EXCESSIVE TAPE ERRORS

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THE PROBLEM

Occasionally with new tapes, but far more often with tapes that have been used previously three or more times, the end user will have tape errors, or will not be able to compare or verify the data which they just backed-up, or will not be able to format the tape with a report of too many bad blocks.

GENERAL SOLUTIONS

The storage of data on tape is a function of magnetics. One side of the tape is coated with magnetic particles. When a current is applied to the tape head and the tape is passed over that head the signal generated by the head alters the positioning or orientation of those magnetic particles in order to lay the data onto the tape. The data is then read back off the tape by means of the tape head reading the position or orientation of those particles and transferring this orientation to the printed circuit boards for interpretation.

In order to insure that the orientation of the magnetic particles is correctly altered to insure the integrity of the data, the tape to tape head gap contact must be correct so that the magnetic signal generated by the tape head is strong enough to properly alter the particles on the tape, and the magnetic fields on the tape must be of the correct strength to allow the signal to alter the particle orientation.

There are four elements which can impact this critical tape to tape head gap contact. The first is the contour of the tape head which will change over time as the tape wears the head down. The second is the build up of debris or oxide from the tape and/or the environment in the tape head gap area which reduces the signal strength. The third is the tension of the tape as it is pulled across the tape head, as this is controlled by the reels of tape in the cartridge. The last and fourth is the tension of the tape across the tape head which can be controlled by the pinch rollers or servo tensioners and the tape guides of the drive itself (as opposed to the cartridge).

With respect to QIC drives and mini-cartridge QIC drives, tape tension and tape path is all determined by the cartridge itself. The tape does not leave the cartridge and pass through any

appreciable tape path setup before going across the tape head. Therefore, item number four listed above is not a factor on these units, BUT it is a very important factor on 1/2" tape drives, 4mm tape drives and 8mm tape drives.

The first element, normal tape head contour wear, the customer or end user can do nothing about. Tape media is abrasive to a degree and it will cause wear of the tape head. If none of the other items discussed in this paper will solve the problem of excessive errors, and this result is obtained with several different new, properly acclimated tapes, then the drive needs to be repaired.

The second element, namely the build up of debris in the gap area, can be solved using a cleaning cartridge. Make sure that the cartridge is a data grade cartridge designed for use in these drives, and that it is used exactly as indicated in the instructions, and is not used more times than is listed in the instructions.

The third element, namely tape tension in the tape cartridge, can be solved by the software retension commands. This is most critical in the larger QIC drives as most of the mini-cartridge drives will do a retension automatically during their power on self test. Also, on the 4mm and 8mm drives, tape tension is controlled primarily by the tape path and tape guides, and not by the cartridge. Retensioning should be done after the tape is acclimated and upon the earlier of once per month or after three uses (before the fourth use).

The fourth element, which truly is only an issue with the 1/2", 4mm and 8mm tape drives, is not something that can be solved by the end user. If none of the other items discussed in this paper will solve the problem of excessive errors, and this result is obtained with several different new, properly acclimated tapes, then the drive needs to be repaired.

BENEFITS OF DEGAUSSING

Any tape designed for storage of information, either analog or digital, contains magnetic particles (particles which can be magnetized). The information is stored on the tape by sending a magnetic signal to magnetize the particles giving them a specific orientation/polarization, the pattern of which is the data.

Given the minuscule size of the millions of particles on a tape, the change in orientation resulting from the magnetic signal

from the head does not merely change one or a specific number of particles, but will have an impact on adjoining particles as well. This can be readily seen when one looks at a signal off of a tape on an oscilloscope. Information is recorded in "tracks". The signal is the strongest in the middle of the track and drops off towards the edges of the track. The tracks are spaced so as to minimize or eliminate overlap of data to reduce the likelihood of poor data integrity.

Theoretically, each brand new tape will have no magnetic field on it (is not magnetized). This is frequently not the case, and is also frequently not within the control of the manufacturer as the tape can pick up a magnetic field in any number of ways after being first shipped by the manufacturer.

The tape drives used in PCs may or may not have a separate erase head. For example, there is no separate erase head in mini-cartridge QIC drives. All that an erase head does in a tape drive is demagnetize the tape, thereby erasing any information on the tape. The erase head in the drives is not strong enough to totally eliminate all of the magnetic field on the tape, but rather leaves a "ghost" or residual magnetic field. This builds up over time, which ultimately results in enough background magnetism on the tape to cause the drive confusion in trying to interpret the signals being read off of the tape. The drive reports this as either data errors or bad spots on the tape.

Another problem with the erase command is that many of the drives, and in particular the mini-cartridge drives, truly only erase the tape header and file directory recorded at the beginning of the tape, and do not actually even try to erase the entire tape. This results in an overwrite of all the other data past the file directory. BUT on these mini-cartridge drive, the software erase <u>does not</u> eliminate the format on the tape.

Most software used in tape backup will permit the overwrite of data. This means that the existing data is ignored, and the tape head writes over the existing field. Each time a tape is used in a drive, the drive will start at slightly different areas, and will position the track slightly differently. The differences are so slight so as not to be readily noticeable, and this is why there is a specific width to each track to allow for this variance. These variances can be measured in the area of 1/10,000 of an inch range. But what this causes on an overwrite is also a nominal loss of data integrity resulting from a residual left over magnetic pattern from the previous uses. Again, this builds up over time, which ultimately results in enough background magnetism on the tape to cause the drive confusion in trying to interpret the signals being read off of the tape. The drive reports this as either data errors

or bad spots on the tape.

The benefit of the degausser is that it generates a signal far stronger than any tape head or erase head, and this signal is strong enough to truly degauss or demagnetize the whole tape, eliminating any residual magnetic field or pattern. This leaves the user with a "blank paper" on which to write, thereby maximizing the integrity of their data.

In order to insure the integrity of the stored data, the end user should never overwrite data nor use the software erase commands. Instead, they should degauss the tape.

HOWEVER, there is a problem with degaussing tapes on the mini-cartridge drives. As they work off of the floppy interface, they require that the tapes be formatted. The formatting process can take anywhere from 45 minutes to over 2 hours on a DC2120 tape and drive. Pre-formatted tapes can be purchased by the end-user. Degaussing the tape will also eliminate the format, and require the end-user to format the tape which is very time consuming. Unfortunately, this is the only way to insure the data integrity.

Thus, on mini-cartridge drives using pre-formatted tapes, it is recommended that the end user not use a tape which has been overwritten or erased via software commands any more than five (5) times AND IT IS STRONGLY SUGGESTED THAT A COMPARE OR VERIFY FUNCTION ALSO BE DONE AFTER EVERY BACKUP.

CONCLUSIONS

1. Retension the tape prior to first use, and at least at the earlier of once per month or three uses.

2. Allow tape to acclimate in drive environment for at least one hour prior to use.

3. Use the proper cleaning cartridges for the drives, following manufacturers instructions on use and on number of usages for that cartridge, after the earlier of once per month or ten uses of the tape drive.

4. Degauss the tapes before use. Do not use software erase commands or overwrites.

5. ALWAYS DO A VERIFY OR COMPARE IMMEDIATELY AFTER COMPLETING THE BACKUP.

NOTE: All suggestions regarding the number of times before degaussing or retensioning, or the number of times to overwrite or

software erase a tape are very conservative and suggested in order to maximize the integrity of the data.

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