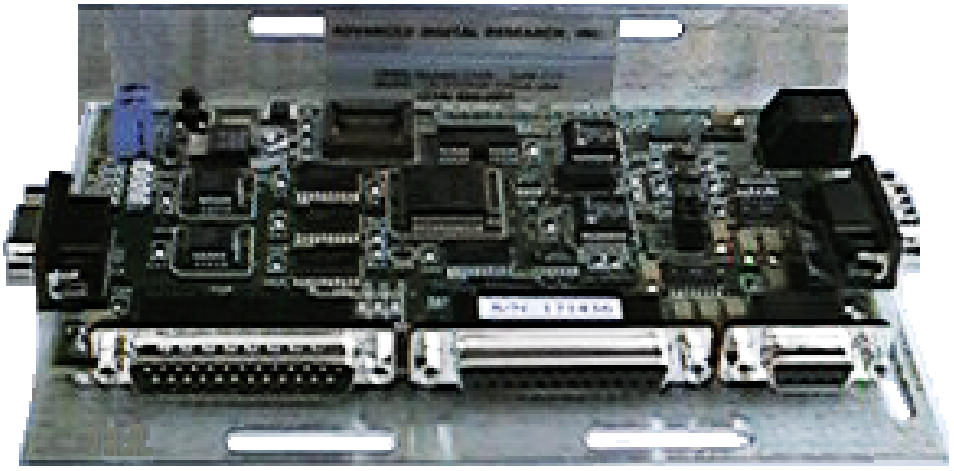
ADVANCED DIGITAL RESEARCH, INC.

Advanced Machine Interface



AMI Hardware Technical Reference

Advanced Machine Interface

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Chapter 1

General Information

The Advanced Machine Interface (AMI) is designed to operate as a universal paper tape emulator capable of dramatically increasing the performance of a Numerical Control (NC) or Computer Numerical Controlled (CNC). The industry term for a device interfacing via a controls tape reader interface is “Behind the Tape Reader” (BTR) adapter. The AMI can be used in single control configuration or in multiple control networks

New technology upgrades your “old” controls - saving you big bucks!

The AMI adapter uses advanced surface mount technology to achieve small foot print. Large memory storage, parallel reader and punch interfaces and serial reader and punch interface as standard features. AMI is directly pin and timing compatible with industry standard reader and punch products for easy installation. The AMI is optically isolated to avoid grounding problems when connecting a computer to a machine -- you get safety and reliability.

DNC with the AMI

AMI’s proprietary, optical isolated, RS-422 interface, a single PC can support up to 64 machines from a single COM port. The processing of the NC programs is done in the control - the central computer generates the part programs and distributes them to the controls via communication software.

DNC Definition - Distributed Numerical Control.

AMI Specifications

Host RS-232 / RS-422 port	J3,J4 DB9 connector J3 - Female, J4 Male - wired one to one Bi-directional 1200 -38,400 baud. EIA Protocol RS-491-Level 1 and RS-491-Level 2	
Reader Output Port	J5 - DB25P Male Reader Speeds 50 - 800 Characters per Second (CPS) + other custom timings	
Punch Input Port	J6 - DB25S Female FACIT and REMEX compatible Punch speeds 75, 120, 500 and 1000 CPS	
Serial Reader/Punch	J7 - DB9S Female 300 - 19,200 baud Parity Odd/Even/None XON / XOFF protocol RTS / CTS modem line handshaking	
ATERM interface	J2 - RJ45 9600 baud fixed 8 data bits no parity 1 stop bit. Uses XON / XOFF protocol	
Environmental		
Operating	0° to 50° C	
Storage	-10° to 60° C	
Humidity	0 - 95% non-condensing	
Power	Unregulated 9 Volts @ 350ma typical	
Memory	128K standard	(1,000 feet of tape equivalent)
	512K option	(4,000 feet of tape equivalent)
	2048K option	(16,000 feet of tape equivalent)
Size	4.5" x 7" x 1.25"	
Weight	8 ounces (with bracket)	

Related products

A-TERM terminal:

Display	4 lines x 20 char LCD
Keypad	40 keys
Housing	Black ABS plastic
Weight	11 ounces
Size	4" x 8" x 1" (approximately)

Software:

AdvancedDNC™ multi-CNC program.
QuickDNC™ single-CNC program.

