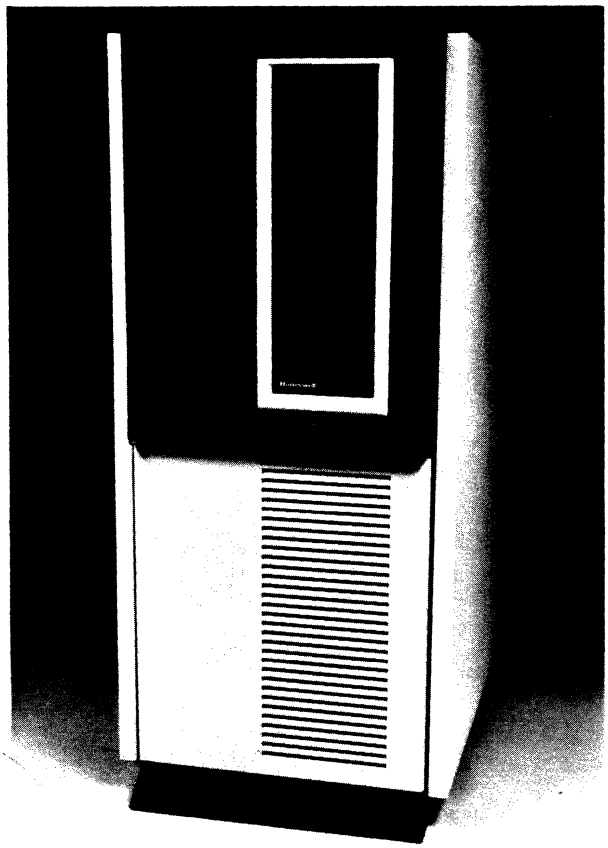
HONEYWELL

DPS 6 & LEVEL 6 MTU9635/9636 GCR/PE MAGNETIC TAPE UNIT OPERATION



HARDWARE

DPS 6 & Level 6
MTU9635/9636
GCR/PE
Magnetic Tape Unit Operation

SUBJECT
General Description, Programming, Operation, and Maintenance Procedures for the MTU9635/9636 Magnetic Tape Units

The following notice is provided in accordance with the United States Federal Communications Commission's (FCC) regulations.

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. The equipment manufactured after October 1, 1983 has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. As temporarily permitted by regulation the equipment manufactured prior to October 1, 1983 has not been tested for compliance. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

ORDER NUMBER
GS12-00

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Honeywell

About This Manual

This manual contains hardware-oriented descriptions and instructions for operators of the MTU9635/9636 GCR/PE Magnetic Tape Units for DPS 6 & Level 6 systems. Section 1 outlines the device capabilities. Section 2 describes the various controls and indicators with which an operator should become familiar before operating the unit. Section 3 explains how to operate the unit. Section 4 provides preventive, remedial, and tape maintenance procedures as well as diagnostic tests. Appendix A outlines tape unit specifications. Appendix B provides programming information.

Readers are invited to use the Technical Publications Remarks Form at the end of the manual to note any publication errors or to offer any suggestions for improvement.

File No.: 1S01, 1R01

GS12-00

Contents

Figures

Tables

Section 1
Introduction

The MTU9635/9636 magnetic tape units, designed for use with DPS 6 and Level 6 systems, are buffered, 9-track, dual-density magnetic tape units that offer 6250-bpi Group Coded Recording (GCR) and 1600-bpi Phase-Encoded (PE) operation. Each tape unit has three operating performance modes: 25-ips start/stop, 25-ips streaming mode, and 75-ips streaming mode. Depending on data flow between the tape subsystem and the host system, the unit automatically selects the mode which provides the maximum throughput.

Each tape unit is located in a separate, freestanding cabinet. Up to four drives per MTC9643 Tape Controller may be used with a system. Each drive is located in a separate cabinet. The first tape unit must be the MTU9635 primary unit; up to three MTU9636 secondary units may be added as required.

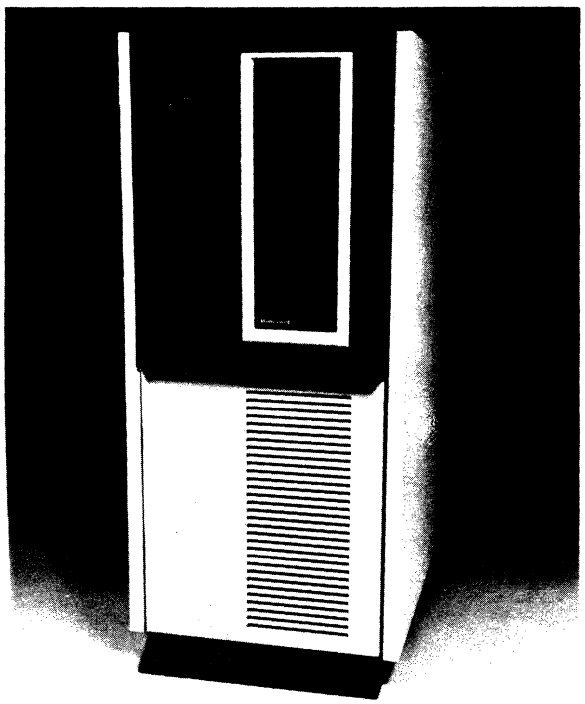


Figure 1-1. MTU9635/9636

Each tape unit contains a 128K-byte electronic data buffer, capable of storing commands and data records. Buffered data is transferred between the host system and the tape unit at the channel data rate which is faster than the typical tape writing rate. As a result, the tape unit can continue read or write operations despite short interruptions in data flow with the host system. Many applications will operate at a much greater throughput rate than with a 75-ips, non-buffered tape unit.

Unlike many other tape units, the tape units contain no tape capstan with motor drive, tension arms, or vacuum columns. The tape is driven by reel motors that are electronically servo-controlled to regulate tape speed and tape tension. The tape is guided over the read/write head by air bearings that sense tape motion and tension to help control supply and take-up reel motors.

Features

- Buffer disable
- Simple loading and operating procedures
- Simplified tape path and quick-release reel latch designed for each of operation
- Servo-controlled reel motors eliminating vacuum columns, capstans, or tension arms
- Full set of operator controls and indicators for major device functions and maintenance
- 128K-byte data buffer
- Integrity features to help ensure accuracy of data written and retrieved from storage media
- Write enable feature allowing file protection from accidental write operation
- Reading/writing on one tape unit simultaneously with rewinding/unloading on other units
- Read/write functions accomplished in ECMA/ANSI-compatible format
- Two-digit display to assist and monitor offline diagnostic tests
- Automatic selection of transport modes (25-ips start/stop, 25-ips streaming, 75-ips streaming)

Supplies and Accessories

Honeywell markets a complete line of computer tape, tape-packaging options, and cleaning accessories. For further information, refer to the *National Distribution Operations Sales Catalog: Supplies and Accessories,* Order No. GF60.

Section 2
Controls and Indicators

This section describes the tape unit indicators and touch-sensitive controls. Become familiar with these controls and indicators to ensure proper tape unit operation.

Operation Panel

Figure 2-1 shows the layout of the operation panel buttons and indicators. All buttons on the panel are touch-sensitive. Button and indicator functions are summarized in Table 2-1.

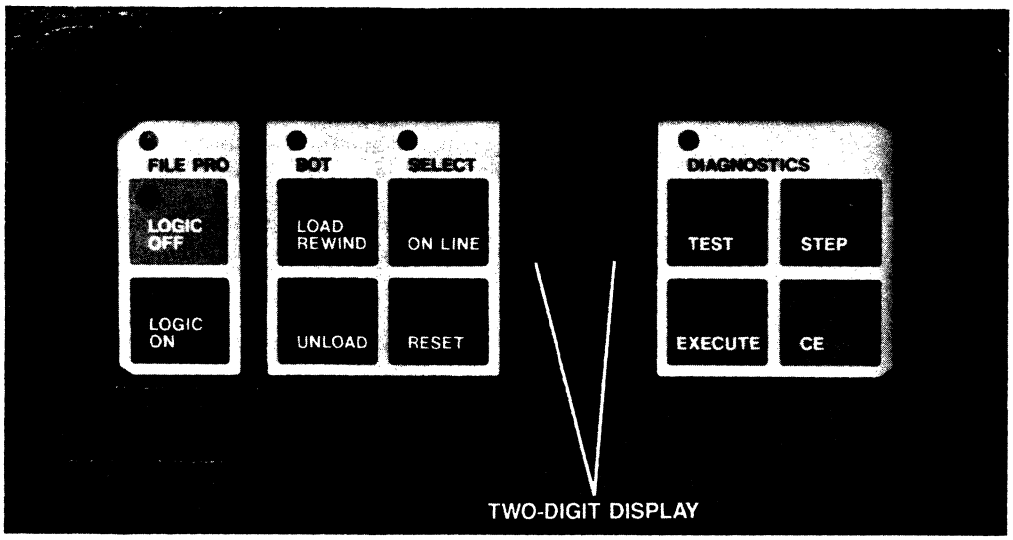


Figure 2-1. Operation Panel

Table 2-1. Controls and Indicators

Button/Indicator		Description
FILE PROTECT	Indicator	Lights to indicate absense of a write-enable ring in supply reel; write operation is inhibited.
LOGIC OFF	Button	When pressed, tape unit is non-operational.
	Indicator	Lights when unit is non-operational and in standby power condition.
LOGIC ON	Button	If pressed when circuit breaker is set to ON, tape unit is powered on and operational.
	Indicator	Lights when tape unit is powered on and operational.
BOT	Indicator	Lights when tape is positioned at beginning-of-tape.
LOAD/ REWIND	Button	If pressed when tape unit is powered on and tape is threaded, causes a load operation to be performed (i.e., tape is positioned at BOT). If tape is loaded, causes a rewind operation to beginning-of-tape.
UNLOAD	Button	If pressed when tape is loaded, tape unloads from take-up reel and tape path onto supply reel. If tape is threaded, but not loaded, unit slowly unloads tape onto supply reel.
SELECT	Indicator	Lights when unit is in GCR mode. (When indicator is turned off, the unit is in the PE mode.)
ONLINE	Button	If pressed when tape is loaded, goes online and becomes available for system control.
	Indicator	Lights when tape unit is online.
RESET	Button	If pressed, takes unit offline, stops tape motion, and clears error status.
	Indicator	Lights when error condition exists, or at completion of diagnostic test.
TWO-DIGIT DISPLAY	Indicator	Lights when unit is in offline diagnostic/test mode. It displays diagnostic/test numbers and results of microdiagnostic or exerciser routines when in offline diagnostic/test mode. When RESET indicator lights during an error condition, display shows either a diagnostic fault code or an online operational failure code.
DIAGNOS-TICS	Indicator	Lights when unit is in diagnostic/test mode.
TEST	Button	If pressed when unit is not online, places the unit in diagnostic/test mode.
EXECUTE	Button	If pressed when unit is in diagnostic/test mode, initiates diagnostic test according to number shown on two-digit display.
STEP	Button	If pressed when unit is in diagnostic/test mode, sequences diagnostic/test numbers
CE	Button	If pressed when unit is in diagnostic/test mode, initiates special diagnostics (see Section 4 for further information).

Section 3
Operation

This section describes the operation procedures for the tape unit. To minimize the possibility of error or damage to the tapes, it is important that the operator understand the use and function of the various controls and indicators previously explained in Section 2.

Power-on Sequence

The power supply circuit breaker (Figure 3-1) is located at the top-right corner of the tape deck. Press this circuit breaker to the ON position (side 1 pressed down). The LOGIC OFF indicator will light momentarily. While the power-on automatic self-test is executed, the LOGIC ON and DIAGNOSTICS indicators light and 00 appears on the two-digit display. When the self-test is successfully completed and the unit is ready for operation, the DIAGNOSTICS indicator and two-digit display turn off, and the LOGIC ON and FILE PROTECT indicators light.

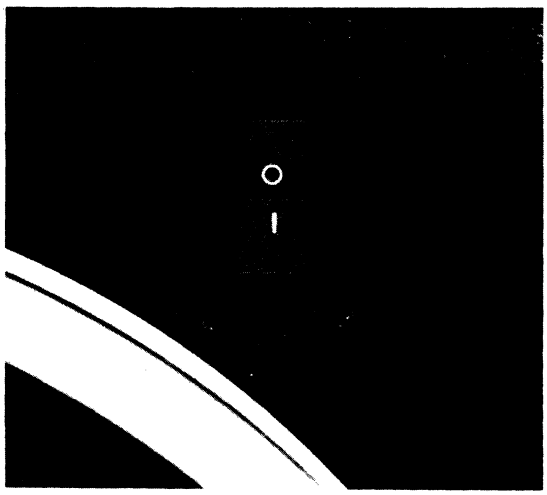


Figure 3-1. Circuit Breaker

Power-off Sequence

Press the power supply circuit breaker to the OFF position (side 0 pressed down) to power down the tape unit.

Note: Pressing the LOGIC OFF button causes the tape unit to enter a standby power condition. Although the unit is not operational when the LOGIC OFF button is pressed, the ac line voltage is still present in the unit.

Tape Loading

CAUTION

Exercise care when handling magnetic tape and the reel on which it is mounted.

To load tape, follow these steps.

1. Make sure the tape unit is powered on and the LOGIC ON indicator is lit.
2. Unlock the hub latch by pressing the hub release button (Figure 3-2) on the face of the supply reel hub.

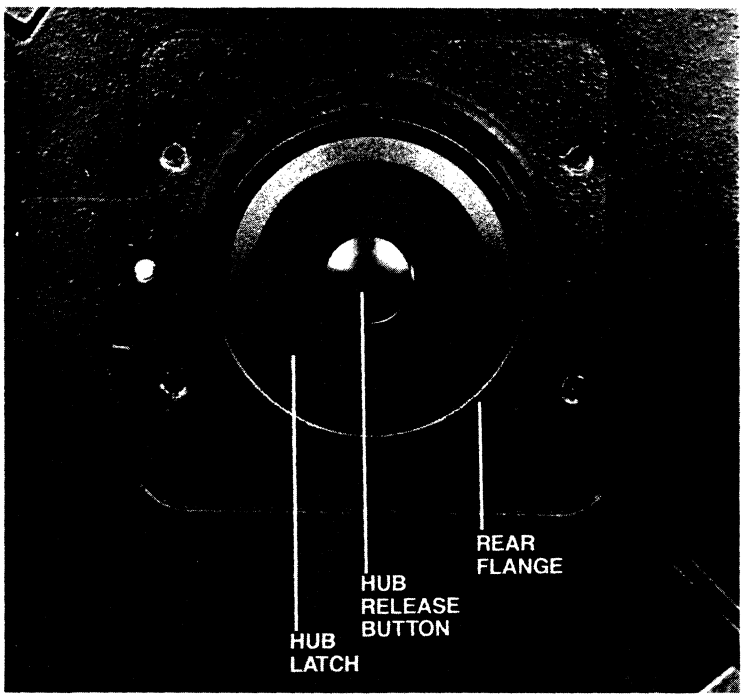


Figure 3-2. Rear Flange, Hub Latch, and Hub Release Button

3. Mount the supply reel onto the hub (clear plastic side of the reel facing you). The back of the reel will be pressed against the rear flange (Figure 3-2). If a write-enable ring is present on the reel, the flange will be pressed in. The flange will be inserted into the groove at the back of the reel if a write-enable is not present.

4. Secure the reel onto the hub by pressing the hub latch.

5. Thread the magnetic tape over the tape path as shown in Figure 3-3. (A diagram of the tape path also appears on the tape deck.)

CAUTION

Be sure to position the tape correctly over all tape path components in order to avoid tape damage.

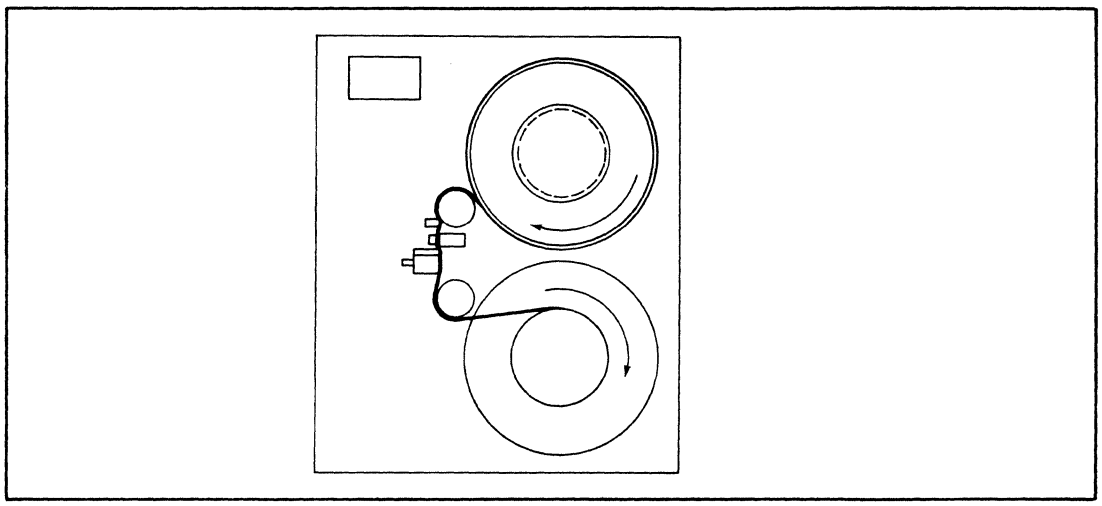


Figure 3-3. Tape Path

6. Wrap the tape onto the take-up reel using the following procedures.

   Note: Hang the tape over the take-up reel (Figure 3-4) after threading for easier tape wrapping.

   a. Secure the tape leader by inserting your index finger through the opening in the take-up reel nearest to the tape end. Make sure to hold your finger on the tape approximately one inch from the end of the tape.

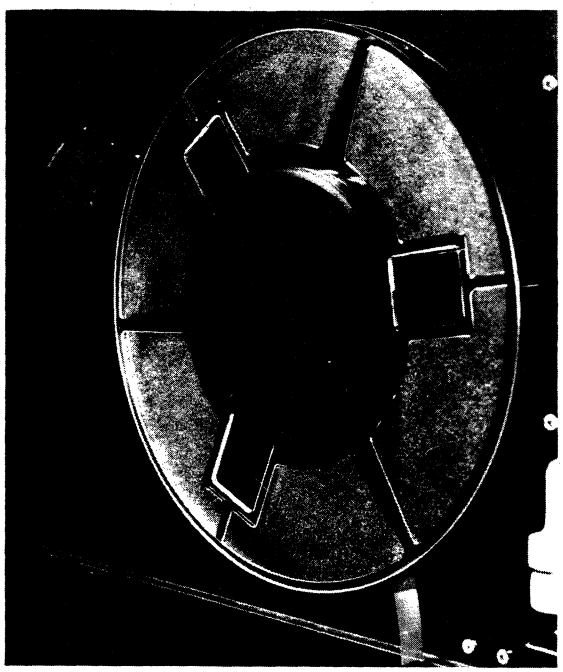


Figure 3-4. Tape Over Take-up Reel

b. With your finger still securing the tape leader, turn the take-up reel clockwise (Figure 3-5) until the tape leader is smoothly wound beneath one layer of the tape. While turning the take-up reel, be sure to provide slack from the supply reel by turning it with your free hand.

