ROLM CORPORATION

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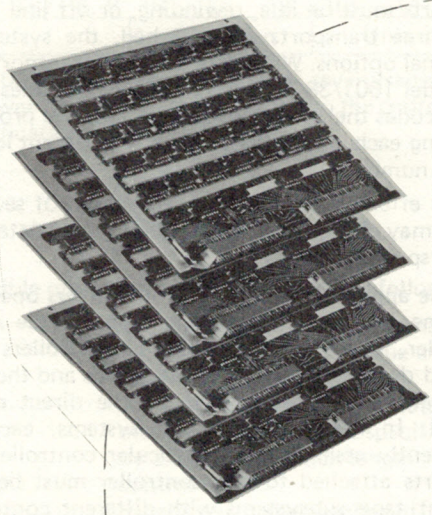
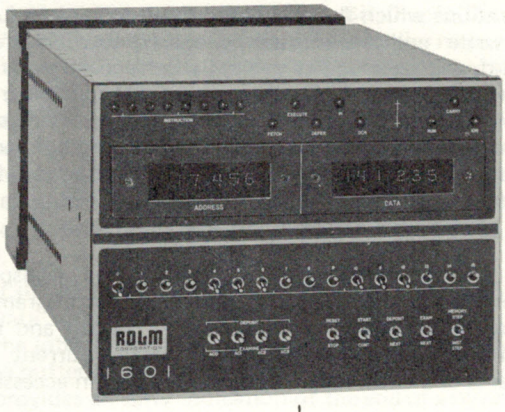
Magnetic Tape Control

Model No. 1601/36-4030





FEATURES

The magnetic tape control unit provides a hardware and software interface for attaching from one to seven magnetic tape transports to the Model 1601 Ruggednova computer. The integrated computer and tape system generates and recognizes fully ASCII/IBM compatible 9-track, 800 bpi formats. Transports which may be attached to this controller include the rugged, militarized Ampex ATM-13, the high speed TM-16, and the low cost TM-Z.

In order to minimize demands placed on the computer's operational program, the controller transfers all data directly between memory and the tape transport on a cycle-steal basis. Although the program must initialize channel control words at the beginning of each tape operation, data chaining features allow the controller to link together non-contiguous memory buffer areas without subsequent program intervention. Hence, scatter read and gather write operations proceed with a facility seldom found in a minicomputer tape system. The programmer also specifies whether data words in memory contain one or two bytes each, and the controller performs the necessary packing and unpacking.

Operations which the programmer can request include read, write, write end-of-file mark, erase, space forward, space backward, and rewind. The controller selects one tape transport at a time for most operations. However, one or more transports rewinding do not prevent the controller from carrying out other operations using a different transport. The programmer also has the means at his disposal to read or write a sequence of records without waiting for the transport to physically stop and restart in each end-of-record gap.

The ability to monitor actions of the transport and occurrences within the controller under direct program control comprises a necessary complement to control and selection capabilities. Control words describing the current memory buffer area and a full-length status word remain accessible at all times.

The magnetic tape control unit occupies four circuit modules which plug into slots reserved for I/O options in either the basic Ruggednova main frame or an Extender Box. Internal interconnections and a single panel connector complete this option. Transports are cabled to the controller in "daisy chain" fashion. For this reason, adding more transports in the field presents no problem.

