT Word is used in conjunction with the mode command 'Transmit BIT word' as described in the MIL-STD-1553B document, which states:

4.3.3.5.1.7.14 Transmit built-in-test (BIT) word.

This command shall cause the RT to transmit its status word as specified in 4.3.3.5.3 followed by a single data word containing the RT BIT data. This function is intended to supplement the available bits in the status words when the RT hardware is sufficiently complex to warrant its use. The data word, containing the RT BIT data, shall not be altered by the reception of a transmit last command or a transmit status word mode code. This function shall not be used to convey BIT data from the associated subsystem(s)

subsystem(s)", the BIT Word can only be accessed by the Bus Controller over the 1553 network. If the BC saw a error bit set in the Status Word it could then initiate a diagnostic or recovery routine which would include the examination of RT's BIT Word. This scenario will be discussed later.

BIT WORD CONTENTS

The BIT word is structured as shown in Figure 1. The entire BIT word contents will be reset to logic zero by a power-up initialization or a legal mode command to reset remote terminal. The default operation (ENABLE input high) for each bit will now be explained.

Bit 0 Transmitter Time-out Flag

This bit shall be set to logic one if a transmitter out occurs while the RT is transmitting. In addition, if the RT is issued a legal Initiate Self-Test mode command, this bit shall be set if the transmitter time-out mechanism does not operate within the range 660µs to 800µs. The time-out mechanism within the transmitter is designed to operate after 680µs of terminal transmission.

Bit 1 Internal Handshake

This bit shall be set to logic one if the internal circuitry the CT252X does not acknowledge an RT request to transfer a data word in time for the transfer to take place correctly.

Bit 2 Loop Test Failure

At all times while the terminal is transmitting, the CT252X checks the 1553 bus for any sync, Manchester, parity, or continuity errors. An extensive bit-by-bit comparison is made on the complete transmission. The LTF bit shall be set to logic one if any such error in the bus transmission is detected. This bit shall also be set if the CT252X has a parity error in its hard wired RT address.

MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved	Reserved	Transmitter Timeout on BUS 1	Transmitter Timeout on BUS 0	Reserved	Reserved	BUS 1 Shutdown	BUS 0 Shutdown	Broadcast Transmit Data Rec'd	Word Count High	Word Count Low	Illegal Mode Command	Mode T/R Bit Wrong	Loop Test Failure	Internal Handshake Failure	Transmit Timeout Flag

Figure 1 CT252X BIT Word Register

The CT252X BIT Word provides the system designer with the information necessary to accomplish comprehensive diagnostic routines over the 1553 network. Since 1553B states "This function shall not be used to convey BIT data from the associated

Bit 3 Mode T/R Bit Wrong

This bit shall be reset to logic zero by the reception of any valid command word with the exceptions as specified in the paragraph "BIT Word Reset Exceptions".

This bit shall be set to logic one if a valid mode command is received with a transmit/receive (T/R) bit opposite to that specified in Table 1 of paragraph 4.3.3.5.1.7 in MIL-STD-1553.

Bit 4 Illegal Mode Command

This bit shall be reset to logic zero by the reception of any valid command word with the exceptions as specified in the paragraph "BIT Word Reset Exceptions".

This bit shall be set to logic one if either of the following two conditions arise:

- A valid mode command is received with one of the reserved mode codes as specified in Table 1 of paragraph 4.3.3.5.1.7.
- A valid mode command is received with the broadcast RT address and broadcast option is not allowed with the associated mode code. The legality of the broadcast option is specified in Table 1 of paragraph 4.3.3.5.1.7 for each mode code.

Bit 5 Word Count Low

This bit shall be reset to logic zero by the reception of any valid command word with the exceptions as specified in the paragraph "BIT Word Reset Exceptions".

This bit shall be set to logic one if fewer valid data words are received than stipulated by the preceding receive command word.

Bit 6 Word Count High

This bit shall be reset to logic zero by the reception of any valid command word as specified in the paragraph "BIT Word Reset Exceptions".

This bit shall be set to logic one of the received message is longer than stipulated by the preceding valid command word.

Bit 7 Broadcast Transmit Data Received

This bit shall be reset to logic zero by the reception of any valid command word with the exceptions as specified in the paragraph "BIT Word Reset Exceptions".

This bit shall be set to logic one if a valid, non-mode command to transmit data words is received with the broadcast address.