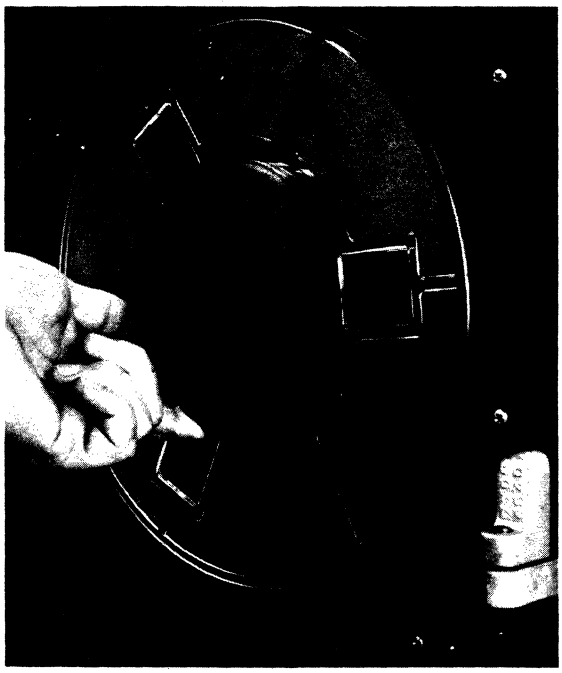


Figure 3-5. Tape Wrapping

c. Remove your finger and carefully place the same finger over the portion of the tape which is covering the tape leader. Make another complete clockwise rotation of the reel.

d. When the tape leader is secured beneath two layers of tape, remove your finger and rotate the reel one or two more times until the tape is taut.

7. Close the dust cover door and press the LOAD/REWIND button to execute a search for the BOT marker. When BOT is found, the BOT indicator will light.

   Note: If no BOT is found, the tape unloads and the RESET indicator lights. If this occurs, refer to "Missing or Defective BOT Marker" in Section 4.

8. After the BOT indicator lights, check the density mode of the tape unit. (When the SELECT indicator is lit, the unit is in the GCR mode. When the SELECT indicator is not lit, the unit is in the PE mode.) If necessary, change the density according to "Changing Density" below.

9. Once the correct density is determined (BOT indicator still lit), press the ON LINE button to place the unit online. The ON LINE button may be pressed while the load operation is in progress. On completion of the load operation, the ON LINE indicator will light.

Changing Density

During the power-on sequence, the tape unit defaults to the PE mode. When a density change is required, follow these procedures.

1. Make sure the tape is positioned at the BOT marker. The BOT indicator will be lit.

2. Press the RESET button and then the LOAD/REWIND button to select the new density.

The SELECT indicator lights when the tape unit is in the GCR mode. The SELECT indicator is turned off when the tape unit is in the PE mode.

Tape Rewinding

To rewind tape, follow these steps.

1. If the tape unit is operating online and the tape is past the BOT marker, press the RESET button to place the tape unit offline. The ON LINE indicator will turn off.

2. Press the LOAD/REWIND button. The tape will rewind at rewind speed (2.5 minutes to rewind a 2400-ft reel of tape) and position itself at the BOT marker. The BOT indicator will light.

Tape Unloading

CAUTION

When unloading, exercise care when handling magnetic tape and the reel on which it is mounted.

To unload tape, follow these steps.

1. If the tape unit is operating online, press the RESET button to place the unit offline. The ON LINE indicator will turn off.
2. Press the UNLOAD button. The tape will leave the take-up reel and tape path component areas to rewind onto the supply reel (2.5 minutes to rewind a 2400-ft reel of tape).

Tape Dismounting

Tape must be unloaded prior to dismounting. If the tape is loaded on the take-up reel, it must be unloaded according to "Tape Unloading" above.

To dismount the tape, follow these steps.

1. Open the dust cover door and press the hub release button (Figure 3-3) on the face of the supply reel hub. The hub will unlatch and the supply reel can be removed.
2. Close the dust cover door to prevent dust accumulation on the tape deck components.

Section 4
Operator Maintenance

This section describes preventive, remedial, and tape maintenance procedures which must be followed for the tape unit to operate properly. The tape unit is designed to provide a high degree of reliability to the user while minimizing maintenance requirements. The low maintenance feature, however, is entirely dependent on the proper care and handling of the tape unit and magnetic tape.

Preventive Maintenance

Cleaning must be performed daily or during each eight-hour shift under normal operating conditions (every four hours when the tape unit is exposed to excessive contamination).

When cleaning, remember that the recommended solvents and equipment *must* be used as indicated. Cleaning should be done with a lint-free cloth or foam-tipped swab moistened with transport cleaning fluid (or equivalent solvent). *Do not use isopropyl alcohol.* After applying cleaner, allow a few minutes for the excess fluid to evaporate before mounting a tape.

Cleaning tools and materials are available from the Honeywell *National Distribution Operations Sales Catalog: Supplies and Accessories,* Order No. GF60.

Before performing the following maintenance, open the dust cover door and make sure the supply reel and head assembly dust covers (Figure 4-1) are removed.

CAUTION

Set the power supply circuit breaker to the OFF position (0 side pressed down).

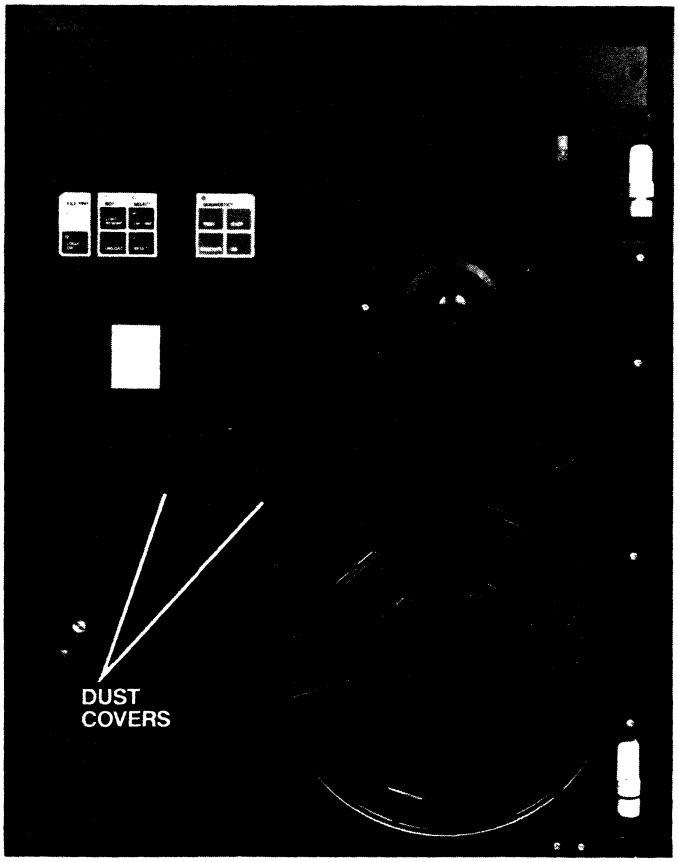


Figure 4-1. Head Assembly Dust Covers

Figure 4-2 illustrates the tape deck components that must be cleaned as follows:

- Magnetic head – Clean the magnetic head recording surface using a lint-free cloth moistened with transport cleaning fluid (or equivalent solvent). Make sure to wipe the recording surface in the same direction that the tape moves across the head (from top to bottom).
- Tape cleaner – Use a foam-tipped swab moistened with transport cleaning fluid (or equivalent solvent) to remove dirt and oxide deposits from the tape cleaner blades.
- EOT/BOT sensor – Use a foam-tipped swab moistened with transport cleaning fluid (or equivalent solvent) to remove dirt and oxide deposits from the EOT/BOT sensor.

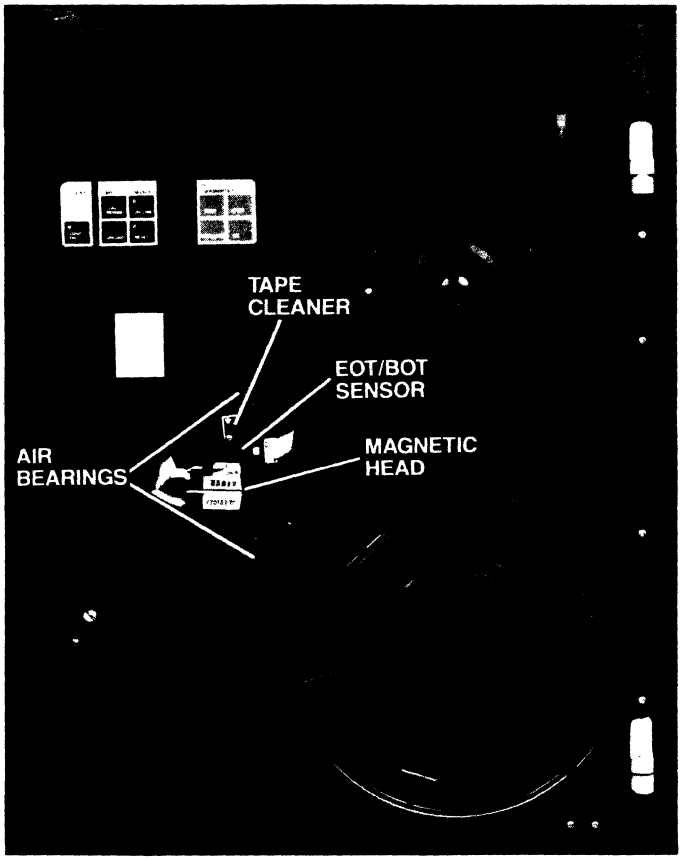


Figure 4-2. Cleaning

- Air bearings (upper and lower) – Clean both air bearings with a lint-free cloth moistened with transport cleaning fluid (or equivalent solvent). Make sure not to soak the cloth with solvent.
- Head assembly dust covers – Clean dust and dirt deposits from the head assembly dust covers with a lint-free cloth moistened with transport cleaning fluid (or equivalent solvent).
- Supply reel hub pads – Clean the supply reel hub pads (Figure 4-3) with a lint-free cloth moistened with transport cleaning fluid (or equivalent solvent). Make sure not to soak the cloth with solvent.

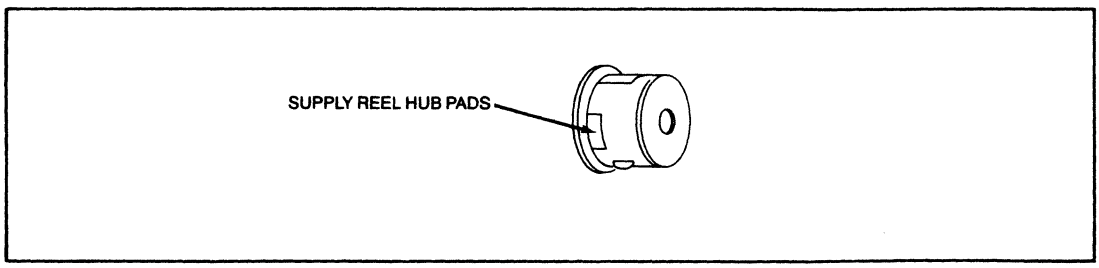


Figure 4-3. Supply Hub Pads

Remedial Maintenance

If an error occurs, the operator is made aware of the abnormal condition with fault codes that appear on the two-digit display. Some error conditions may be resolved with operator action (e.g., missing BOT marker and improper threading). If an error occurs which cannot be resolved by the operator, Honeywell must be contacted according to the terms of your service agreement (see "Service" at the end of this section). Before contacting Honeywell, be sure to run the necessary operator diagnostic tests in order to ensure faster maintenance response.

Power-on Self Test

A built-in power-on self test is automatically executed when the tape unit is powered on and each time the LOGIC ON button is pressed. When the self test is executed a code 00 appears on the two-digit display and the LOGIC ON and DIAGNOSTICS indicators light. When the test is successfully completed, the two-digit display and DIAGNOSTICS indicator turn off and the LOGIC ON and FILE PROTECT indicators light. If an error condition is detected, a fault code appears on the display. Record the fault code and report it to Honeywell according to the terms of your service agreement.

Functional Fault Recovery

If a fault condition occurs during online operation, a fault code appears on the two-digit display and the RESET indicator lights. Refer to Table 4-1 for corrective procedures. If a problem persists after executing corrective procedures, record the fault code and report it to Honeywell according to the terms of your service agreement.

In some cases, corrective procedures call for further testing (i.e., your system diagnostic test and the operator diagnostic test 01). If you are a TACPAC user, refer to *TACPAC User's Reference Manual,* Order No. CJ69, for system testing information. Operator Diagnostic Tests 01, 02, and 03 information is provided below. Upon completion of all diagnostic testing, all fault codes must be recorded by the operator and reported to Honeywell according to the terms of your service agreement.

Table 4-1. Functional Fault Recovery Procedures

Fault Code	Cause	Corrective Procedures
10	Operator door open	Ensure that front door is securely closed.
11	Tape not threaded	Thread tape.
12	Hub not latched	Check that the supply reel hub is latched, the BOT marker is located correctly, or correct the tension fault which occurred during the load operation. If a tension fault occurred, the tape may be wound too tightly and not stablized. Thread the tape (do not load) and press the LOAD button and then the TEST button to reset the tension of the tape.
13	Tape incorrectly threaded	Refer to Figure 3-3 to ensure that tape is threaded correctly.
14	BOT marker fault	Check that BOT marker is positioned correctly (see Figure 4-4). If fault condition still occurs, replace with tape of known good quality.
15	RESET button aborted LOAD/UNLOAD	RESET button was pressed inadvertently by operator. Reinitiate test.
16	Tape not write enabled	Check for presence of a write-enable ring in rear of supply reel. Install ring if one is not present.
17	EOT marker fault	Check for presence of EOT marker. If fault condition still occurs, replace with tape of known good quality.
18	Tape already loaded	Tape was loaded when the test was initiated. Thread tape, but do not press LOAD button.
20 through 29	Tape/Unit fault	Execute appropriate system diagnostic test and operator diagnostic Test 01.
30 through 99	Unit fault	Execute the appropriate system diagnostic test and operator diagnostic Test 01.

Operator Diagnostic Test 01

Operator diagnostic test 01 must be run when specified in Table 4-1. Upon completion of the test, refer to Table 4-2 for corrective procedures.

When no errors are detected during diagnostic test 01, the test runs for approximately 13 minutes, if a 2400-ft, 10.5-inch tape reel is used. Test time varies with other size tape reels. The test is interrupted and a numeric fault code appears on the two-digit display when a fault is detected.

Certain test 01 fault codes are prerequisites for further operator diagnostic testing. Table 4-2 lists the fault codes which require further testing. Upon completion of all diagnostic testing, all fault codes must be recorded by the operator and reported to Honeywell according to the terms of your service agreement.

Initiate operator diagnostics test 01 as follows:

1. Power up the tape unit. The LOGIC ON indicator should light. If an error occurs during the power-on self test a fault code will appear on the two-digit display. Follow the appropriate corrective actions (Table 4-1) to clear all fault conditions. If the corrective procedures in Table 4-1 are not effective or a fault code not listed in Table 4-1 appears on the two-digit display continue with this test.
2. Thread a write-enabled work tape through the tape path and onto the take-up reel. *Do not* load the tape.
3. Close the dust cover door.
4. Press the TEST button. The DIAGNOSTICS indicator will light and 01 will be indicated on the two-digit display.
5. Press the EXECUTE button. The test will begin by checking the display panel with the two-digit display incrementing from 00, 11, 22...99. Check that all of the digits are displayed properly.

Next, the following indicators will be lit: FILE PROTECT, LOGIC ON, ON LINE, RESET, AND DIAGNOSTICS.

An error-free test runs to completion and the tape unit performs a REWIND/UNLOAD operation. An 00 is indicated on the display and the RESET indicator is lit.

If an error is detected, the diagnostic halts, a numerical code appears on the display, and the RESET indicator lights. Record the code number and refer to Table 4-2 for corrective procedures.

Table 4-2. Diagnostics Test 01 Corrective Procedures

Fault Code	Cause	Corrective Procedures
01 and 02	Read/Write errors	Clean magnetic head and tape path according to procedures in "Preventive Maintenance." If fault condition still occurs, replace with tape of known good quality.
03 and 04		1. Run diagnostic test 03[a]. 2. Record code displayed during test 03 and report it and any other fault codes to Honeywell according to terms of your service agreement.
05	Read/Write errors	Clean magnetic head and tape path according to procedures in "Preventive Maintenance." If fault condition still occurs, replace with tape of known good quality.
06		1. Run diagnostic test 03[a]. 2. Record code displayed during test 03 and report it and any other fault codes to Honeywell according to terms of your service agreement.
07 through 09	Read/Write errors	Clean magnetic head and tape path according to procedures in "Preventive Maintenance." If fault condition still occurs, replace with tape of known good quality.
10	Operator door open	Ensure that front door is securely closed.
11	Tape not threaded	Thread tape.
12	Hub not latched	Check that the supply reel hub is latched, the BOT marker is located correctly, or correct the tension fault which occurred during the load operation.
13	Tape incorrectly threaded	Refer to Figure 3-3 to ensure that tape is threaded correctly.
14	BOT marker fault	Check that BOT marker is positioned correctly (see Figure 4-4). If fault condition still occurs, replace with tape of known good quality.
15	RESET button aborted LOAD/UNLOAD	RESET button was pressed inadvertently by operator. Reinitiate test.
16	Tape not write enabled	Check for presence of write-enable ring in rear of supply reel. Install ring if one is not present.
17	EOT marker fault	Check for presence of EOT marker. If fault condition still occurs, replace with tape of known good quality.
18	Tape already loaded	Tape was loaded when the test was initiated. Thread tape, but do not press LOAD button.
20 and 21		Mount tape of known good quality.
23		Mount tape of known good quality.