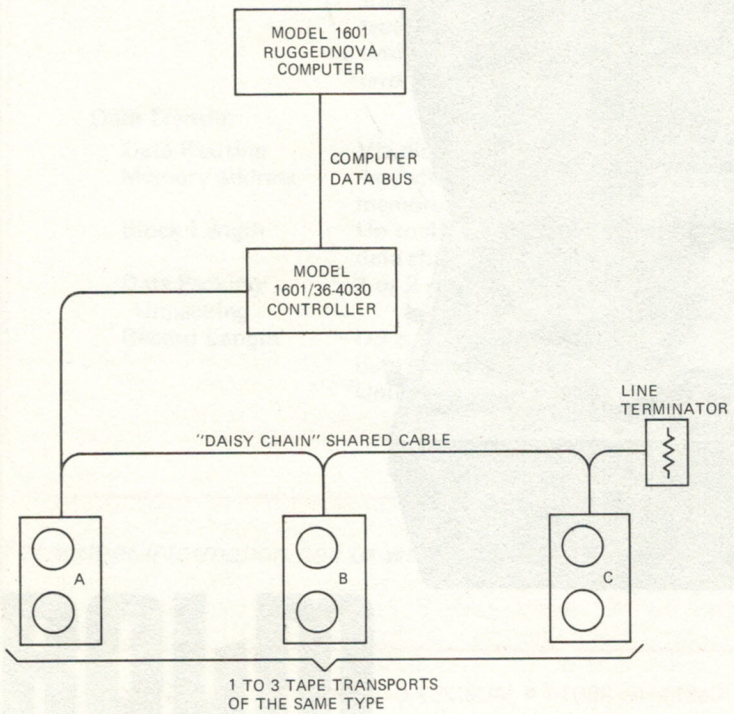


Figure 1

MAGNETIC TAPE SYSTEM CONFIGURATIONS

The Model 1601/36-4030 Magnetic Tape Control operates in conjunction with any of the following tape transports.

Name	Speed	Character Transfer Rate	Special Features
Ampex Tm-Z	24 ips	19.2 kHz	Low Cost
Ampex TM-7	45 ips	36 kHz	Shared electronics available
Ampex TM-9	75 ips	60 kHz	Shared electronics available
Ampex ATM-13	75 ips	60 kHz	Militarized
Ampex TM-16	150 ips	120 kHz	High Speed

Up to seven transports, all of the same type, may be connected to one controller. The controller selects one transport at a time for read, write, erase, or space operations. All other transports must be idle, rewinding, or off line. When no more than three transports are attached, the system requires no additional options. When four to seven transports are attached, the Model 1601/38 Transport Selector becomes necessary. This unit decodes the 3-bit transport address and provides means for switching each physical transport to different logical transport address numbers.

Cost effective tape systems composed of several TM-7's or TM-9's may also be configured using shared data electronics per Ampex specifications.

If the application requires simultaneous operation of more than one transport, the system may include more than one controller. The limiting number of controllers which may be installed depends upon transport speeds and the resulting total data transfer rate demanded of the direct memory access channel. In multiple controller systems, each transport is permanently assigned to a particular controller. Although all transports attached to one controller must be similar types, different tape subsystems with different controllers are free from this restriction.

Figure 1 shows the basic configuration for a single controller and three or fewer transports. Figure 2 shows a more complex system.

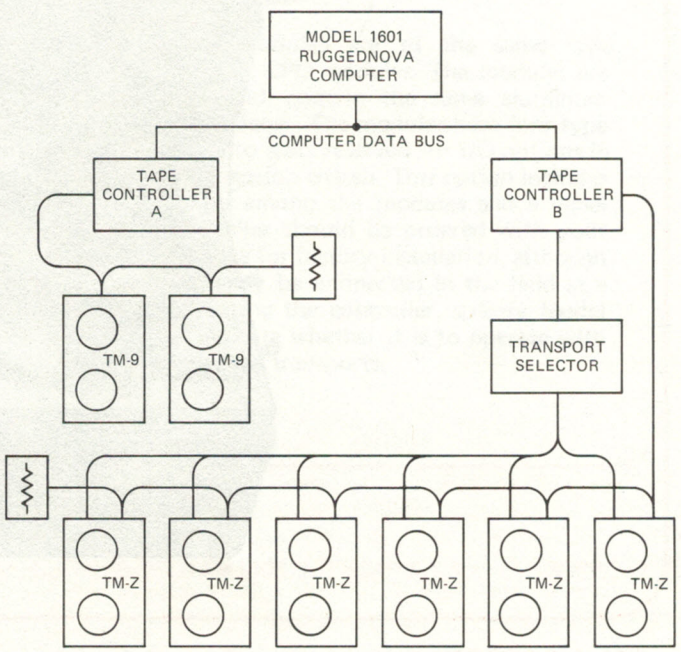


Figure 2

PROGRAMMING

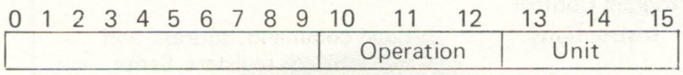
I/O Instructions

The entire magnetic tape system is organized as a single I/O device, with an identifying address of 22_8. The interrupt mask bit is 10.