Optional Punch Cables

Control	ADR Part Number
OKUMA	350410
FANUC	360901
K&T GEMNI	360902
MITSUBISHI	360903
ACRAMATIC	360904
FACIT 4070	360905

Optional Reader Cables

Reader	ADR Part Number
DECITEK	330600
FANUC20A	350307
FANUC200	350308
ADDMASTER	350310
SANYO DENKI	350403
SANYO DENKI	350500
GE trad 4	350505
CIN MIL PIC4	350520
ACRAREAD	350600
EECO	350700
EECO 2001	350701
SLO-SYN	350702
EECO Stepmate	350703
K&T	350710
GNT	350801
MELDAS	350900
FANUC 50 pin	350901
CINCINNATI	350902
SANYO DENKI 36	350903
CINCINNATI MILACRON	350910
Others	call

The AMI directly supports hundreds of control types.

Option adapters:

Bar Code Wand.
Machine monitor adapter.
Serial RS-232 interface.

Chapter 2

CHAPTER 2

AMI and ATERM Installation

Bench test your AMI before installing it.

When you receive your AMI, before you install it inside your control, you may want to set it up on your desk. Plug it directly into your PC using the serial cable supplied, and verify that you can send and receive data. Try going into the AMI setup routine. You can then learn how the AMI works with your DNC software without walking back and forth to the control. ADR pre-tests all AMI before shipping, and leaves the AMI set for your control, so everything should work straight out of the box.

Single CNC configuration

The AMI can be used to connect **one CNC to one COM port** on a computer. Typically this method is used where there is a personal computer at each machine or small group of machines. The AMI has two important functions: 1) it gives the CNC a serial port that allows any DNC software program to transfer files. 2) it gives the CNC external memory so the PC does not have to constantly feed the control.

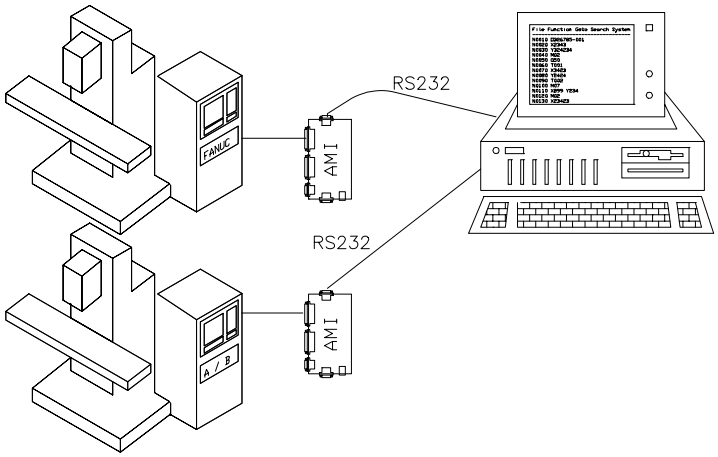


Figure: Single CNC mode hookup

Multi CNC configuration

When many machines are to be networked, the AMI offers a very low cost method of supporting **many machines from a single PC COM port**. Initial savings come from needing only one computer to host all machines and from eliminating the need for multi-ported COM board in the PC. Your shop operates more efficiently because operators do not have to learn to use computer software, saving operator time. Data is more secure because floppy disks are not required to distribute files and there is no cost of operator time to manage floppy disks.

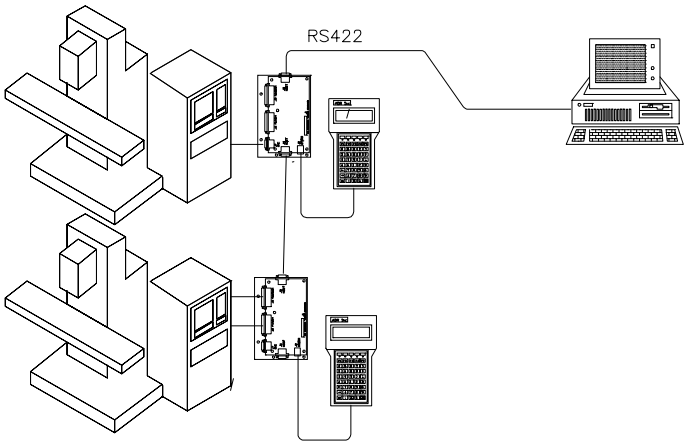


Figure: Multi CNC mode hookup

The steps to setting up a single CNC DNC system

DNC via an RS-232 connection from PC to AMI .