Table 4-2 (Cont). Diagnostics Test 01 Corrective Procedures

Fault Code	Cause	Corrective Procedures
24		1. Run diagnostic test 02[b]. 2. Record code displayed during test 02 and report it and any other fault codes to Honeywell according to terms of your service agreement.
25		1. Run diagnostic test 03[b]. 2. Record code displayed during test 03 and report it and any other fault codes to Honeywell according to terms of your service agreement.
26		1. Run diagnostic test 02[b]. 2. Record code displayed during test 02 and report it and any other fault codes to Honeywell according to terms of your service agreement.
27 through 29		Mount tape of known good quality.
30 and 31		1. Run diagnostic tests 02 and 03[c]. 2. Record codes displayed during tests and report them and any other fault codes to Honeywell according to terms of your service agreement.
32 and 33		1. Run diagnostic test 03[a]. 2. Record code displayed during test 03 and report it and any other fault codes to Honeywell according to terms of your service agreement.
34		Mount tape of known good quality.
35		1. Run diagnostic test 03[a]. 2. Record codes displayed during test 03 and report it and any other fault codes to Honeywell according to terms of your service agreement.
36		1. Run diagnostic tests 02 and 03[c]. 2. Record codes displayed during the tests and report them and any other fault codes to Honeywell according to terms of your service agreement.
37 through 48		Contact Honeywell according to terms of your service agreement and report all recorded fault codes.
52		1. Run diagnostic test 03[a]. 2. Record code displayed during test 03 and report it and any other fault codes to Honeywell according to terms of your service agreement.
53 through 99		Contact Honeywell according to terms of your service agreement and report all recorded fault codes.

[a]Operator diagnostic test 01 is a prerequisite of test 03.

[b]Operator diagnostic test 01 is a prerequisite of test 02.

[c]Execute the operator diagnostic tests in sequence.

Operator Diagnostic Test 02

Note: This test should be executed only when specified in "Operator Diagnostic Test 01."

To initiate Diagnostic Test 02 follow these procedures:

1. Make sure the tape unit is powered on.
2. Thread a write-enabled work tape through the tape path and onto the take-up reel. *Do not* load the tape.
3. Close the dust cover door.
4. Press the RESET button.
5. Press the TEST button. The DIAGNOSTICS indicator will light and 01 will be indicated on the two-digit display.
6. Press the STEP button. An 02 will be indicated on the two-digit display.

If a 70 is indicated on the two-digit display, an illegal operator sequence has been detected and Operator Test 01 must be run. If a 71 is indicated on the two-digit display, ensure that the tape is threaded and repeat the test.

When the test ends a numerical code appears on the display and the RESET indicator lights. Record this code and any other fault codes and contact Honeywell according to the terms of your service agreement (see "Service" later in this section).

Operator Diagnostic Test 03

Note: This test should be executed only when specified in "Operator Diagnostic Test 01."

To initiate Status Test 03 follow these procedures:

1. Make sure the tape unit is powered on.
2. Mount a write-enabled work tape onto the supply hub. *Do not* thread the tape.
3. Close the dust cover door.
4. Press the RESET button.
5. Press the TEST button. The DIAGNOSTICS indicator will light and 01 will be indicated on the two-digit display.

6. Press the STEP button twice. An 03 will be indicated on the two-digit display.

If a 94 is indicated on the two-digit display, ensure that the tape is not threaded. If a 95 is indicated on the two-digit display, repeat the test.

When the test ends a numerical code appears on the display and the RESET indicator lights. Record this code and any other fault codes and contact Honeywell according to the terms of your service agreement (see "Service" later in this section).

Service

Your MTU9635/9636 GCR/PE tape unit has a 90-day warranty beginning on the date of shipment from Honeywell.

If you purchased a Honeywell maintenance contract, warranty service will be provided in accordance with the terms of your maintenance contract. Perform the instructions specified in your contract and contact Honeywell according to the telephone number provided.

If you have not purchased a maintenance contract and your equipment requires service after the warranty has expired, contact the Honeywell National Response Center for information on service options.

National Response Center telephone numbers are:

800-241-1634	Outside Georgia
800-282-4350	Within Georgia
982-3066	Local – Atlanta, GA

When you call the National Response Center, you will be asked for your identification number.

If you do not have a maintenance contract, you will be asked for your proof of purchase number which is recorded on your PROOF OF PURCHASE FORM. This will indicate to the attendant whether or not your equipment is still under warranty. The National Response Center will collect some additional information, and forward your service request to the appropriate Honeywell organization which, in turn, will return your call to provide the assistance you need.

Tape Maintenance

Tape must be maintained to ensure the proper operation of the tape unit. When maintaining tape, keep in mind the physical layout of half-inch magnetic tape, as illustrated in Figure 4-4. A full reel of tape has a nominal recording length of 2400 ft (732 m). The entire length of the tape is oxide-coated. Beginning- and end-of-tape sensing is controlled by reflective markers affixed to the Mylar-base side of the tape. The beginning-of-tape (BOT) marker is attached approximately 16.0 ft (4.9 m) from the physical beginning of the tape, and the end-of-tape (EOT) marker is attached approximately 25.0 ft (7.6 m) from the physical end of the tape.

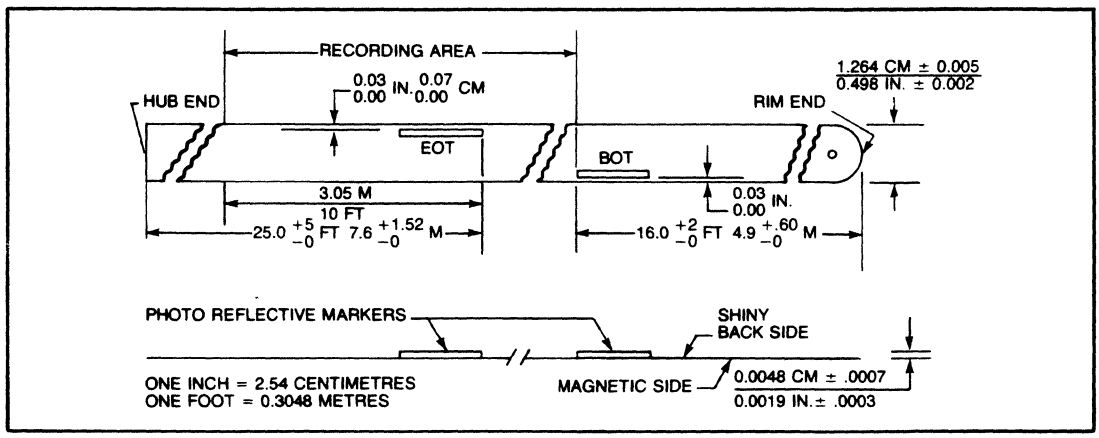


Figure 4-4. Magnetic Tape Layout

Missing or Defective BOT Marker

A missing or defective beginning-of-tape (BOT) marker prevents the completion of the load operation. Not sensing BOT, the unit rewinds the tape onto the supply reel. To check the BOT marker, do the following:

1. Open the dust cover door.
2. Remove the supply reel to inspect the condition and location of the patch.
3. Add or replace the BOT patch if necessary, and remount the reel (see Figure 4-4 for physical specifications).
4. Close the dust cover door and press the RESET button.
5. Resume normal operations to load the tape (see Section 3).

Missing or Defective EOT Marker

A missing or defective end-of-tape (EOT) marker may cause writing past the appropriate end of the tape. The end-of-tape will come off the supply reel and the unit will cycle down. If this occurs the operator should perform the following:

1. Open the front door.
2. Manually unwind about 25-30 feet of tape from the take-up reel.
3. Inspect the condition and location of the EOT marker.
4. Add or replace the EOT patch, if necessary. (See Figure 4-4 for physical specifications.)
5. Wind the tape onto the empty supply reel several turns past the EOT marker. The tape must be threaded correctly over all tape path components.
6. When the tape is properly threaded and taut, close the dust cover door and press the RESET button.
7. Press the LOAD/REWIND button to begin the load. The tape will rewind to the BOT marker when the load is complete and the BOT indicator will light.
8. Resume normal operations.

Tape Handling, Storage, and Shipping

A tape that has been subjected to abusive treatment in handling, storage, or shipping, or used on an old and damaged reel can cause read/write failures and should not be used. See the following guidelines for proper magnetic tape handling, storage, and shipping:

1. Keep tapes clean. Dust and dirt can reduce the intensity of reading or recording signals by altering the distance between the head and the tape. Therefore:
   - Never touch the tape's oxide coating; body oils on tape attract dust and lint.
   - Keep the tape in its dust-proof container until just prior to use on the tape drive.
   - Keep tape containers clean and dust-free inside and out. Don't leave containers open when the tape is in use.
   - Keep the dust cover door closed when the tape unit is not in use.
   - Avoid dangling the free end of the tape on the floor when changing reels.

- Don't eat, drink, or smoke in the computer room. Smoke and ashes are dirt; hot ashes are destructive to magnetic tape.
- Identify reels with adhesive stickers, which are easily removed and leave no residue. Change the label, don't erase it, eraser particles are dirt.

2. Handle and store tapes with care. Avoid damaging tapes and reels or placing tapes where temperature, dust, or magnetic fields could affect them adversely.
   - Make sure that the tape leader is properly wound when the tape is returned to its container. This avoids accidental crushing of the tape leader edges and possible damage to the tape itself.
   - Avoid dropping reels. If the tape is dropped, the reel may break or become dirty, resulting in possible damage to the tape. Reel damage can be determined by a visual inspection. Never use a reel that may damage the tape or the tape drive.
   - Always store tapes in containers in a dust-free cabinet. The containers should be placed on edge so that the reel is in an upright position. Stacking tape reels one on top of the other is not recommended since the excessive weight of the stacked reels may damage the bottom containers.
   - Never place reels of tape on top of a tape drive as this exposes them to heat and dust from the cooling system.
   - Never store reels of tape in an area where strong magnetic fields are present or where they may come in contact with magnetic materials.
   - Whenever possible, store tapes in the controlled environment where they are to be used to avoid subjecting the tapes to excessive handling and variations in temperature and humidity. The surrounding atmosphere should be controlled within the following limits:

     Temperature (operational): 60°F to 90°F (15°C to 33°C)
     Relative humidity (operational): 20% to 80%
   - For long-term storage, the reel of tape in its container should be hermetically sealed in a moisture-proof bag.
   - When mounting or dismounting tapes, handle the tape reels by the hub and not by the flanges which could result in damaged tape edges and eventual loss of contact with the magnetic head.
   - In loading, when mounting a reel onto the tape unit, apply pressure to the hub and not to the flanges.
   - Make routine library inspection of tape reels. Check for protruding tape edges. Exposed edges are vulnerable to damage and cause loss of contact with the tape drive head.

3. Ship tapes properly. Whenever it is necessary to mail or ship recorded tapes to other locations, take certain precautions to ensure the safety and integrity of the tapes in transit.
   - The outer shipping container into which the canisters are placed must afford the necessary strength and ridigity to protect the tapes from damage caused by dropping or crushing. Pack wood or cardboard spacing material between the tapes and the outer shipping container for physical protection as well as for isolation from any magnetic fields that could cause accidental tape erasure. Three inches of this bulk spacing should constitute adequate protection from stray magnetic fields.
   - While a 100% watertight container is not necessary, a reasonable degree of water resistance must be ensured. For example, the container should be able to protect the contents from damage if it is left on a loading dock in the rain.
   - Though the free end of a reel of tape should always be secured, it is particularly important when preparing reels for shipping. While in storage, either a hold-down sponge or vinyl strip may be used. During shipping, however, it is advisable to use both.
   - Tape in transit may be subjected to temperature extremes. Temperatures as low as -40°C might be encountered in an aircraft cargo hold at high altitudes. A temperature of 120°F could easily be encountered in a motor vehicle in the summer sun. It must again be emphasized that all incoming tape should be allowed to reach environmental equilibrium before being used.

Appendix A
Specifications

Performance Characteristics:
Number of Tracks — 9

Tape Density:
GCR — 6250 bpi
PE — 1600 bpi

Read/Write Speed: 25-ips start/stop, 25-ips streaming, or 75-ips streaming

Rewind Speed: 2.5 minutes for 2400-ft reel

GCR Mode Transfer Rate:
High Speed — 469K bytes/second
Low Speed — 156K bytes/second

PE Mode Transfer Rate:
High Speed — 120K bytes/second
Low Speed — 40K bytes/second

Interblock Gap:
PE — 0.6 in. (1.5 cm), nominal; 1.2 in. (3.0 cm), max
GCR — 0.3 in. (0.8 cm), nominal; 0.6 in. (1.6 cm), max

Tape Head: Dual read/write, separate erase head

Recording Format: Compatible with ANSI standards (X3.39-1973, X3/40-1976, X3.54-1976) for recorded magnetic tape information interchange

Physical Characteristics:
Height — 61.5 in. (156.2 cm)
Width — 24.0 in. (61.0 cm)
Depth — 36.4 in. (92.5 cm)
Weight of:
MTU9635 - 378 lb (171.5 kg)
MTU9636 - 368 lb (166.9 kg)

Electrical Characteristics:
Voltage — 120 Vac, single-phase @ 60 Hz;
Power Consumption — .30 kVA (standby and loaded); 55 kVA (max) (start/stop)
Heat Generation — 1025 Btu/hr

Environmental Characteristics:
Operating Temperature — 60° F to 90° F (15° C to 33° C)
Relative Humidity — 20% to 80% (noncondensing)

Cables:
Power Cord — 10.0 ft (3.0 m)
System to Primary Tape Unit — 6.0 ft (1.8 m)
Primary Tape Unit to Secondary Tape Unit — 5.0 ft (1.5 m)

Tape Supplies:
M1317 — 6250 bpi, 1200 ft (365.8 m) bulk
M1316 — 6250 bpi, 2400.0 ft (731.5 m) bulk

Appendix B
Programming

MTC Memory and Command Interpretation

The GCR/PE Magnetic Tape Controller (MTC9643) has a 128-word Read/Write memory that is divided into 32 registers (16 bits per register) for each of the four MTC ports (or channels). The address of each of the various registers in the MTC is a combination of two bits of the channel number and the five high-order bit of the function code used to write into or read from a particular register.

The central processor (CP) can read or write any register as long as the specific channel is not busy. To write into a register, an I/O *output* command is used; reading is done with an I/O *input* command. Addressing of the various registers relates to the I/O command as shown in Figure B-1.

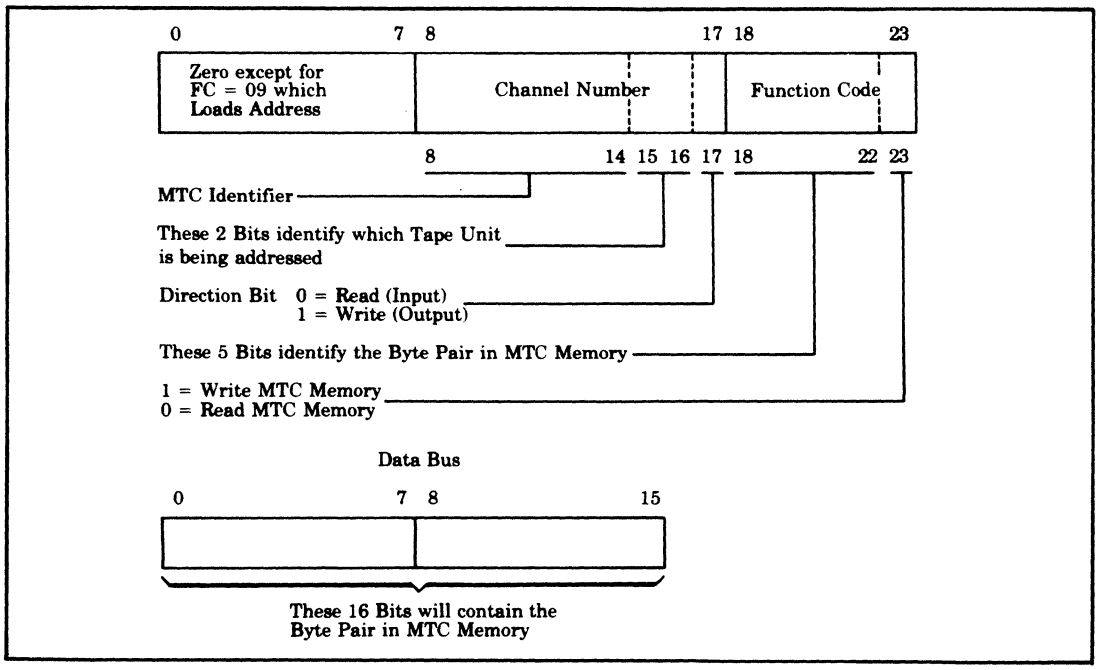


Figure B-1. Register Addressing

The format shown in Figure B-1 is for a Write cycle on the bus. For a Read cycle, the memory data will be returned from the MTC on a second bus transfer.

To perform a specific operation, software first loads the address, range, and configuration registers. The task register is loaded last and specifies the operation to be performed. The MTC begins command execution when it receives the task word.

Channel Number

Units attached to the GCR/PE Tape Unit are software-addressable via channel numbers. Each tape unit has two such channel numbers assigned, differing only in their low-order bit position called the direction bit.

The channel number for the MTC is separated into three fields:

- MTC Identifier (bits 8-14) — switch-selectable and assigned at system installation time.
- MTC Port (bits 15-16) — identifies which of the four tape units is being addressed.
- Direction Bit (bit17) — specified in the IOLD command whether it is an input or output data transfer. For all other commands, the direction bit is ignored by the hardware.

Simultaneity

The GCR/PE Tape Unit provides a single level of simultaneity (only one data transfer can be active in the subsystem). However, the MTC will accept a data transfer command to unit B while unit A is performing a data transfer but will not start the data transfer on B until A's data transfer is completed.

Interrupts

An interrupt will be attempted whenever a channel interrupt level is not zero, and an operation initiated by an Output Task Word or Output Control Word instruction is completed or the Attention bit is set in Status Word 1. If a negative response is received during an interrupt cycle, the MTC will store the interrupt until it can be retried. In the meantime, the MTC can receive commands and/or conduct data transfers on any of the other channels. The channel with the

pending interrupt will remain busy and the MTC will not accept any commands issued to that channel except an Output Control Word.

If an interrupt level of a channel is zero (either via initialization or loaded to zero) no interrupts will be attempted for the channel. If a condition or event occurs that would normally cause an interrupt, the appropriate bits in the Status Words will be set, but no interrupt will be attempted or accepted.

If the interrupt level is set to zero then an interrupt is pending via an Output Control Word (Initialize) or a Master Clear, the pending interrupt will be discarded.

Media Interchangeability

Tapes generated by these units are compatible with tapes generated by other units if the other tape units comply with American National Standards Institute recording standards.