Bit 8 Bus 0 Shutdown

This bit shall be set to logic one if Bus 0 has been shutdown by one of the legal transmitter shutdown mode commands.

This bit shall be reset to logic zero if Bus 0 is reopened by one of the legal override transmitter shutdown code commands.

Bit 9 Bus 1 Shutdown

This bit operates as described for Bus 0, but relates to Bus 1.

Bit 10 Reserved

This bit is a reserved function and shall be set to logic zero.

Bit 11 Reserved

This bit is a reserved function and shall be set to logic zero.

Bit 12 Transmitter Time-out on Bus 0

This bit shall be set to logic one if a transmitter timeout has occurred on Bus 0.

Bit 13 Transmitter Time-out on Bus 1

This bit shall be set to logic one if a transmitter timeout has occurred on Bus 1.

Bit 14 Reserved

This bit is a reserved function and shall be set to logic zero.

Bit 15 Reserved

This bit is a reserved function and shall be set to logic zero.

BIT WORD RESET EXCEPTIONS

The contents of the BIT word register shall not be altered by any of the following legal mode commands:

- Transmit Status Word
- Transmit Last Command
- Transmit BIT Word

PRESERVING THE BIT WORD **(when using the ENABLE option)**

In order to preserve the Transmitter Time-out Flag, Internal Handshake Failure, Word Count High, Word Count Low, and Loop Test Failure Bits in the BIT Word, it is necessary to select the BIT DECODE input (hold it low). This will prevent resetting those bits if the Transmit Bit Word Mode Command immediately follows the fault, or follows a Transmit Last Command or Transmit Status immediately following the fault. It will also prevent resetting the TF and SSF Bits in the Status Word. Any other valid commands will cause those BIT Word bits and the Status Word bits to be reset. For further information on this subject please refer to the Application Note entitled "Optional Control of the Subsystem Flag and Terminal Flag Bits".

THE BIT WORD AS AN EXPANSION OF THE STATUS WORD

If the BC should receive a status word with any of the error bits set, it would then be very easy to determine the exact cause of the error by immediately requesting the RT's BIT Word. Depending on the results obtained, further diagnostic actions could then be performed. An explanation of the

Status bits and their related BIT Word bits follows.

Expansion of the Message Error bit

The following BIT Word bits may be used to analyze the cause of the message error bit being set in the RT's status word:

- Bit 3 A mode command having been received with an incorrect T/R bit.
- Bit 4 A mode command having been received with a reserved mode code or an illegal broadcast address.
- Bit 5 Too few valid data words having been received.
- Bit 6 Too many valid data words having been received.
- Bit 7 A broadcast command to transmit data words having been received.

Expansion of the Subsystem Flag bit

Bit 1 of the BIT word may be used to determine whether the Subsystem Flag is set due to an internal RT handshaking failure or due to the subsystem itself flagging a fault.

Expansion of the terminal Flag bit

The following BIT Word bits may be used to analyze the cause of the terminal Flag bit being set:

- Bit 0 A transmitter time-out error has occurred.
- Bit 2 The terminal has detected an erroneous waveforms on the bus while transmitting, or the hard wired RT address has intermittent or incorrect parity.

RT SELF-TEST RESULTS

If the RT fails a self-test after servicing an Initiate Self-Test mode command, the Terminal Flag bit in the Status Word will be set. The error source may be further analyzed by presenting the RT with the following sequence of mode commands:

- A. Reset Remote Terminal

B. Initiate Self Test

C. Transmit BIT Word

Bits 13, 12, and 0 of the BIT word may then be interpreted using Table 1. It should be noted that an RT self-test forces the transmitter time-out mechanism to operate. The self-test circuitry then checks:

A. That the mechanism does operate

and

B. That the mechanism operates correctly.

Table 1

TX TIME-OUT ON BUS N	TX TIME-OUT FLAG	INTERPRETATION
0	0	Self-Test aborted due to superseding valid command
0	1	Transmitter time-out mechanism inoperative.
1	0	Self-Test good.
1	1	Transmitter time-out mechanism operating incorrectly

N = The bus on which the self-test command was issued.

SUMMARY

This paper has attempted to answer the most commonly asked questions concerning the use of the CT252X series of hybrids. Forthcoming application notes will address additional hardware concerns and software methodology. Information on the CT252X series, or any other 1553 data bus product, can be obtained by calling the Applications Dept. at (516) 752-2484.

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