1. Cable the AMI to your computer via serial cable. You may need to use the 9 to 25 pin adapter supplied. Attach the ATERM if you have one.

2. Attach an unregulated 9VDC power supply to the AMI. Power up. If the ATERM is attached, the ATERM will show a copyright notice - so you will know the AMI is alive. Some controls supply power to their readers via the reader cable - FANUC and Sanyo Denki for example. For these cases you should attach only regulated 5VDC for these experiments.

3. Set your computer to work with the AMI - 9600 baud 8 data bits NO parity for binary file, 9600 baud 7 data bits EVEN parity for ISO files or ASCII files. Use the AMI program supplied, or your favorite PC communication software.

4. Send some data to the AMI - it will blink DS4

5. Enter AMI setup by typing “-S” followed by Enter.

6. Review the AMI parameter settings - but do not change them unless you are familiar with the AMI.

7. Transfer a file to the AMI - the AMI will accept it, but may or may not output to the control port (control not attached yet).

8. If you have an ATERM, view the file by using the MORE key.

9. Now, power the AMI down and attach it to your CNC using a parallel reader cable or serial cable.

10. Turn power on to your control and AMI. Load a file into the AMI from your computer, and at the control's panel request a load (cycle start) "from tape" or serial data source.

11. View the file in the controls memory.

12. Power down your control and the AMI. Attach the AMI to the controls "PUNCH" output. This is done with either a parallel or serial punch cable.

13. Turn power on to your control and AMI. At the computer, set your communication software to save files. At the control's panel request an output to "PUNCH." The data will flow from the control through the AMI and into the computer. The data may need translation to ASCII to be viewable on the PC.

The steps to setting up a multi-CNC DNC system

DNC with an RS-422 connection shared by all AMI.

1. Attach ATERM to the AMI.
2. Attach AMI J3 to RS-422 serial data source.
3. Attach AMI J4 to next AMI or install a terminator plug
4. Load ADNC software on your computer - see ADNC manual.
5. Apply power to AMI - ATERM will show the AMI main menu
6. Edit the Poll.bat file on the PC to have the AMI serial numbers. Load a test file into each machine directory.
7. Start the ADNC software by typing ADR.
8. The AMI indicates it is communicating by slowly blinking DS4
9. Use the ATERM to change setup parameters required for your control. To enter setup, press F1 followed by ? as the filename.

10. Request a LOAD from the ATERM using F1. The ATERM will show a series of periods as the LOAD is in progress, followed by the word DONE.