Magnetic Tape

The physical layout of half-inch magnetic tape is illustrated in Figure B-2. A full reel of tape has a nominal recording length of 2400 feet (732 m). The entire length of the tape is oxide-coated. Beginning- and end-of-tape sensing is controlled by reflective markers affixed to the Mylar-base side of the tape. The beginning-of-tape (BOT) spot is attached approximately 16.0 feet (4.9 m) from the physical beginning of the tape, and the end-of-tape (EOT) spot is attached approximately 25.0 feet (7.6 m) from the physical end of the tape.

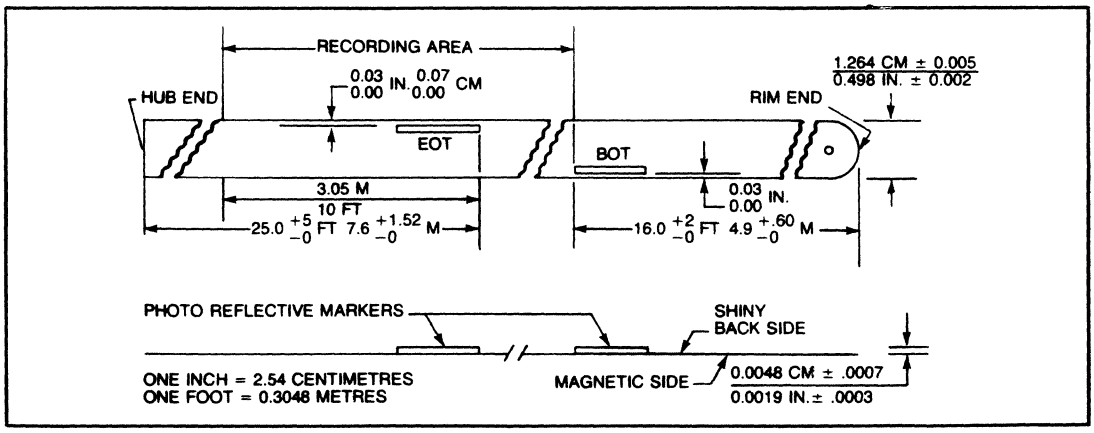


Figure B-2. Magnetic Tape Layout

Phase-Encoded Recording

The PE or phase-encoded recording technique is described according to Figures B-2 and B-3. Figure B-2 shows the orientation and layout of the usable recording area as defined by ANSI for 1600 cpi, PE tapes. Figure B-3 shows the orientation and layout of the recording format as defined by ANSI for 9-track and 1600 cpi PE tapes. All phase-encoded data blocks contain a preamble, data, and postamble.

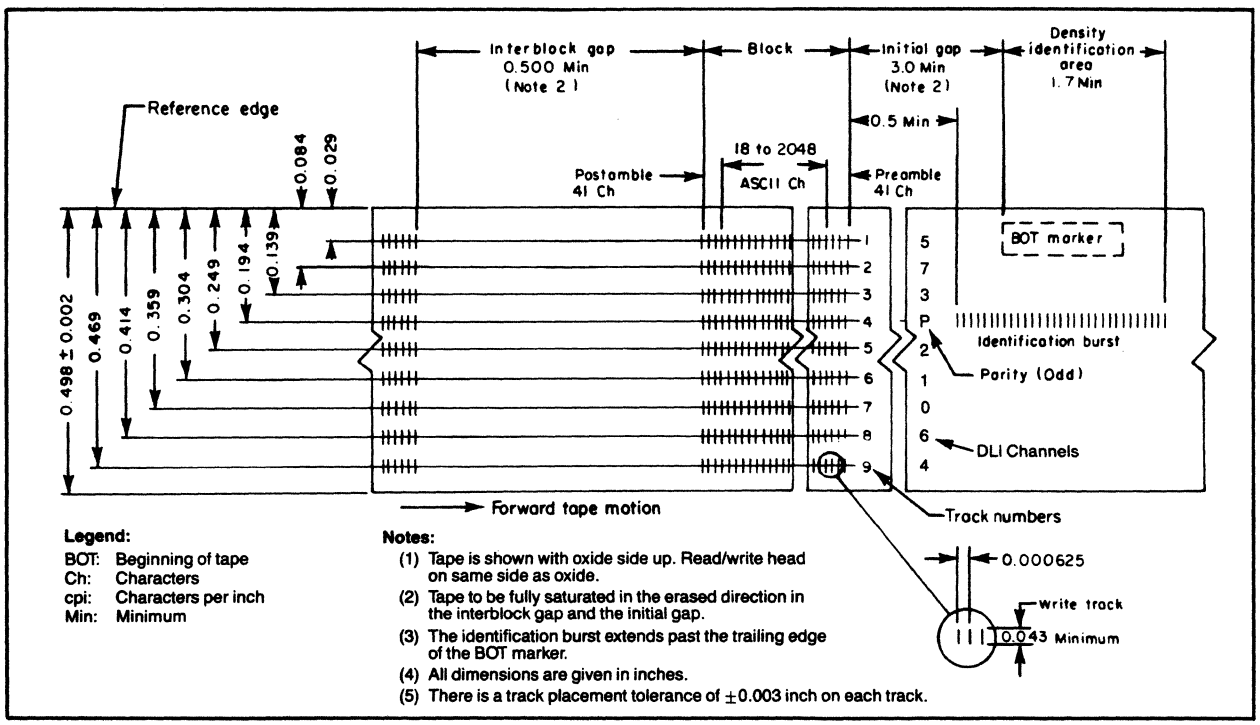


Figure B-3. Recording Format for 1600 cpi

Group-Coded Recording

The GCR or group-coded recording technique is described according to Figures B-2, B-4, and B-5. Figure B-2 shows the orientation and layout of the usable recording area as defined by ANSI for 9-track GCR tapes. Figure B-4 shows the orientation and layout of the recording format as defined by ANSI for 9-track GCR tapes.

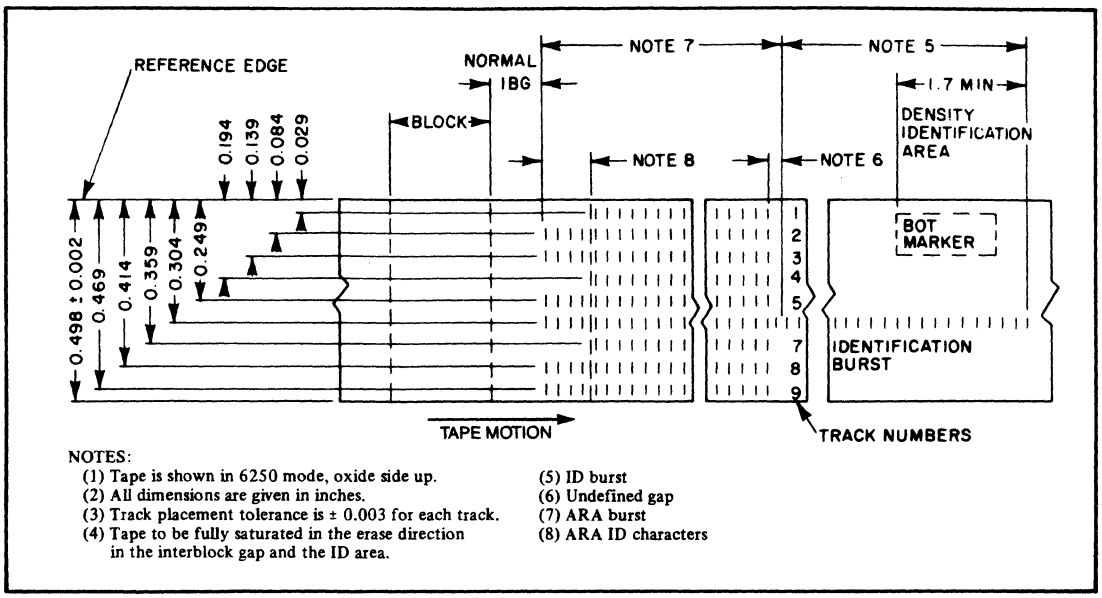


Figure B-4. Recording Format for 6250 cpi

Figure B-5 is a more detailed breakdown of the GCR format as recorded on tape. Table B-1 represents the data groups as received by the F/C from the GCR-MTS which are then encoded into the group-coded recording format and stored on tape. Table B-2 gives the actual 5-bit record values as encoded from each 4-bit data value.

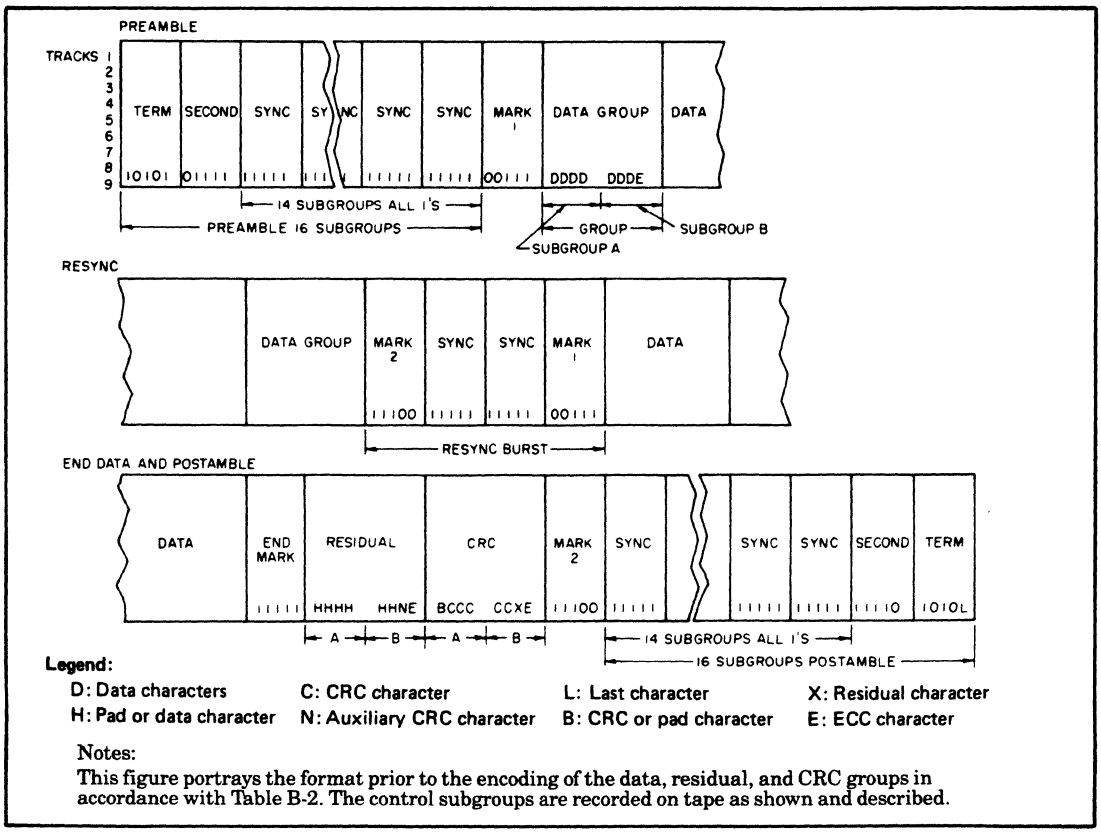


Figure B-5. Detailed GCR Format

Table B-1. Data Group to Storage Group Example

	Data Group								Storage Group									
Physical Tracks	**Data Subgroup "A"**				**Data Subgroup "B"**				**Storage Subgroup "A"**					**Storage Subgroup "B"**				
1	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
2	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
3	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
4	P	P	P	P	P	P	P	P	X	X	X	X	X	X	X	X	X	X
5	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
6	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
7	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
8	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
9	D	D	D	D	D	D	D	E	X	X	X	X	X	X	X	X	X	X
Group Positions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Note: Tape is recorded in 9-bit characters (across tape) by 10 bits long. This 90-bit group is called a "storage group." Prior to the record code values conversion, there are eight linear bits, made up of seven data bits and one check bit. This group of 72 bits is called a "data group." the 4-bit and 5-bit combinations are called "subgroups."

Table B-2. Record Code Values

Data Values (Group Positions: 1 2 3 4 / 5 6 7 8)					**Record Values (Group Positions: 1 2 3 4 / 5 6 7 8 9 10)**					
0	0	0	0		1	1	0	0	1	
0	0	0	1		1	1	0	1	1	
0	0	1	0		1	0	0	1	0	
0	0	1	1		1	0	0	1	1	
0	1	0	0		1	1	1	0	1	
0	1	0	1		1	0	1	0	1	
0	1	1	0		1	0	1	1	0	
0	1	1	1		1	0	1	1	1	
1	0	0	0		1	1	0	1	0	
1	0	0	1		0	1	0	0	1	
1	0	1	0		0	1	0	1	0	
1	0	1	1		0	1	0	1	1	
1	1	0	0		1	1	1	1	0	
1	1	0	1		0	1	1	0	1	
1	1	1	0		0	1	1	1	0	
1	1	1	1		0	1	1	1	1	

The definitions of GCR terminology are as follows:

- Alternate Record Code: Five bits along any track representing encoded 4 bits of data, padding characters, check characters, residual characters, or a combination of these characters, on tape.

- Automatic Read Amplification (ARA) Burst: A string of bits in all tracks for setting up the amplifiers.
- Automatic Read Amplification (ARA) Identification (ID) Character: A special control blck used at the end of the ARA burst to identify the ARA burst when reading backward to the load point.
- Auxiliary Cyclic Redundancy Check (CRC) Character: A CRC charactr usable for error-detection purposes.
- Beginning-of-Tape (BOT) Marker: A photoreflective marker placed on the tape to indicate the beginning of the permissible recording area.
- Block: A group of contiguous recorded characters considered and transported as a unit containing one or more logical records. Blocks are separated by an interblock gap.
- Control Subgroups: Those special subgroups of characters that (except for the subgroup containing the last character) have sets of identical control five-serial-bit values in the nine tracks.
- Cyclic Redundancy Check (CRC) Characters: Characters usable for error detection.
- Cyclic Redundancy Check (CRC) Data Group: A specially formatted data group containing one of the CRC characters, the residual character, and an error-correcting code (ECC) character.
- Data Group: Seven data characters plus an ECC character accululated as a group prior to the record code value translation.
- Density: The nominal distribution per unit length of recorded information, usually expressed in characters per inch.
- End Mark: A subgroup used to demark the residal area group. When the media movement is in a forward direction, it denotes that the next group is the residual group.
- End-of Tape (EOT) Marker: A photoreflective marker placed on the tape to indicate the ending of the permissible recording area.
- Error-Correcting Code (ECC) Character: A special character usable for error detection and correction.
- Flux Reversal Position: The point that exhibits the maximum free-space surface flux density normal to the tape surface.
- Flux Spacing: The space between successive flux transitions.
- Group-Coded Recording (GCR): A recording technique that collects groups of characters and encodes them prior to putting them on tape.

- Interblock Gap: A dc-erased section of tape separating blocks of information.
- Last Character: The last character in each block, which restores magnetic remanence in all tracks to the dc erase polarity.
- Mark 1: A subgroup used to demark data groups from other control subgroups. When the media movement is in a forward direction, the onset of data groups is denoted.
- Mark 2: A subgroup used to demark data groups from other control subgroups. When the media movement is in a forward direction, the onset of other control groups is denoted.
- Postamble: Groups of special signals recorded at the end of a block on tape for the purpose of electronic sychronization.
- Preamble: Groups of special signals recorded at the beginning of each block on tape for the purpose of electronic sychronization.
- Record Code: The coded representation of data, padding characters, check characters, and residual characters on tape.
- Residual Character: The character that occupies the seventh group position of the CRC data group and contains two data byte counts, one to module 7 and one to module 32.
- Residual Group (Group Positions): The group that contains the extra characters (the remainder of the number of characters divided by 7), an auxiliary CRC character, and an ECC character. Each such extra character is a residuum character.
- Resync Burst: A set of control subgroups identifying format resynchronization points in a block. It is intended that read-back circuits be able to resynchronize operations when sensing such bursts.
- Second Control Subgroups: The second subgroup and next to last subgroup of a record.
- Skew: The deviation of bits within a tape character from the intended or ideal placement, which is perpendicular to the reference edge.
- Storage Group: Ten characters created from the data group via the record code value translation.
- Subgroup: One half of a data or storage group. See control subgroups.
- Sync Control Subgroups: A subgroup used to indicate recorded frequency and phase to allow synchronization of the variable-frequency clock (VFC).
- Terminator Control Subgroups: The first subgroup and last subgroup of a record.

9-Track Data Format

Data being written on or read from tape is handled on a byte basis. All 16 bits of a data word are transferred to or from the tape as shown in Figure B-6. Odd parity (vertical parity) is written on tape and is checked when read.

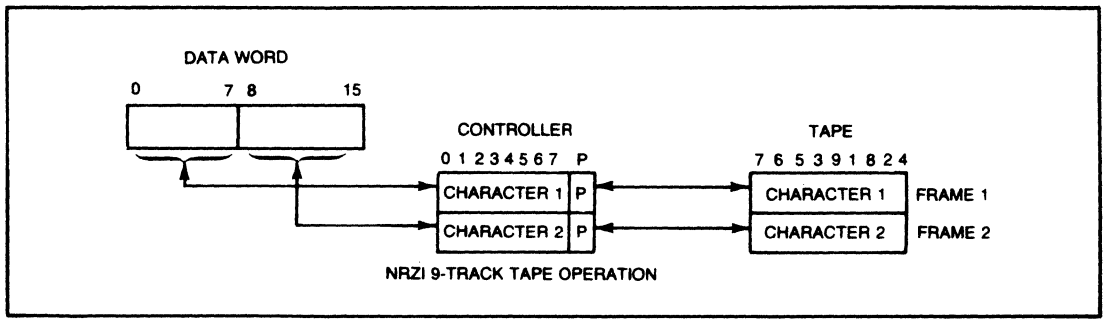


Figure B-6. 9-Track Data Format

Instructions

Table B-3 lists the I/O commands. A detailed description of each command follows this table.