All six data transfer instructions are used; their actions are defined as follows:

DOA	Store new command in controller
DIA	Read current status word
DOB	Store new memory address
DIB	Read current memory address
DOC	Store new block length
DIC	Read remaining block length

Command Word



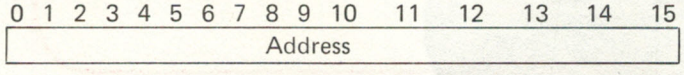
"Unit" is a 3-bit number selecting one of seven transports. When three or fewer transports are connected to the controller, three fixed identifications normally are used:

001	Transport A
010	Transport B
100	Transport C

The eight possible operation codes are defined as follows:

000	No operation; an illegal command
001	Rewind to beginning of tape and reposition at load point
010	Read one record and store data in a memory buffer area as specified by address and block length control words
011	Space forward the number of records specified by the block length control word unless end of tape or an end-of-file mark is encountered first. Transfer no data to memory.
100	Space backward the number of records so specified unless load point or an end-of-file mark is located first.
101	Write one record of data from a memory buffer area specified by address and block length words
110	Write end-of-file mark. Transfer no data.
111	Erase approximately 3-1/2 inches of tape, moving forward

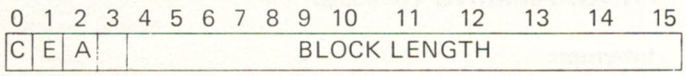
Memory Address Word



A new memory address word may be loaded into the tape controller by executing a DOB in the program or through direct memory access when a data chaining operation is specified. At the end of each DMA cycle stolen, the controller increments the stored address. Therefore, a DIB instruction always obtains the address of the next memory location to be used for data.

Bits 1 – 15 of this control word contain the full 15-bit address of any location in the 32K word maximum memory size. Bit 0 is ignored.

Block Length Word



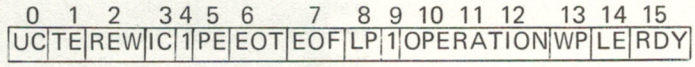
The Block Length control word, which also contains control bits for the current operation, may be loaded by a DOC instruction or through direct memory access during data chaining. Bits 4 – 15 contain the ones complement of the number of words of data to be handled. At the end of each DMA cycle stolen, the controller increments this number. A DIC instruction reads the current count of words remaining, plus the original control bits. Either DOC or DIC may be executed at any time during read or write operations.

The bit labelled "A" in the word format controls whether or not the data stored or read from memory is packed two characters per word. If A = 0, the controller assembles during read and disassembles during write. Bits 8 – 15 of the data word are read or written first; bits 0 – 7 come last. If A = 1, no assembly or disassembly takes place. All characters are then read or written from bits 8 – 15.

Bits 0 and 1 determine what action the controller takes when the block length count reaches 7777_8. Bit 0 specifies data chaining. When this bit contains a one, the controller responds to the end of count situation by reading two or more words from sequential memory locations immediately following the end of the data buffer area just completed. The first of these words replaces the old block length word, including the three control bits. The second word becomes a new memory address. When the block length reaches 7777, but bit 0 is zero, the controller begins the termination process for the operation being performed.

Bit 1 of the Block Length control word arms or disarms the End of Data interrupt. When used concurrently with data chaining, the interrupt notifies the program that the tape system is switching buffer areas. When used without data chaining, this interrupt provides an early indication of the end of a record and allows the program to read or write a series of consecutive records without stopping tape movement in each interrecord gap.