11. View the file using the ATERM, using the MORE key.

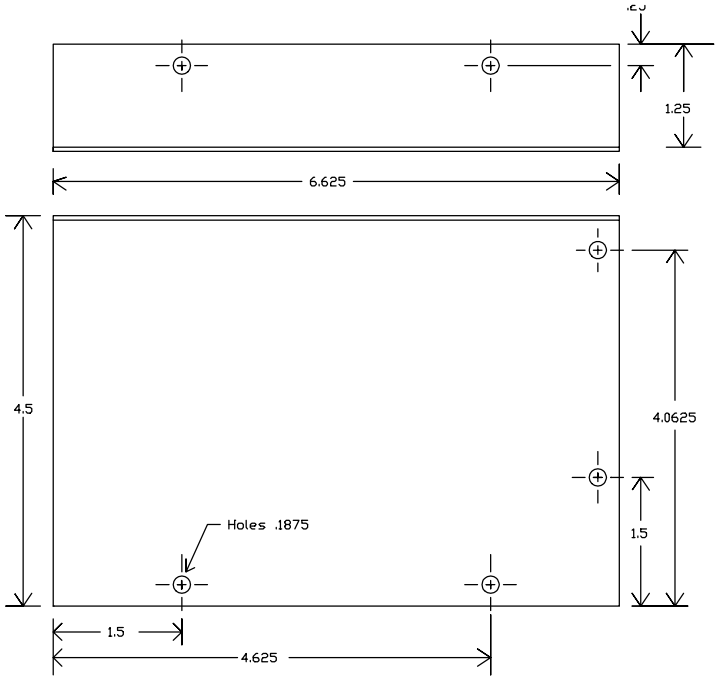
Unpacking and inspection

Remove the AMI from the shipping carton. Carefully check packing material for parts. Remove the AMI board from its plastic envelope and check for any shipping damage. If you find damage, contact your dealer immediately. DO NOT install or apply power to a damaged unit.

Mounting the AMI

The bracket, supplied with the AMI, mounts in any orientation. Be sure to securely connect the bracket to a stable surface, using lock washers or rivets. Strain relief the cables so that the weight of the cables is not burdening the connectors.

Figure: AMI Bracket



Velcro® mounting - you can attach the AMI to any convenient smooth surface using two strips of Velcro®. Attach the Velcro to itself so that the adhesive protectors face out. Peel off a protector from one side of both Velcro® strips and attach them to the back of the AMI bracket. Then peel off the protectors from the back of the AMI at press the AMI into place.

When you attach cables, beware of the following problems:

1. If the cable hangs down, there will be a torque on the connector. Over time will tend to pull out of the connector.

2. Leave some service slack in the cable so you can remove the cable without removing the AMI.

3. Tie the cables down using plastic tie wraps.

4. If the AMI bracket were to fall, try to have it fall where it will not come in contact with high voltages.

5. Shielded cables should have the shield attached to chassis ground on one or both ends, depending on whether you have a voltage potential difference between the two ends. If no potential exists, you can ground both ends of the shield to get better radio frequency (R.F.) shielding.

6. The host computer interface is optically isolated so the ground from the host is not connected to the controls ground.

7. Some controls have the earth ground in their power cables attached to the chassis. This is a safety feature to prevent electrical shock, but sometimes this also provides a path for high frequency signals that can cause problems. The controls power supply ground should float relative to chassis. If the logic power supply connects to chassis, R.F. noise can enter logic circuits via "skin effect."

8. The two host connectors on the AMI are identical except for sex. You can attach the host using either one. To remove an AMI that is multi-dropped, connect the male host cable to the female cable - bypassing the removed AMI.

AMI DC power adapter

Powering the AMI using a 9V transformer!.

ADR supplies a 9 Volt DC voltage adapter to provide the correct DC voltage needed by the voltage regulator on the AMI. The two wires from the adapter connect to the two-position power terminal on the board. Make sure that the polarity on the board matches to polarity marking on the wires.

The Green DS1 LED will light up and stay ON when the correct voltage and polarity are applied. If DS1 does not light up, try reversing the polarity from the DC-adapter.

The DC power adapter requires 100-120 VAC. Some controls have a convenient AC outlet. Also beware of using an AC outlet that contains voltage spikes from motors or other high current devices. The voltage surges can pass right through the transformer in the DC power adapter and enter the AMI board. If voltage surges go high enough they can permanently damage the AMI. If the surge goes low enough for long enough the AMI may detect power loss and go into reset, causing loss of data to the control. Solutions to power related problems are: install line filters, un-interruptible power supplies (UPS), or to use a switching power supply that operates over a much wider AC voltage ranges.

The ground wire, from your computer (RS-232) to the AMI, is NOT connected to the controls' chassis or logic ground! Your computer is optically isolated from your control, and therefore "floats."

Be careful when attaching +5v from the CNC to an AMI, polarity matters!.

You can directly connect the AMI to the +5v power in your control to eliminate having to use AC to power the AMI DC adapter. The advantage is the AMI gets clean power and a known ground. The disadvantage is the AMI looses power and contents of its memory when the control is turned off.

AMI Board Layout

The AMI board consists of several I/O connectors, indicators, jumpers, reset switch, etc. It is important to become familiar with these items so the board can be properly configured. The Figure below shows the layout of the AMI board.