Table B-3. Magnetic Tape Commands

Type	Function Code	Command
Output	09[a]	Address
	0D	Range
	11	Configuration Word A
	13	Configuration Word B
	03	Interrupt Control
	07	Task Word
	01	Control Word
Input	0C	Range
	08	Memory Byte Address
	10	Configuration Word A
	12	Configuration Word B
	02	Interrupt Control
	26	Device ID
	06	Task Word
	18	Status Word 1
	1A	Input Status Word 2
	04	Firmware/Hardware Revision

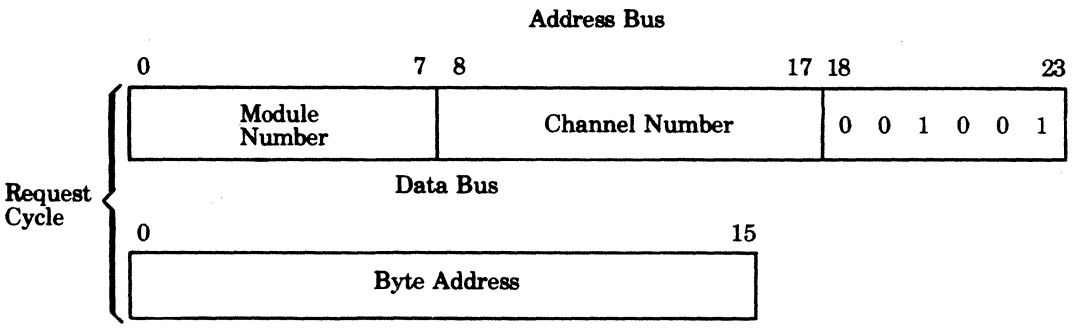
[a]Function Code 09 as executed by the CP will result in execution of functions 09 and 0D.

Output Commands

Command Output Address

Function Code 09

Format



Function

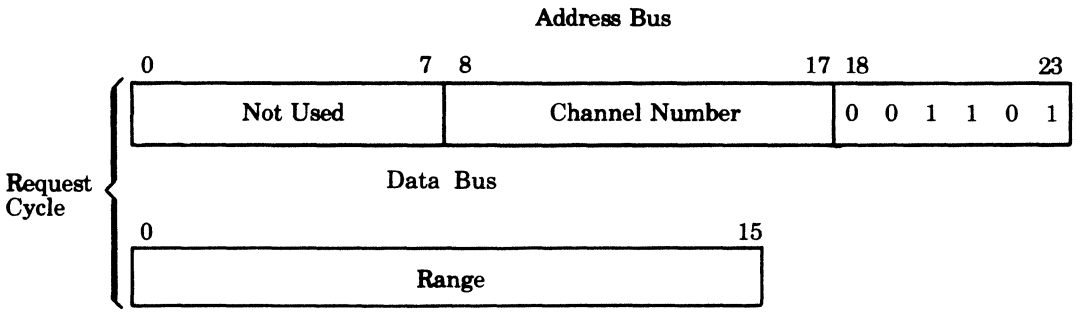
Loads a 24-bit address into the address register associated with the referenced channel (device). The address refers to the starting (byte) location in main memory where the MTC will commence input or outputs data transfers. Bits 0-7 of the Address Bus (Module Number) are the most significant bits of the address. The Data Bus contains the 16 least dignficant bits. Data transfers to or from memory will normally be on a work basis but byte mode transfers can occur associated with the first and/or last memory cycle of a particular data transfer if the main memory buffer (identified by this instruction) begins or ends on an odd byte boundary.

Bit 17 of the address bus (direction bit of the channel number) determines the direction of any subsequent data transfer operation. A logical one specifies an output operation (writing on media) while a logical zero specifies an input operation (reading from media).

Command Output Range

Function Code OD

Format



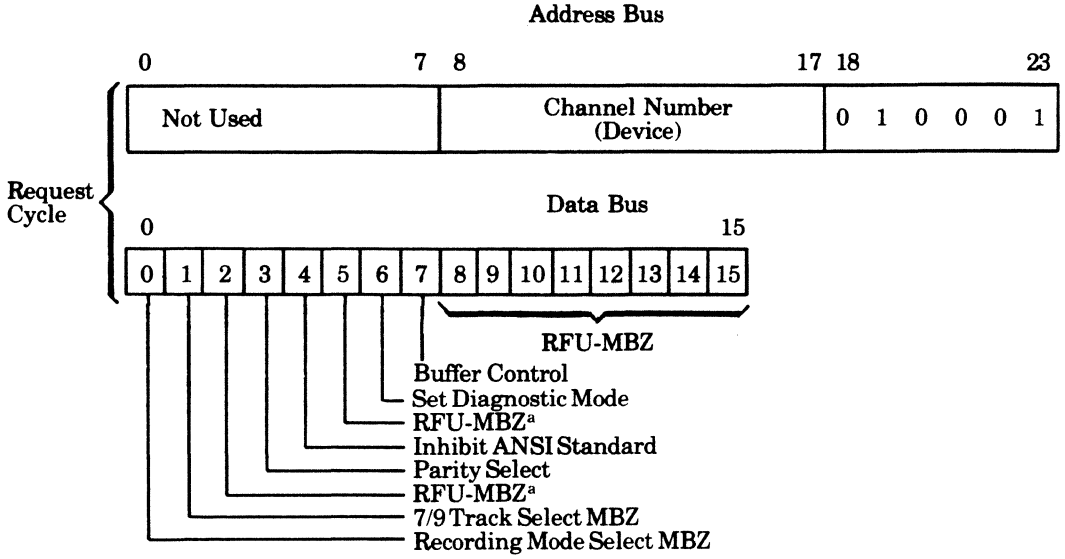
Function

Loads the Range register associated with the referenced channel. The (16-bit) quantity loaded (data bus) is the number of bytes to be transferred during the data transfer that is being set up. The number is a positive binary quantity (bit 0 must be zero) and is decremented by the MTC after each memory transfer. A range of zero results in a subsequently issued Read Forward order to perform the equivalent of a Forward Space Block order transferring no data to memory. A range of zero results in a subsequently issued Write order setting the Operation Check bit of Status Word 1, no data transfer, no tape motion initiated, and termination of the order. Any address and range register residue is applied to the next command unless reset by another Output Range instruction.

Command Output Configuration Word A

Function Code 11

Format



[a]Reserved for future use, must be zero.

Function

Loads the Configuration Word for the device corresponding to the referenced channel. Bit descriptions follow.

- Bit 0 — Recording Mode Select: Must be zero.
- Bit 1 — 7/9 track Select: Must be zero.
- Bit 2 — RFU, MBZ: This bit is reserved for future use and must be zero for the subsystem specified herein.
- Bit 3 — Parity Select: This bit selects either even or odd parity for the selected controller/device. The FCU interfaces only with 9-track tape drives; therefore, the normal setting of this bit is a zero selecting odd parity.
- Bit 4 — Inhibit ANSI: This mode is used for diagnostic purpose only.
- Bit 5 — RFU, MBZ: This bit is reserved for future use and must be zero for the subsystem specified.
- Bit 6 — Normal/Diagnostic Mode Select: This bit is normally set to a zero indicating that normal functionality is selected. The one state indicates that the controller selected is in a diagnostic mode. When this bit is set to a one for the FCU, and MTC issues a Set Diagnostic Mode command to the FCU prior to the execution of the Task Word that follows. This places the FCU in the

diagnostic state for the Task Word that follows the Output Configuration Word instruction. Note that the FCU enters the diagnostic state for each Task Word issued where the diagnostic mode select bit (bit 6) of the Configuration Word is set to a one. The status information, available after execution of the Task Word in the dignostic state, has specific meaning to the T&V software. Formatted tapes are not necessarily ANSI-compatible.

- Bit 7 — Buffer Control: This bit is zero when initialized or powered up which enables the device data buffer; this buffer can also be enabled at BOT by issing this command with bit 7 = 0. The buffer can be disabled by setting bit 7 = 1 when the command is executed at BOT.

  Note: When the device is buffer disabled, a code 40 appears on the two-digit display.

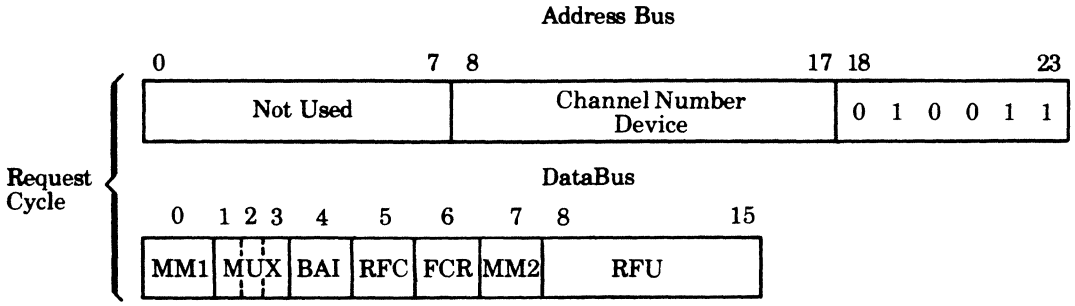
- Bit 8 — Density Select: This bit can be used to select one of two recording densities for the FCU operations (not implemented on MOD 400 or 600).

- Bit 9 through 15 — RFU, MBZ: These bits are reerved for future use and must be zero for the subsytem specified herein.

Command Output Configuration Word B

Function Code 13

Format



Function

This instruction loads the Configuration Word B for the device controller corresponding to the referenced channel. The bit significance is defined below. The command is to be used primarily for diagnostic purposes when exercising the FCU and device Test & Diagnostic (T&D) procedure.

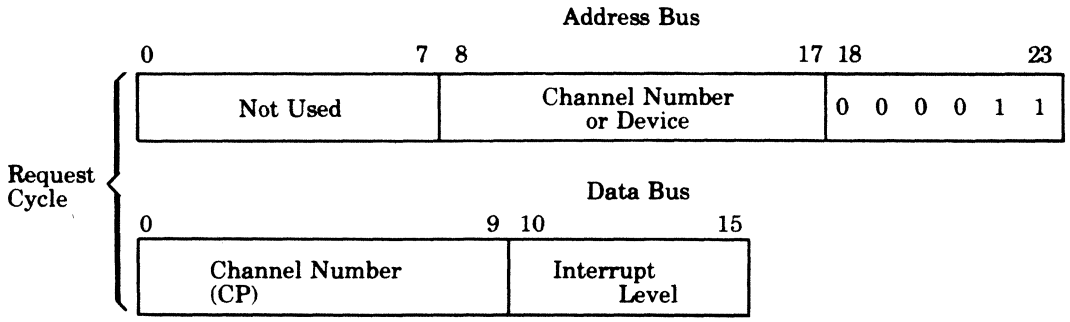
- Bit 0 — MM1 (Maintenance Mode One): This bit, in conjunction with Configuration Word A bit 6, is used by the controller firmware to set T&D maintenance mode of operation.

- Bits 1, 2, and 3 — Multiplexer control lines: These bits, which are part of the control logic, enable the error and status bus lines.
- Bit 4 — BAI, Bus Address Inhibit to the FCU.
- Bit 5 — RFC, Reset FCU.
- Bit 6 — FCR, FCU ready.
- Bit 7 — MM2 (Maintenance Mode Two): This bit is used to set maintenance mode of operation without Configuration Word A bit 6 being set, so that the F/C is not in diagnostic mode. In maintenance mode, the MPTC executes a write task by transferring only even bytes with bit 7 of the odd bytes used as the parity bit. Since the F/C is not in diagnostic mode, the data is actually written on tape.
- Bits 8 through 15 — RFU: These bits are reserved for future use.

Command Output Interrupt Control

Function Code 03

Format



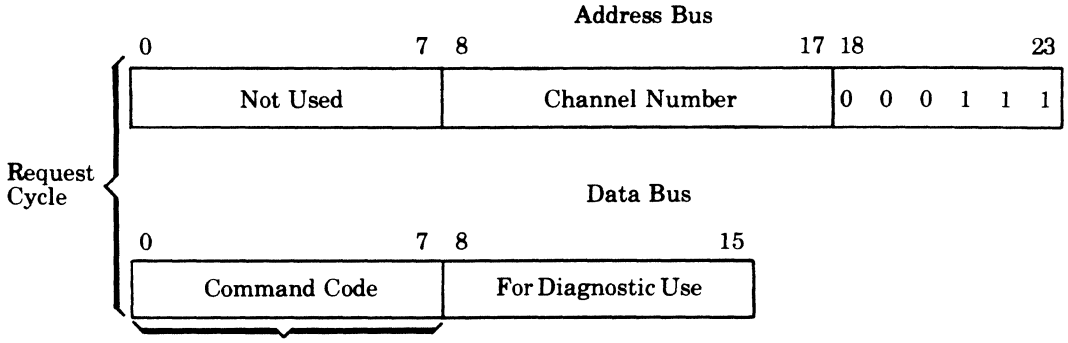
Function

Loads for the referenced device, the interrupt level and the channel number of the CP to which subsequent interrupts should be sent. The level number is a 6-bit quantity and is positioned on the data bus as illustrated. Bits 0-9 of the data bus contain the channel number of the CP loading the interrupt level. If an interrupt level of zero is loaded, the subsystem will not generate or save interrupts for any events that occur while the interrupt level is zero. For example, if the attention bit in Status Word 1 is set to one with a stored interrupt level of zero, the subsystem will not generate an interrupt on the bus. The interrupt level is set to zero whenever the subsystem is initialized.

Command Output Task Word

Function Code 07

Format



8000	– Rewind	3A00	– Write Tape Mark
C000	– Rewind and Unload	2B00	– Write
0800	– Forward-Space Block	0000	– No Operation
0400	– Backspace Block	009N	– Store Detail Status
1800	– Forward-Space Tape Mark	009A	– Loop Write-to-Read
		009B	– Execute Diagnostic Command
1400	– Backspace Tape Mark	009C	– Drive Sense Status
0900	– Read Forward	009D	– Device Clear
0500	– Read Backwards	00A0	– Wraparound MPTC
2800	– Erase	00A1	– Adapter Wraparound

Where N implies the nibble has specific meaning for the command (refer to command description).

Function

Outputs a Task Word to the referenced channel. The coding bits 0-7, illustrated above, represent the operations that are to be performed. When this command is accepted, the channel enters the Busy state. All configuration, addresses and range information must be loaded prior to execution of this command. The direction of data transfer indicated by the low order bit of the most recent Output Address command must agree with the direction of transfer (read or write) specified by command code of the Output Task Word. If it does not, Status Word 1 bit 11 Operation Check will be set and a normal termination of the command without data transfer and tape motion will result. These commands addressed to a device not in the online state result in the setting of an Operation Check bit prior to a normal termination of the order.

- *Rewind* — This command rewinds the tape to the BOT marker. The drive remains in the busy state until the completion of the rewind operation. If the tape on the drive is at BOT when this order is issued, tape motion is not initiated and a normal termination of the order results. Note that the rewinding of a drive via the REWIND button on the drive does not put the device in the Busy state but activates rewinding (Status Word 2 bit 1), which affects the status of the Device Ready and Attention bits of Status Word 1. When the manually initiated rewind is complete, the Rewinding status condition resets, Device Ready changes state, and the Attention bit is set again.

- *Rewind and Unload* — This command causes the addressed tape unit to rewind to BOT, remove the tape from the tape path, and rewind it completely onto the file reel.

  If the tape on the drive is at BOT when this order is issued, only the unload sequence is initiated prior to termination of the order. The unload sequence puts the selected tape device into the offline state and extinguishes the online indicator. Operator intervention is required to place the drive back in the online state.

- *Forward-Space Block* — This command causes the drive to space forward over the next *n* blocks. The order terminates when tape is positioned in the *n*th interblock gap. The number of blocks spaced over is a function of bits 8 through 15 of the Command Code. These bits act as a counter with a range of 0 to 255_{10}. Note that a count of zero or one results in the spacing of one block.

- *Backspace Block* — This command causes the drive to space back over the previous *n* blocks on tape. The order terminates when tape is positioned in the *n*th previous interblock gap.

  The number of blocks spaced over is a function of bits 8 through 15 of the Command Code. These bits act as a counter with a range of 0 to 255_{10}. Note that a count of zero or one results in the spacing of one block. If this order is issued when the tape is positioned at BOT, tape motion is not initiated and the order is terminated; however, the tape's position beneath the read/write head will not be the same as that following the termination of a rewind operation. In order to place the tape in the proper position beneath the heads following the termination of BOT of a reverse direction command (Backspace Block Tape Mark), a Read Forward command followed by a Rewind command is necessary. This correction sequence needs to be implemented by software.

- *Forward-Space Tape Mark* — This command causes the drive to space forward over one or more blocks until a tape mark is detected. The order terminates when the tape is positioned in the interblock gap following the block containing a tape mark. If EOT is sensed while spacing, tape motion does not stop until tape mark is detected. This can result in the drive spacing off the end of the reel if there is no tape mark after the EOT marker.

- *Backspace Tape Mark* — This command causes the drive to space back over one or more blocks until a tape mark is detected. The order terminates when the tape is positioned in the interblock gap preceding the block containing the tape mark or when the tape is positioned at BOT. If this order is issued when the tape is positioned at BOT, tape motion is not initiated and a normal termination of the order follows; however, the tape's position beneath the read/write head will not be the same as that following the termination of a rewind operation. In order to place the tape in the proper position beneath the heads following the termination of BOT of a reverse direction command (Backspace Block, Backspace Tape Mark), a Read Forward command followed by a Rewind command is necessary. This correction sequence needs to be implemented by software.

- *Read Forward*

  — Unbuffered Mode — This command causes the drive to read forward over the next block on tape (Configuration Word bit 7 set to 1, 25/75-ips tape transport only). The order terminates when the tape is positioned in the next interblock gap. The format of the data transferred from tape to memory is a function of the stored configuration word. In addition to reading data, integrity checks are made.

  The GCR-MTS also provides for the automatic retry of records when read errors occur. The retry capability is enabled when bits 8 through 15 of the command code are nonzero. This field (bits 8 through 15) acts as a retry counter with a range of 0 to 255. Upon successful retry, Corrected Media Error (Status Word 1, bit 4) and Retry Attempted (Status Word 2, bit 9) are set in the terminating status. Retryable Media Error (Status Word 1, bit 4) and Retry Attempted (Staus Word 2, bit 9) are set in the terminating status. Retryable Media Error (Status Word 1, bit 2) is set if the retry mechanism was unsuccessful or a read error occurred and the retry counter was zero.

  — Buffered Mode — This command causes the F/C to initiate a read operation on the tape transport and the data is transferred to the device data buffer. Data transfer to the GCRA is not started until the complete record is in the buffer without errors. If an error is detected, the F/C issues a back space command to the tape transport, rereads the data block, and updates its read error counter. If there are no errors, or an error recovery procedure was successful, BUSY is asserted to the GCRA and a normal data transfer takes place. Read data recovery is performed by the F/C according to the following:

  If a data check is on the first block on the tape, rewind and reread that block up to ten times.

  If a data check is on a block other than first, space reverse and reread that block up to ten times.

  If the data check persists, repeat step 3 at the high threshold.

  If the data check persists, repeat step 3 at an alternate speed.

  Note: Maximum number of retries is 40.