Status Word



Bit		Contents
0	UC	– Unusual Condition
1	TE	– Timing Error
2	REW	– Rewinding
3	IC	– Illegal Command
5	PE	– Parity Error
6	EOT	– End of Tape
7	EOF	– End of File Mark
8	LP	– Load Point
10-12	Operation Code (from Current Command Word)	
13	WP	– Write Protection
14	LE	– Length Error
15	RDY	– Transport Ready

Status information is available to the program at any time through execution of a DIA instruction. Those bits associated with transport conditions are present only when the unit selected by the command word is physically connected and ready to operate. The other status bits indicate conditions within the tape controller at the end of the last operation, assuming the controller is Done. During the Busy state, the controller sets and clears the individual bits as the associated events occur.

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PROGRAMMING *continued*

Interrupts

The controller provides two types of interrupts, which are identifiable by their response to an INTA instruction.

First, the Job Done interrupt occurs when the controller enters its Done state. At this time the controller is available to begin executing any legal operation with any transport. All transports are fully stopped unless a rewind operation is in progress. The Done interrupt responds to the INTA instruction with 22_8, the device address.

The second interrupt flags an End of Data condition rather than the end of an operation. Placing a 1 in bit 1 of the Block Length Control Word arms this interrupt. It responds to an INTA instruction with 122_8 to distinguish it from the Job Done interrupt.

SPECIFICATIONS

Recommended transports	
Types	Ampex TM-Z, TM-7, TM-9 TM-16 or ATM-13
Tape Speeds	24, 45, 75, or 150 ips
Data Transfer Rate	19.2, 36, 60, or 120 kHz
Number attached	1 to 7
Number Simultaneously Active	1
Number of Tracks	9
Tape and Reel	0.5"x10.5" IBM Standard
Recording Format	
Compatibility	ASCII/IBM
Recording Mode	NRZI
Bit Density	800 bpi
Checking Features (Write)	Lateral and longitudinal parity; CRC character
Read Checks	Both parity checks
End of Record Gap	0.5" to 0.75"
End of File Gap	3.5" nominal
End of File Mark	Not interpreted as data
Control Functions	
Operations Performed	Read, write, write end-of-file, erase, space forward, space backward, rewind.
Status	
Sensed	Beginning-of-tape, end-of-tape, transport ready, write protected, rewinding, parity error, timing error, record length error, illegal command.
Data Transfer	
Data Routing	Via direct memory access
Memory address	Anywhere in 32K maximum memory size
Block Length	Up to 4K words (without data chaining)
Data Packing/ Unpacking	1 or 2 characters per word
Record Length	Up to 8K characters (without data chaining) Unlimited (with data chaining)
Data Chaining	Permits address and block length to be replaced via direct memory access
Program Control	
Instructions	Load command, address, and block length registers. Sense status, address, and block length. Start or stop operation. Skip if busy or done.
Interrupts	Job Done End of data (separate arming; different response to INTA instruction)
Interrupt Mask	Bit 10 (for both interrupts)
Device Address	22_8 (alternatively 02, 20, 40, 42, 60, or 62)
Physical Properties (Nominal; for controller only)	
Net weight	4.2 lbs
Power Requirements	+5v, 4Amps (supplied by computer or extender box power supply)
Thermal Dissipation	20 watts (circuit modules are conductively cooled to the ATR box side plates).
Environment	Same as Model 1601 Ruggednova computer.

EQUIPMENT SUPPLIED

The four circuit modules are of the same type construction as the basic CPU modules. The modules are conductively cooled and contain the same aluminum "cookie sheet" type stiffener. The modules have fork type connectors and plug into slots reserved for I/O options in the main frame or expansion chassis. This option includes interconnecting wiring among the modules and a panel connector. The controller should be ordered with your Model 1601 Ruggednova for factory installation, although additional transports may be connected in the field at a later date. When ordering the controller, specify Model 1601/36-4030 and indicate whether it is to operate with 24, 45, 75, or 150 ips tape transports.

For further information call or write:

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