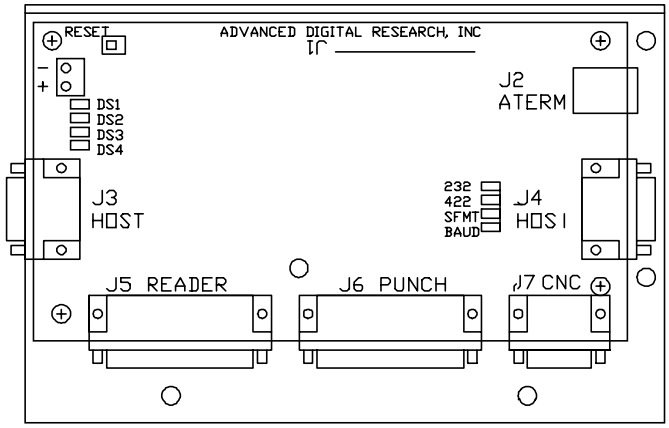


figure: AMI Layout

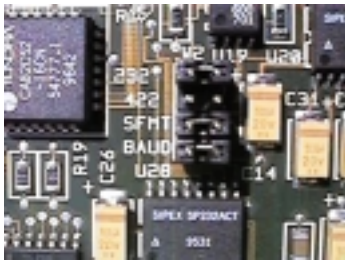


figure: photo of jumpers

AMI jumpers

The AMI board has a jumper block containing four jumpers. The meanings of the jumpers are listed below:

422	**232**	**MEANING**
OUT	OUT	I/O DISABLED - DO NOT USE
OUT*	IN*	RS-232 Operation enabled
IN	OUT	RS-422 Operation enabled
IN	IN	ILLEGAL - DO NOT USE

The AMI has a jumper for selecting RS-232 or RS-422

SFMT	**BAUD**	**STD MEANING**	**ALTernate MEANING**
OUT	OUT	19.2Kbaud	38.4kbaud
IN	OUT	2400 baud	1200 baud
OUT	IN	4800 baud	600 baud
IN*	IN*	9600 baud	9600 baud

The HOST BAUD RATE is set by two jumpers

* = Default Setting.

Notice that you can always use 9600 baud when both jumpers are in - STD or ALTernate

AMI Connections

TB1 - DC power connector +9 volt unregulated input

TB1 is a two position screw-down terminal block. Unregulated DC voltage is powers the board. The board has "+" and "-" markings. Jumper W1 allows you to bypass the on-board regulator, so you can and use +5 Volts from the control's power supply.

WARNING:

IF JUMPER W1 IS INSTALLED BE SURE THAT THE POLARITY OF THE POWER IS CORRECT, AND THAT NO MORE THAN 5 VOLTS IS APPLIED. OTHERWISE THE AMI COULD BE DESTROYED!

NEVER INSTALL W1 WHEN USING THE UNREGULATED DC SUPPLY THAT PLUGS INTO AN AC OUTLET.

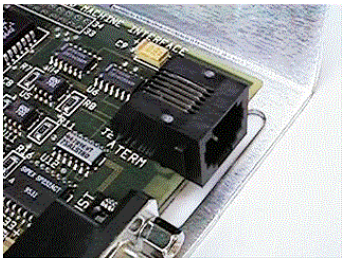
J1 - Expansion Connector

This connector allows additional circuits for special applications.

J2 - ATERM connector

The ATERM may give your operator a view of the program - when the control can not!.

Serial interface to a hand held terminal via RJ-14 6-pin modular jack. The cable is a standard (no-reversal) 6-wire modular cable. This connector carries +5V power to the ATERM. It is very important to be sure the correct cable is used. OR PERMANENT DAMAGE TO THE ATERM COULD RESULT!



Pin Signal	SIGNAL NAME	I/O	Notes
1	TX	O	RS-232 output from AMI
2	nc	-	
3	RX	I	RS-232 input to AMI
4	nc	-	reserved
5	+5V	O	DC power for ATERM
6	GND	O	ATERM ground

J3 - Host serial port - 9 pin D Female connector

The cable to the HOST PC needs at twist!.