  Anticipating that the other Read commands will be issued and to maintain streaming, the F/C initiates another Read command to the tape transport and starts transferring data into the data buffer. This continues until the buffer is full or until a command other than read is issued by the GCRA. If a file mark is detected, the status is stored and another Read command is initiated; if two successive file marks are detected, prereading is terminated. On receipt of other than a "Read command" command, if there are more block records in the data buffer that were requested, the F/C backspaces the tape to the end of the last record to be successfully transferred to the GCRA; the pending command is then executed.

- *Read Backwards* — This command is not available in the GCR-MTS. The issuance of this order to the subsystem results in no data transfer; no tape motion initiated; the activation of Status Word 1, bit 11, Operation Check, and Status Word 2, bit 11, Functionality Not Available; followed by a normal termination.

- *Erase* — This command causes the drive to erase tape in the forward direction producing a 3-inch gap on the tape. The device channel remains busy for the duration of the erase order and terminates normally.

  This command can be used to "flush" the data buffer on the transport to ascertain that all the data in the buffer is written on the tape before initiating another write command or terminating present transaction; the controller remains busy until the Erase command is executed after all the data from the buffer has been transferred. Using this command for this purpose reduces both the tape capacity and the average transfer rate; some applications can perform better in the unbuffered mode.

- *Write Tape Mark* — This command causes the addressed tape unit to move tape in the forward direction, execute an Erase, and write a tape mark identifier appropriate to the recording mode in effect at the time the command is issued. No data is transferred during the write portion of the command. The channel remains busy for the duration of the command. During the entire write operation, the read detection circuitry verifies that a complete erasure has occurred and that the tape mark written is correct. The order terminates when the tape is positioned in the gap beyond the tape mark block.
  - — Unbuffered Mode — BUSY stays activated until the Tape Mark is written on the tape medium.
  - — Buffered Mode — The task is stacked and BUSY is deactivated allowing other tasks to be issued before the Tape Mark has been written on the tape medium. If two consecutive Tape Mark commands are issued, the second one causes BUSY to stay activated until that second Tape Mark is written on the tape medium.

- *Write*
  - — Unbuffered Mode — This command causes the drive to write, in the forward direction, a data block of the format specified by the configuration word (in particular, Configuration Word bit 7 set to 1) most recently issued to this addressed channel. Nondata characters used for synchronization and error checking are recorded on tape; the generation of all such characters is an F/C function. The block that is written on tape is checked for validity as it passes under the read head.

    The command terminates when the tape is positioned in the gap beyond the data block written. An attempt to write a data block to a drive in write-protect results in no data transfer, no tape motion initiated, and the activation of the Operation Check bit of Status Word 1.

— Buffered Mode — The first Write command initiates a data transfer operation between the GCRA and the F/C data buffer. BUSY is activated and TREQ is generated at the selected rate as data is transferred to the buffer. On receipt of the Stop from the GCRA, the F/C deactiviates BUSY and is ready for another command. Depending on the speed, density, and ramp time, the F/C initiates the tape motion while data transfers to the buffer are still in progress for the next block. When the tape is up to speed, the F/C starts transferring data from the buffer to the tape.

As long as the GCRA continues to send Write commands and the transfer rate of data is higher than that to tape, streaming is maintained and the data buffer is eventually filled. If a command other than a Write command is issued, the F/C continues transferring from the data buffer and then executes the new command when the buffer is empty.

If a data error is detected while writing (error counter is incremented and is available to the GCRA as a sense byte), the F/C invokes the following error recovery procedure:

If the data check is on the first block, rewind, erase, and rewrite the block up to five times.

If the data check is on erase, replace media.

If there is no data check on erase, rewrite. Continue to the next step if there is a data check on rewrite.

If the data check is on a block other than first block, space reverse over the error block, erase, and rewrite up to five times.

If the data check persists, repeat the above step up to ten times or up to the maximum IBG permitted by ANSI standard.

In the event that an error occurs that cannot be corrected, Data Check Error is set (Status Word 2, bit 15) and the number of records still in the buffer is available in the sense status.

- *No Operation* — This command results in no data transfer, no tape motion initiated, the normal reset of status word bits upon reception of an Output Task command, and a normal termination of the command. However, this command is NAKed if the channel is busy. It should be noted that any status information within the F/C is unaltered by this command.

- *Store Detail Status* — This command provides the capability of transferring to software up to eight words of detail status. The status information is stored in the starting memory location specified by the IOLD. Bits 13, 14, and 15 of the Command code determine which of the eight status words are sent first; for example, if bits 13, 14, 15 are set to 010, the transfer begins with Status Word 2. If the Range specifies more than one word (two bytes), data transfer continues until the range is exhausted or eight status words are transferred from the F/C.

Eight detail status words are associated with the F/C. To retrieve the first status word from the controller, bits 13, 14, and 15 of the Command code must be zeros.

Normal tape operations do not require the reading of detail status since sufficient information is available in Status Words 1 and 2. Detail status information is provided primarily for diagnostic visibility.

A brief description of each detail status bit follows.

90 – F/C Status Word 0 – Dead Tracks

91 – F/C Status Word 1 – Read/Write Errors

92 – F/C Status Word 2 – Diagnostic Aids (reject codes)*

93 – F/C Status Word 3 – Drive Sense Status

94 – F/C Status Word 4 – NRZI CRC Status

95 – F/C Status Word 5 – RFU

96 – F/C Status Word 6 – RFU

97 – F/C Status Word 7 – RFU

*See your Customer Service Representative.

F/C Status Word 3 – Drive Sense Byte

EOT STAT – End-of-Tape Status:

This line is asserted by the F/C when the loaded tape is positioned on or past the EOT marker indicating that the tape is positioned in the end of the recording area.

BOT STAT – Beginning-of-Tape Status:

This line is asserted by the F/C when the loaded tape is positioned at BOT.

WRT INH – Write Inhibit:

This line is asserted when the IBG is being created during a write operation.

FILE PROT – File Protect:

This line is asserted by the F/C when the loaded tape reel does not contain a write-enable ring.

BKWD STAT – Backward Status:

Must be zero.

HI DEN – High Density:

This line is asserted when the F/C is set to GCR mode.

RDY STAT – Ready Status:

This line, when asserted, signifies that the F/C has tape-loaded and is not rewinding.

ONLINE STAT – Online status:

This line, when asserted, signifies that the F/C has been placed online by pressing of the ON LINE push button on the MTU control panel.

WRT STAT – Write Status:

This line is asserted by the F/C when it is in write mode and erase status is asserted concurrently. When write status is asserted, both write and erase heads are active.

F/C Status Word 4 – CRC Status

This byte contains the contents of the CRC-F generator and is used in certain STC diagnostic tests.

- *Loop Write to Read* — When issued to an F/C, the order is translated into the Loop Write-to-Read command which provides a means of checking the read/write data paths, inside an F/C, for proper operation. A normal Write command is simulated and the F/C loops the information presented to the write bus back to the read bus and through most of the read data path. There is no tape motion and the MTU is not involved. The operation is performed in the recording mode selected and the data rate of the selected MTU.
- *Execute Diagnostic Command* — For a description of this command, refer to *"Bit 6-Normal/Diagnostic Mode Select"* of *"Output Configuration Word A."*
- *Drive Sense Status* — Upon power up or initializaton of the MPTC, the Sense Drive Status bytes (DSB00, DSB01, and DSB02) are stored in registers 1C/1D and 1E/1F (see below); these registers can be read by performing I/O inputs 1C and E, respectively. To obtain correct Drive Sense Status at this time, the tape drive must be in the Ready status. The DSB00 byte is also stored in the Detail Status Word 3 during MPTC power up and as part of the automatic status retrieval after each functional task.

  For an alternative method of obtaining Drive Sense Status, at any time, the following sequence must be used. (The assumption is made that the tape device was ready during initialization and is ready now.):

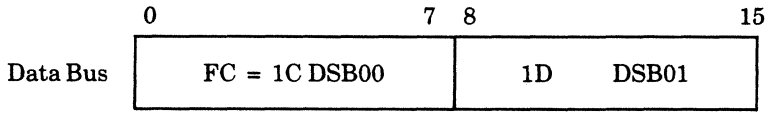
  - Output Drive Sense Status Task (009C) to the device.
    - — Read Detail Status Word 3 for DSB01
    - — Input Function Code #36
    - — Output the NOP Task (0000)

- Output Drive Sense Status Task (009C) to the device.
  - — Read Detail Status Word 3 for DSB02
  - — Input Function Code #36
  - — Output the NOP Task (0000)
- Follow this procedure to read the Drive Sense bytes and terminate the sequence by the Output the Device Clear Task (009D)

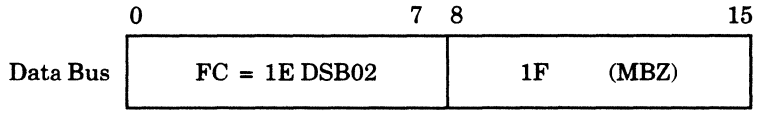
This returns the firmware pointer to DSB00 and clears the F/C busy. If the above sequence is not adhered to, the MPTC and F/C enter an undefined state which can be cleared by Master Clear only.

F/C provides up to 40 bytes of Detailed Status.

Status Word 3A



Status Word 3B



DSB01	D1	D0	MTU Mode	M2	M1	M0	MTU Speed PE/GCR
	0	0	RFU	0	0	0	50 ips
	0	1	RFU	0	1	0	75 ips
	1	0	PE	1	0	0	125 ips
	1	1	GCR	All other states are RFU.			

DSB02	S1	S0	MTU Switch Position
	0	0	Software Select
	0	1	RFU
	1	0	PE
	1	1	GCR

Drive Detailed Status

- Output Drive Sense Status Task Command (009C) to the drive then:
  - — Read Detail Status Word 3 for DSB00 & DSB01
    Input Function Code #36
  - — Read Detail Status Word 3 for DSB02 & DSB03
    Input Function Code #38
  - — Read Detail Status Word 3 for DSB04 & DSB05
    Input Function Code #3A
  - — Read Detail Status Word 3 for DSB06 & DSB07
    Input Function Code #3C
  - — Read Detail Status Word 3 for DSB08 & DSB09
    Input Function Code #3E

    Note: Input Function Code #3X inputs two bytes of Detail Status (i.e., #3X and 3(X+1)).

- Output second Drive Sense Status Task Command (009C) to the drive to continue reading sequential Sense Status bytes, then:
  - — Read Detail Status Word 3 for DSB10 & DSB11 Input Function Code #36

    ---------- etc. ----------
  - — Read Detail Status Word 3 for DSB18 & DSB19 Input Function Code #3E
- Device Clear Task (009D) command terminates the sequential Sense Status read procedure and resets the pointer of DSB00.

For additional Drive Sense Status bytes, up to maximum of 40, repeat the sequence above (e.g., after the third output Drive Sense Status Task Command is issued, DSB20 and DSB21 bytes are present in the Scratch Pad Memory location #36 and so on in groups of ten bytes). To terminate the sequence at any status byte, output the Device Clear Task (009D) command.

- *Device Clear* — This command is used by the F/C to reset a selected transport and associated error indicators to initial conditions. Tape motion (if any) is halted. The formatter remains busy until the reset is completed. The command results in no data transfer, no tape motion initiated, the normal reset of status word bits upon reception of an Output Task command, and a normal termination of the command.
- *Wraparound MPTC* — The wraparaound level is at the MPTC level. The direction of data transfer (read or write) is determined by the low-order bit of the channel number of the most recent Output Address command.

  During a Wraparound Write command, the channel reads one to eight words from memory (at the address specified in the subsystem's memory address register) and transfers them to the MPTC FIFO buffer.

When a Wraparound Read command is received (immediately following a Wraparound Write), the bytes previously loaded into the specified FIFO buffer by the previous Wraparound Write command are returned to main memory at the address specified in the subsystem's memory address register. The bytes returned during this operation are the same as the bytes supplied by software in the preceding Wraparound Write command. The range specified for the Wraparound Write must be the same as the range for the Wraparound Read or the results are unpredictable.

A range of one to eight words must be specified for these commands. If a range of zero is selected, the command is immediately terminated (without being executed and with no status indications). If a range greater than eight words is selected, the results are unpredictable. In any case, the Wraparound Write and its associated Wraparound Read must start and end from the same memory boundary (byte or word).

A Task instruction issued to any other channel during a wraparound sequence is ignored.

- *Adapter Wraparound (Wraparound GCRA)* — The wraparound level is at the GCRA level. The direction of data transfer (read or write) is determined by the low-order bit of the channel number of the most recent Output Address command.

  During a Wraparound Write command, the channel reads 16 words from memory (at the address specified in the subsystem's memory address register) and transfers them to the GCRA FIFO buffer.

  When a Wraparound Read command is received (immediately following a Wraparound Write), the bytes previously loaded into the specified FIFO buffer by the previous Wraparound Write command are returned to main memory at the address specified in the subsystem's memory address register. The bytes returned during this operation are the same as the bytes supplied by software in the preceding Wraparound Write command. The range specified for the Wraparound Write must be the same as the range for the Wraparound Read or the results are unpredictable.

  A range of 16 words must be specified for these commands. If a range of zero is selected, the command is immediately terminated (without being executed and with no status indications). If a range other than 16 words is selected, the results are unpredictable. In any case, the Wraparound Write and its associated Wraparound Read must start and end from the same memory boundary (byte or word).

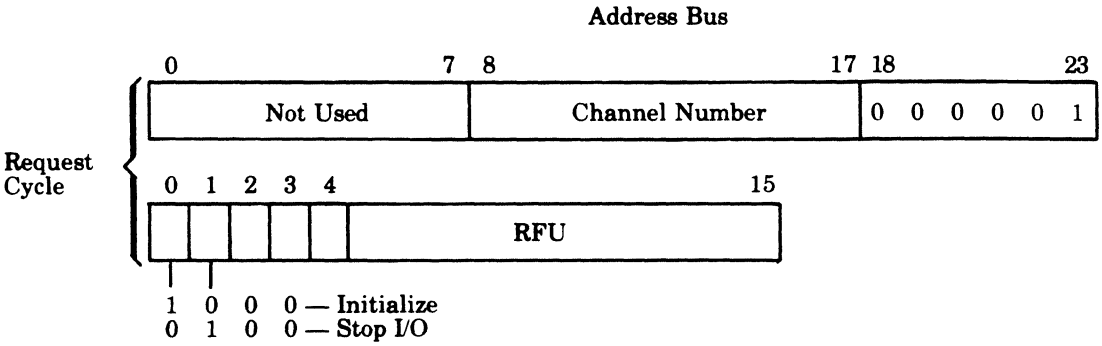
  A Task instruction issued to any other channel during a wraparound sequence is ignored.

- *Unspecified Operations* — All Output Task commands issued to the MPTC-GCRA, other than those specified above, will result in unspecified operations.

Command Output Control Word

Function Code 01

Format



Function

Loads a Control Word into the referenced channel. This command will be unconditionally accepted by the channel regardless of its Busy status.

- *Initialize* — This command will cause the MTC to reset to the same state that it enters after power up. When an initialize command is received by the MTC all of its channels are intitialized (regardless of which channel the command was received over).

  Operations that are in progress in the MTC at the time of the Initialization will be abruptly terminated and all registers will be initialized, including control registers device select and control signals to the drives. No information about the terminated operations will be retained and no interrupts for the operations will be generated. The interrupt level for all channels will be set to zero (interrupts blocked).

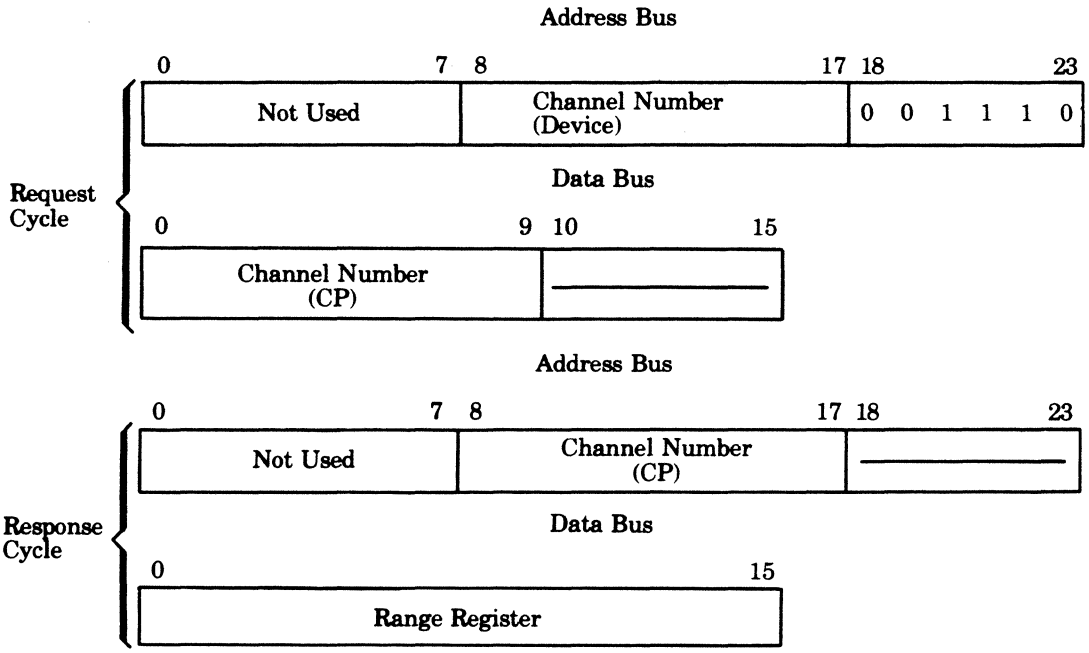
- *Stop I/O* — This command causes any operation currently active on the specified channel to be abruptly terminated. If a data transfer operation is in progress, it will not be completed. An Interrupt will be generated for the operation terminated by this command as if the operation had come to a normal ending point. Status, Address, and Range information, present in the MTC when this command is received, will be retained.

Input Commands

Command Input Range

Function Code 0C

Format



Function

Causes the current contents of the referenced channel's Range Register to be transferred to the requesting channel.

During the Response cycle (Second-Half Read), the MTC will return in bits 8-23 of the Address Bus the same data that was received in bits 0-15 of the Data Bus during the instruction cycle.