Serial RS-232 / RS-422 interface to host computer or other equipment using serial communication. The HOST computer connector pinout is shown below.

Pin Signal	SIGNAL NAME	I/O	Notes
1	+RX	I	RS-422 Receive +
2	RxD	I	RS-232 Receive
3	TxD	O	RS-232 Transmit
4	-RX	I	RS-422 Receive -
5	Gnd	-	RS-232 / RS-422 Ground
6	+TX	O	RS-422 Transmit +
7	CTS	O	RS-232 Clear to send
8	RTS	I	RS-232 Request to send
9	-TX	O	RS-422 Transmit -

J4 - Host serial port - DB9P Male connector

J4 Is identical to J3 - only with different sex connector. This connector is used in the multi-drop wiring to connect to the next AMI.

J5 - READER CONNECTOR - DB25P Male connector

The AMI uses a Pinout similar to REMEX readers - for ALL machines!.

The signal names in this connector change according to the reader emulation selected during the AMI setup.

J5Pin	Signal name	I/O	J5-PIN	SIGNAL NAME	I/O
1	DATA BIT 1	O	14	SYSTEM READY	O
2	DATA BIT 2	O	15	SPROCKET -	O
3	DATA BIT 3	O	16	DRIVE RIGHT-	I
4	DATA BIT 4	O	17	DRIVE LEFT-	I
5	DATA BIT 5	O	18	BROKEN TAPE	O
6	DATA BIT 6	O	19	SPROCKET	O
7	DATA BIT 7	O	20	WIND RIGHT-	I
8	DATA BIT 8	O	21	WIND LEFT-	I
9	DATA READY	O	22	WINDING	O
10	MODE SELECT	I	23	DRIVE ACK.	O
11	GND	-	24	GND	-
12	GND	-	25	CHASSIS	-
13	GND	-			

J6 - PUNCH CONNECTOR - DB25S Female connector

FACIT Punch cables can plug straight into the AMI.

Standard Punch timings are supported. You can directly cable to the controls punch port. Some controls have circuits powered by the power supply inside the FACIT punch. The AMI does not source power, so if your control does not punch via AMI - check if you need to supply power somewhere. The pin-out for parallel punch emulation is shown below.

J6-Pin	Signal name	I/O	J6-Pin	SIGNAL NAME	I/O
1	DATA BIT 1	O	14	INPUT MODE	-*
2	DATA BIT 2	O	15	OUTPUT MODE	-*
3	DATA BIT 3	O	16	CHASSIS	-
4	DATA BIT 4	O	17	CHASSIS	-
5	DATA BIT 5	O	18	GND	-
6	DATA BIT 6	O	19	no connect	-
7	DATA BIT 7	O	20	PUNCH ERROR	O
8	DATA BIT 8	O	21	GND	-
9	no connect	-	22	+5V(510• to +5V)	O
10	no connect	-	23	GND	-
11	PUNCH CMD	I	24	+5V(510• to +5V)	O
12	PUNCH READY	O	25	GND	-
13	GND	-			

NOTE: data /command modes are established by software setup not by pins in the connector.

J7 - Serial CNC port

Standard RS-232 port for connection to the CNC's serial reader, serial punch or bi-directional serial port.

J7-Pin	Signal name	I/O
1		
2	RxD	I
3	TxD	O
4	reserved	
5	GND	-
6	reserved	
7	RTS	O
8	CTS	I
9		

The AMI can pass serial data to and from a control changing baud rate in the process.

RS-232 / RS-422 Host port

The host of the AMI uses either RS-232 or RS-422 signals. If multi-drop networking is to be used, then the host must use RS-422 - unless only one AMI is to attached (say for Demo purposes or remote requests using the ATERM are needed). Due to the high baud rate used in multi-drop mode, RS-232 cables must be kept short (less than 20 feet).

If the distance from the PC to AMI is more than 100 ft consider using RS-422

The RS-422 port type allows 4000 feet of cabling. The RS-232 port type has a maximum of 100 feet (9600 baud - depends on capacitance of wire used).