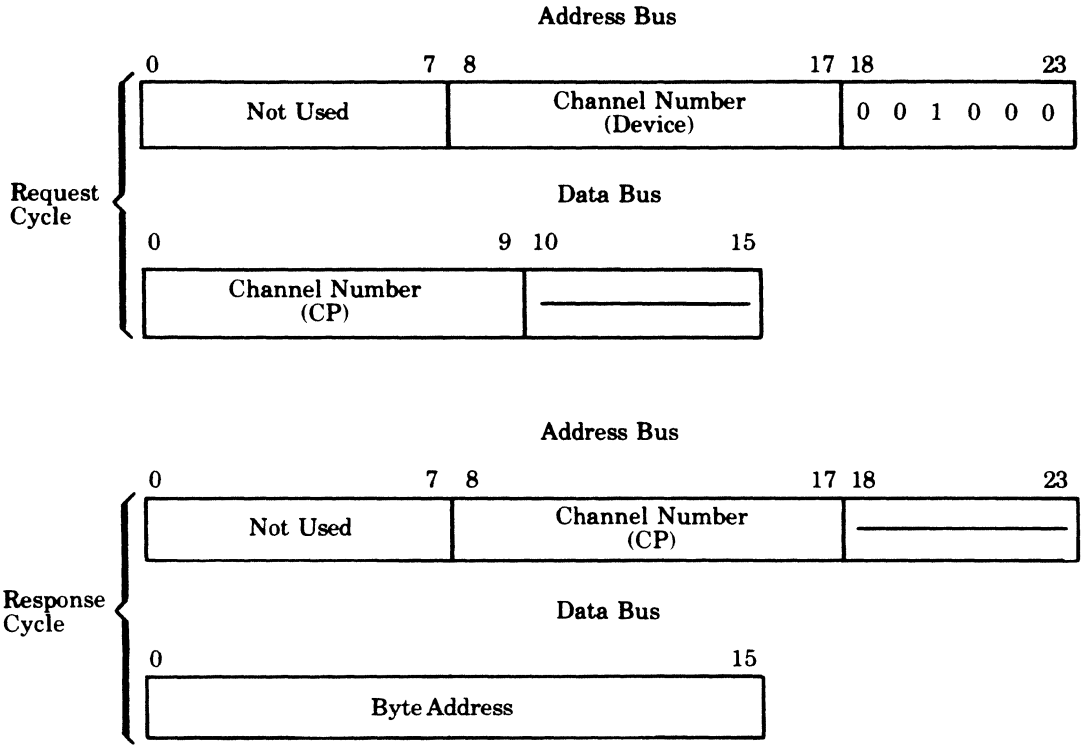
After the completion of a read operation, the contents of the Range Register reflect the status of that transfer with respect to the physical block read.

- If the contents are a positive value greater than zero and bit 8 of Status Word 1, Unequal Length Check, is set to a logical one, the length of the physical block was less than the range.
- If the contents are zero and bit 8 of Status Word 1 is equal to one, the length of the physical block was greater than the original range.
- If the contents are zero and bit 8 of Status Word 1 is equal to zero, the length of the physical block was equal to the original range.

Command Input Memory Byte Address

Function Code 08

Format



Function

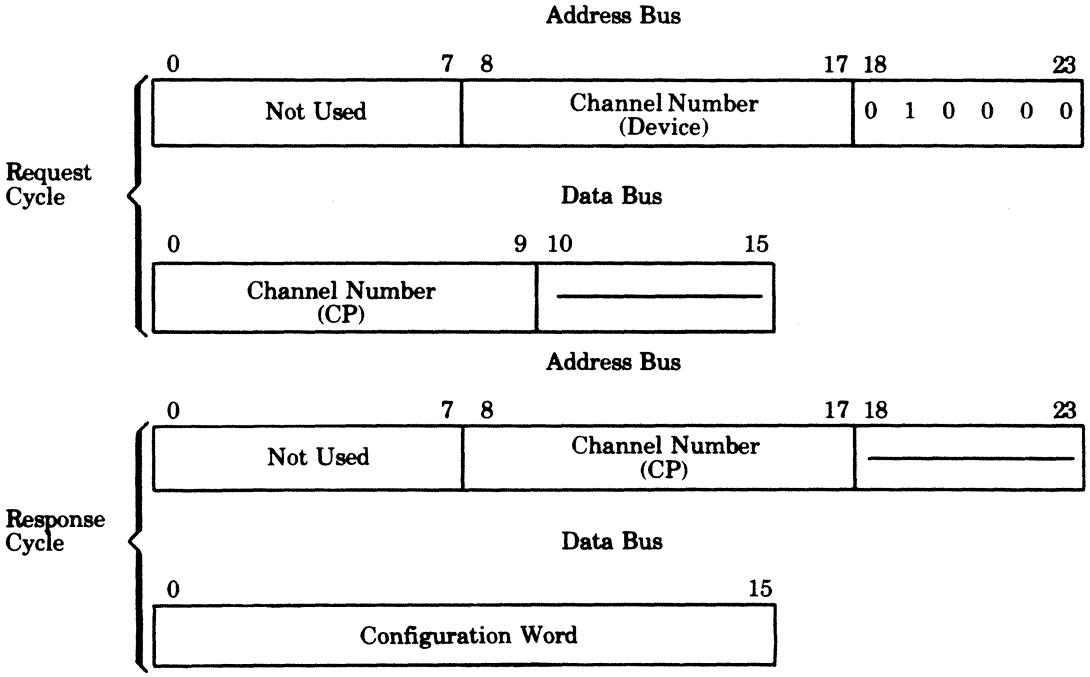
This instruction cause the current contents of the referrenced channel's memory byte address to be transferred to the requesting channel.

During the Response cycle (Second-Half Read), the MTC returns in bits 8 through 23 of the Address Bus the same data that was received in bits 0 through 15 of the Data Bus during the Request cycle. The Data Bus contains the low-order 16 bits of the memory byte address currently stored for the specified channel in the MTC. Note that if a Write command ended at a byte boundary (high-order 8 bits of word), the memory address reflects the next word (not the low-order 8 bits of the previous word).

Command Input Configuration Word A

Function Code 10

Format



Function

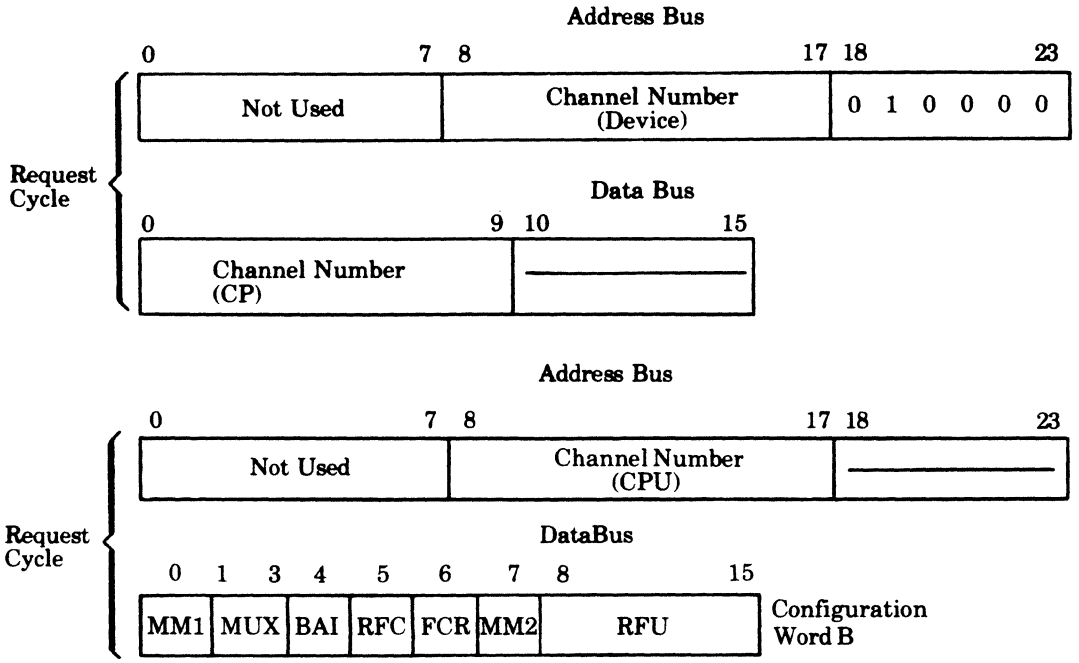
Causes the channel's Configuration Word to be transferred to the requesting channel.

During the Response cycle (Second-Half Read) the MTC will return in bits 8-23 of the Address Bus the same data that was received in bits 0-15 of the Data Bus during the Instruction cycle.

Command Input Configuration Word B

Function Code 12

Format



Function

This instruction causes the current contents of the referenced channel's Configuration Word B register to be transferred to the requesting channel.

During the Response cycle (Second-Half Read) the MTC returns in bits 8 through 23 of the Address Bus the same data that was received in bits 0 through 15 of the Data Bus during the Instruction cycle.

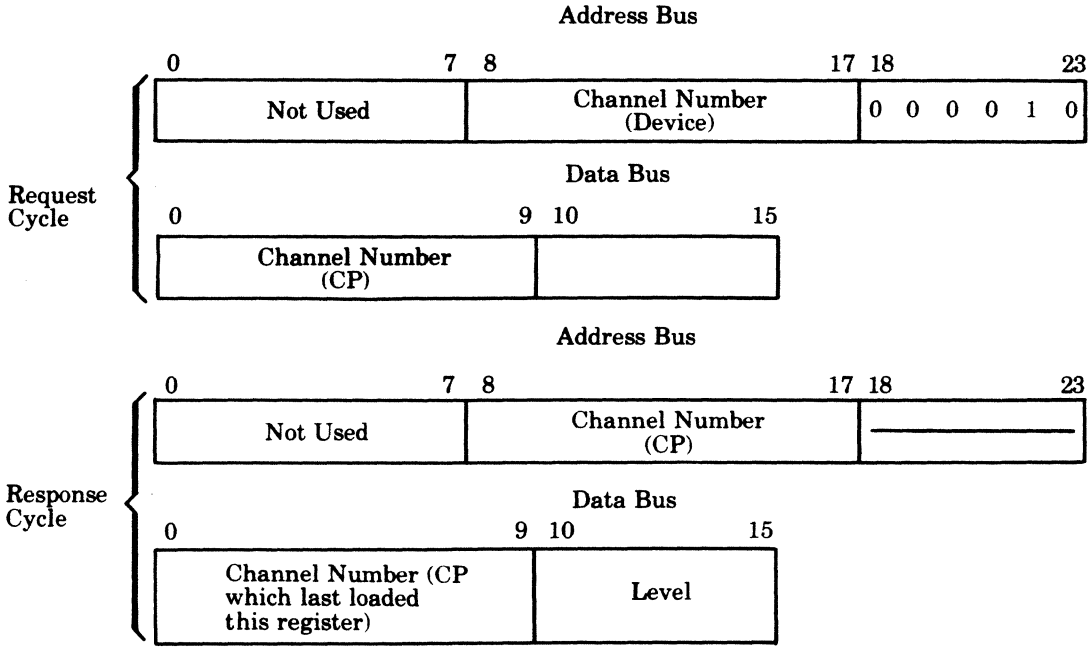
The bit significance is defined below. This command is primarily intended for diagnostic and maintenance purposes.

- Bits 0 through 3 — R, Reserved for use in Output Configuration Word B.
- Bit 4 — BAI, Bus Address Inhibit: Used for processing data in diagnostic mode only.
- Bit 5 — RFC, Reset FCU: Diagnostic mode only.
- Bit 6 — FCR, FCU Ready: Indicates that it is ready for the next command.
- Bit 7 — Sets maintenance mode for T&V checkout.
- Bit 8-15 — RFU, Reserved for future use.

Command Input Interrupt Control

Function Code 02

Format



Function

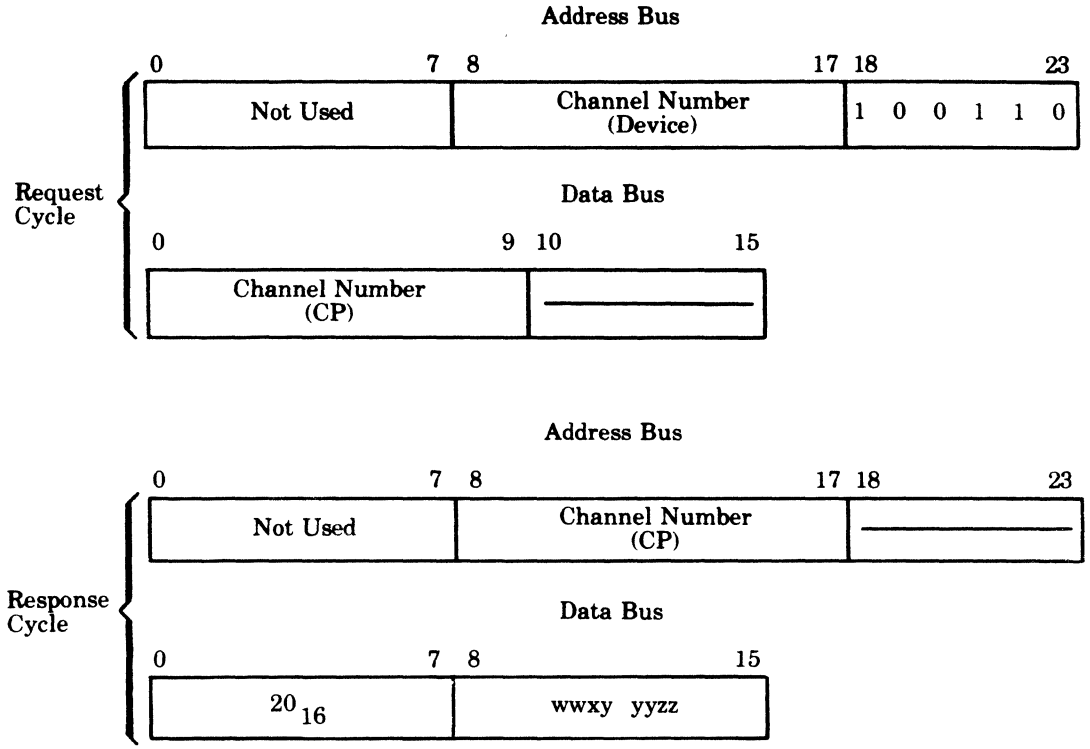
Causes the channel's interrupt level to be transferred to the requesting channel. The level value will be placed on Data Bus bits 10 through 15 with bit 15 as the least significant bit. This quantity is the value previously received in the Output Interrupt Control instruction or a default value of 00. The default value is the interrupt level assumed by the channel when initialized. Note that the channel number returned in bits 0-9 of the Data Bus might be different from the channel number of the CP executing this instruction if more than one CP is attached to the Megabus.

During the Response cycle (Second-Half Read) the MTC will return in bits 8-23 of the Address Bus the same data that was received in bits 0-15 of the Data Bus during the Request cycle.

Command Input Device ID

Function Code 26

Format



Function

Causes the referenced channel to transfer its identification code to the requesting channel. The codes for each type of tape device are defined as follows:

- Bits 0 through 7 — 20_{16} identifies MTC-GCRA tape subsystem.
- Bits 8 through 9 — WW identifies controller type attached to MTC:

  00 - RFU
  01 - FCU (GCR/PE drives)
  10 - RFU
  11 - RFU

- Bit 10 — X 0- (9-track) and 1- (7-track)
- Bits 11 through 13 — YYY identifies tape densities which the channel can accommodate:

  100-6250 CPI (GCR)
  010-1600 CPI (PE)
  001-800 CPI (NRZI, not implemented)

- Bits 14 through 15 — ZZ Tape speeds:

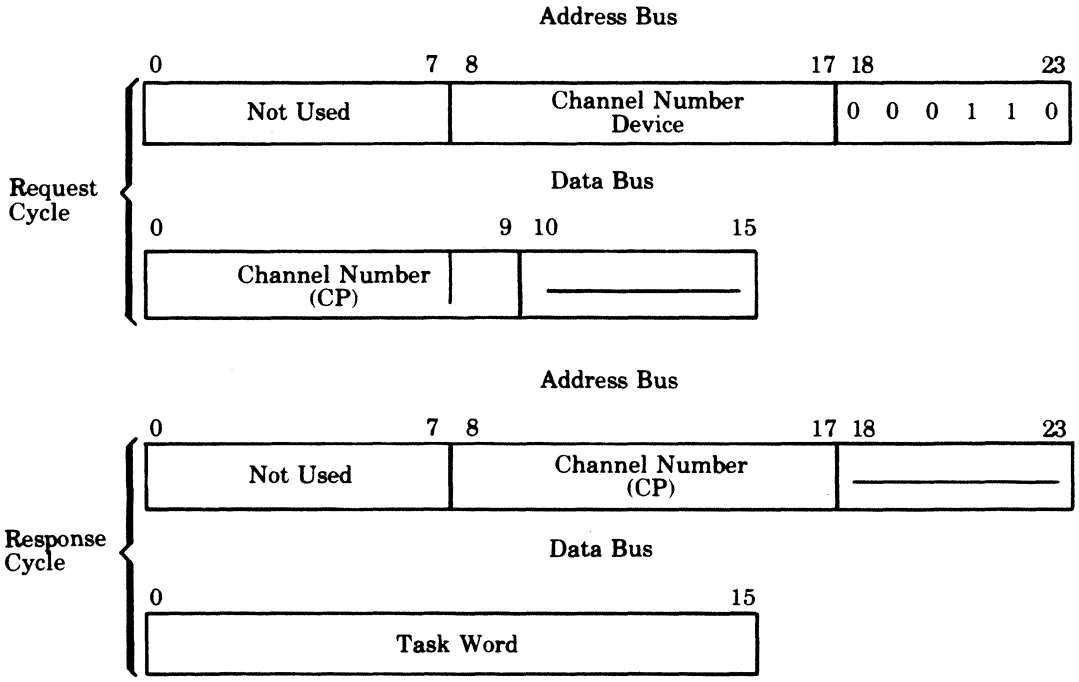
  00-25 ips
  25-50 ips (not implemented)
  10-75 ips
  11-125 ips (not implemented)

During the Response cycle (Second-Half Read) the MTC returns in bits 8-23 of the Address Bus, the same data that was received in bits 0-15 of the Data Bus during the Request cycle.

Command Input Task Word

Function Code 06

Format



Function

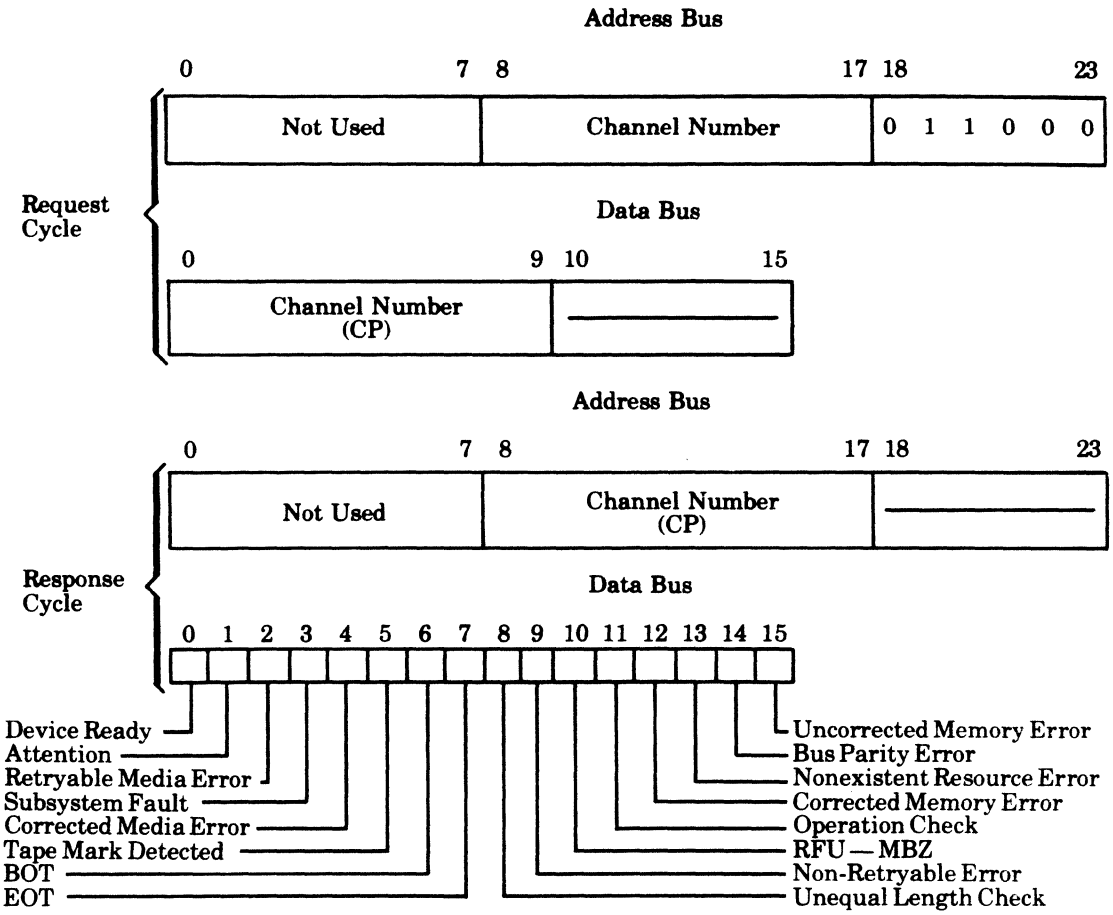
Causes the Task Word of the referenced channel to be transferred to the requesting channel. The Task Word transferred will contain the code for the last operation executed by the channel (unless an Initialize has occurred).

During the Response cycle (Second-Half Read) the MTC will return in bits 8-23 of the Address Bus the same data that was received in bits 0-15 of the Data Bus during the Request cycle.

Command Input Status Word 1

Function Code 18

Format



Function

Causes the referenced channel's Status Word 1 to be transferred to the requesting channel. During the Response cycle (Second-Half Read), the MTC will return in bits 8-23 of the Address Bus the same data that was received in bits 0-15 of the Data Bus during the Request cycle.

Table B-4. Status Bit Definitions – Word 1

Status Condition	Bit	Definition	Reset by
Device Ready	0	Unit is online with tape loaded, is not rewinding, and no further manual intervention is required to place it under program control. This bit will be zero, if either Status Word 2 bit 0 is a zero or Status Word 2 bit 1 is a one.	A change in condition
Attention	1	Indicates an event has occurred at the unit which requires software action. This event, moreover, was not related to a current task but rather was unsolicited. This bit will be set whenever the device changes its ready condition as a result of a non-software-initiated command (i.e., enter or leave the online state, rewinding state, or media loaded state). Attention status may occur following a software initiated Stop I/O or initialize command if the device was performing a Rewind or Rewind and Unload Instruction. Whenever the Attention bit is set, an interrupt is attempted (if the interrupt level is nonzero). If a previously initiated operation is in progress when a device state change is sensed, the resultant interrupt (with the Attention bit set) will serve as notification of both the end of the operation and the device state change.	Initialize or Input Status Word 1
Retryable Media Error	2	Indicates a data error has occurred and will be set whenever Status Word 2 bit 4, 5, 6 or 7 is active.	Initialize or Output Task Word command
Subsystem Fault	3	Indicates that the MTC-GCR has detected a controller type fault (FCU or MTU) which cannot be associated with a particular tape drive. Software treats this error as if the entire subsystem (that is, FCU and its attached tape drives) is down and requires maintenance action. The cause of this fault is indicated in Status Word 2, bits 12, 13, and 14.	—
Corrected Media Error	4	Indicates that an error condition was detected on the media; however, the data read is not lost. For this subsystem, the detected condition indicates that a single-track error as been corrected during a PE operation, or that single- or double-track error correction has taken place during a GCR operation. This bit is also set when a read retry by the MTC-GCR was successful. This bit is reset by an Initialize or Output Task Word command.	Initialize or Output Task Word command
Tape Mark	5	Indicates a Tape Mark has been detected during the execution of a Write Tape Mark. Forward-space Tape Mark, or a Backspace Tape Mark order. This status bit will also be active if the block encountered during execution of a Forward-space/ Backspace/Read block instruction is a Tape Mark.	Initialize or Output Task Word command

Table B-4 (Cont). Status Bit Definitions - Word 1

Status Condition	Bit	Definition	Reset by
BOT (Beginning of Tape)	6	Indicates the BOT marker is positioned at the BOT sensor. A backspace or rewind order issued to a unit with tape at BOT will result in no tape motion initiated and a normal termination of the order.	—
EOT (End of Tape)	7	Indicates the EOT marker is positioned at, or has passed beyond, the EOT sensor. This status bit will remain active until the EOT marker passes back over the sensor as a result of a Tape Backward Motion command (e.g., backspace, rewind). The state of this status bit has no effect on forward motion commands.	—
Original Length Check	8	Indicates that for the previous Read Operation, the physical block was either greater or less than the value in the range register, at the beginning of the Read operation. This bit, a 1 and a residue in the range register, indicates that a short block was transferred. This bit active and a range register contents of zero indicate that a long block was transferred.	Initialize or Output Task Word command
Non-Retryable Error	9	Indicates that the position of media under the tape read/write and erase heads is unknown. This bit will be set when a write order RAW[a] failure occurs (i.e., the detection of magnetic transitions on tape before the start or following the completion of a recorded data block, or the failure to detect magnetic transitions in the area where a data block is being written, or the failure to detect a GCR or PE density identification area on tape when writing a GCR or PE tape). This bit will also be set when an erase order RAW failure occurs (i.e., the detection of magnetic transitions in the area on tape being erased) or when, during a read order, a split block is detected. A split block is a data block in which its beginning and end positions cannot be guaranteed detectable because of a detected unrecorded area within the block. This status bit also becomes active when Status Word 2 bits (Data Check Error) is set.	Initialize or Output Task Word command
Reserved for Future Use	10	Must be zero.	—

Table B-4 (Cont). Status Bit Definitions - Word 1

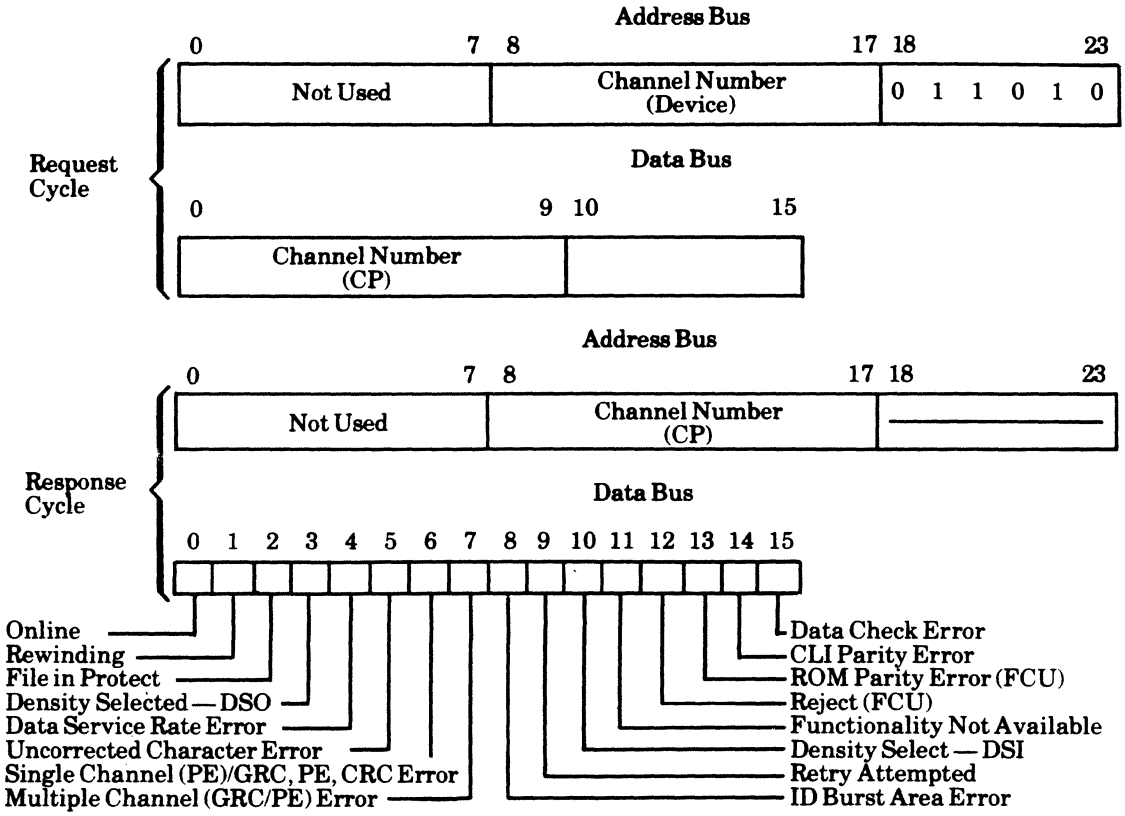
Status Condition	Bit	Definition	Reset by
Operation Check	11	Indicates a write type order (Write, Write Tape Mark, Erase) was issued to a tape drive in Write Protect (see state of Status Word 2 bit 2); that upon acceptance of an Output Task Word data transfer command, the direction of data transfer is not the same as that specified by the direction bit of the channel number issued by the previous Output Address command; that upon acceptance of an Output Task Word data transfer command, the contents of the range register is zero; or that a command (other than No Operation) was issued to a channel on which the device is in the offline or Not Ready state.	—
Corrected Memory Error	12	Indicates that during execution of the previous operation, main memory detected and corrected a memory read error. The data that was delivered to the MTC was assumed to be correct.	Initialize or Output Task Word command
Nonexistent Resource Error	13	Indicates the MTC attempted a Write or Read request bus cycle and received a NAK response. Occurrence of this condition does not cause a termination of the operation in progress; however, it can result in bad data being written on the tape.	Initialize, Input Status Word 1, or Output Task Word command
Bus Parity Error	14	Indicates the MTC detected a parity error on either byte of the Data Bus during any output bus cycle (i.e., odd function code), during a second-half memory read cycle, or when a parity error is detected in bits 0-7 of the Address Bus during an Output Address command. Occurrence of this condition does not cause a termination of the operation in process; however, it can result in bad data being written on tape.	Initialize or (error free) Input Status Word 1 command
Uncorrected Memory Error	15	Indicates that during execution of the previous operation, the main memory detected a memory read error which the EDAC algorithm could not correct. The data that was delivered to the MTC was incorrect. Occurence of this condition does not cause a termination of the operation in progress; however, it can result in bad data being written on tape.	Initialize or Output Task Word command

*Read After Write

Command Input Status Word 2

Function Code 1A

Format



Function

Causes the referenced channel's Status Word 2 to be transferred to the requesting channel. During the Response cycle (Second-Half Read), the MTC will return in bits 8-23 of the Address Bus the same data received in bits 0-15 of the Data Bus during the Instruction cycle. Bits 0-7 of the Address Bus and the parity bit associated with these bits are the same data received during the Instruction cycle. See Table B-5.

Table B-5. Status Bit Definitions - Word 2

Status Condition	Bit	Definition	Reset by
Online	0	Indicates that the device is online to the subsystem. The device can be put into the online or offline mode via the ONLINE control. Offline status can also be activated by the REWIND and UNLOAD control.	—
Rewinding	1	Indicates that the device is processing a rewind operation, either via a command issued by the subsystem or by the rewind control. This bit is not visible to software when rewinding has been initiated by a command because I/O commands issued to a busy channel are NAKed.	—
File in Protect	2	Indicates that the device is in write protect (i.e., write-permit ring is not in position on the mounted file reel).	—
High-Density Selected	3	DS0 0 PE – 1600 bpi 0 NRZI – Not Available 1 GCR – 6250 bpi	—
Data Service Rate Error	4	Indicates that during a Read or Write operation, data transfer between main memory and the device via the MTC-FCU did not maintain the rate in demand. Either data was lost on input because of failure to keep up with device demands or data was unavailable on output when required by the device. The detection of this error condition does not affect the execution of the operation in process.	Initialize or Output Task Word command
Uncorrected Character Error	5	Indicates that during a read or write operation either a VRC[a] error and/or a dropped character error was detected. Retryable Media Error is also set with this type error.	Initialize or Output Task Word command
Single Channel (PE)/ CRC (GCR) Error	6	Indicates that during a write operation for PE, a single channel error was detected. During read operations, single channel errors are corrected by FCU and also set Status Word 1 bit 4. During write operations, single channel errors set bit 2 of Status Word 1 (Retryable Media Error). The detection of a single channel error does not prevent the detection of a multiple channel error in the block. Also indicates that during a read or write operation for GCR, the media CRC character failed to compare with the reconstructed value. It also causes the setting of Status Word 1 bit 2.	Initialize or Output Task Word command
Multiple Channel (GCR/PE) Error	7	Indicates that a multitrack error has occurred during a PE or GCR operation which was not correctable by the FCU[a]. The detection of these error conditions also sets Status Word 1 bit 2.	Initialize or Output Task Word command

Table B-5 (Cont). Status Bit Definitions - Word 2

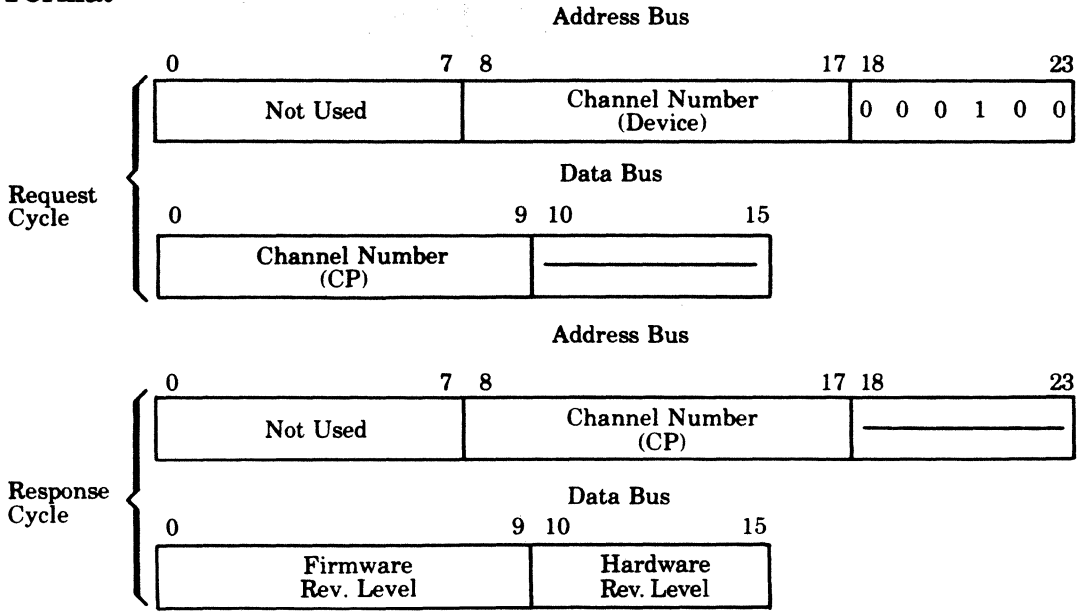
Status Condition	Bit	Definition	Reset by
ID Burst Area Error	8	Indicates that during a read or write (RAW) operation, an error was detected in the ID burst area; that is, the ID burst cannot be read or an incompatibility exists in the ID burst area. Nonretryable Error, Status Word 1 bit 9, is also set when this error occurs.	Initialize or Output Task Word command
Retry Attempted	9	This bit is set whenever the MTC attempts a read retry, regardless of whether or not the retry was successful.	Initialize or Output Task Word command
Density Select	10	DS1 0 PE – 1600 bpi 1 NRZI – Not Available 0 GCR – 6250 bpi	—
Functionality Not Available	11	Indicates that, for the subsystem specified herein, the Output Task Word – Read Backwards order is not available, or that an attempt was made to utilize a feature which was not available. The order terminates without tape motion.	Initialize or Output Task Word command
Reject FCU	12	Indicates that the FCU has responded to a command sequence from the MTC-GCR with the REJECT signal at the incorrect time. This indicates a serious error in the FCU and also causes the setting of Subsystem Fault Status Word 1 bit 3.	Initialize or Output Task Word command
ROM Parity Error (FCU)	13	When set, indicates that the control memory portion of the FCU detected a word having incorrect parity. This line points out a serious hardware malfunction which should be repaired before attempting to use the FCU again. Subsystem Fault, Status Word 1 bit 3, is also set when this error occurs.	Initialize or Output Task Word command
CLI Parity Error	14	Indicates tht a parity error has been detected on the CLI interface. Occurrence of this condition does not cause a termination of the operation in progress; however, it my result in bad data being written on the medium. Subsystem Fault, Status Word 1 bit 3, is also set as a result of this error.	Initialize or Output Task Word command
Data Check Error	15	This line is asserted by the FCU when any of the following error conditions occur. CRC error, white tape mark check, uncorrectable error, partial record, multile track error, end data check, velocity check, BOT reached, overrun.	—

*VRC Error (PE, GCR) — One or more data characters were detected with incorrect vertical parity. Data character parity is odd unless bit 3 in the stored configuration word is set.

Command Input Firmware Revision

Function Code 04

Format



Function

The firmware and hardware revision level are represented by a hex number.

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