Setting AMI to match host serial port

Setting AMI host baud rate

In single drop mode, the baud rate used to communicate with the host PC is determined by the setting of the AMI jumpers SFMT and BAUD.

Note:

The host can communicate with the AMI at a high baud rate and the AMI can communicate with a control at a low baud rate (serial device interfaces). This allows fast load of the AMI, minimizing the time needed to get the file into the AMI. When a control uses a serial port on the AMI, the control's baud rate must match the baud rate setting accessed via AMI setup (SERIAL CNC parameter).

In multi-drop mode the baud rate used by ADNC is always 115K baud.

The AMI host SERIAL FORMAT **(stops, data bits, parity)**

Most customers set their PC's to use 7 data bits, Even Parity, 2 stop bits.

The AMI host serial format is fixed as 8 data, No parity, 1 stop bits. In single drop mode the host computer serial format does NOT have to match the AMI host port serial format. An exception is when you want to convert an ASCII file to an ISO (RS-358) file "on-the-fly." Set your computer serial format to 7e1 or 7e2. The even parity bit, sent by the host, is interpreted by the AMI to be bit eight of the RS-358 byte.

Note:

If your control uses a serial port, match its setting in the AMI via the AMI setup procedure (SERIAL CNC parameter).

In multi-drop mode ADNC always uses 8n1 serial format.

How to get into AMI setup

First set the PC com port to work with the AMI.

The AMI is configurable from the host computer. The serial link between the AMI and computer can be used in an interactive mode. This can be done with a terminal emulator software (Procomm , Windows Terminal, and HyperTerminal for example) or via with the program supplied by ADR called "AMI".

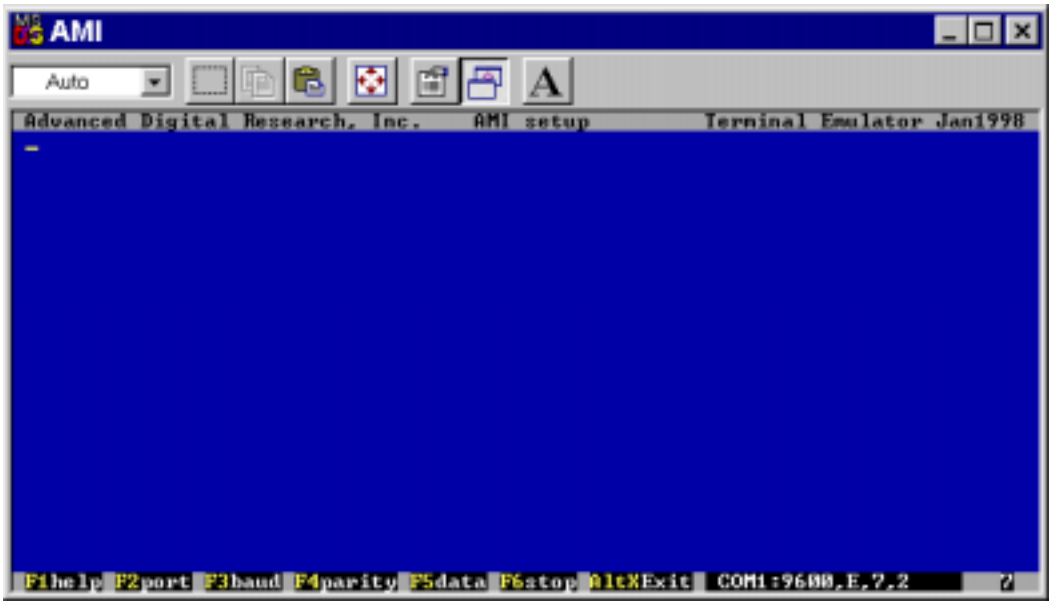


figure:AMI program after starting

The lower right corner shows the current settings for the COM port. Use the Function keys to change settings - they will have immediate effect. Pressing F1 will get you the help screen which shows all of the Function Key commands - F7 thru F12 are not shown.
F7 - Change receive display mode (7 bit, 8 bit and Binary (Hexadecimal codes).
F8 - Send Pattern - Used for memory testing.
F9- AMI setup - Dumps AMI setup and makes a hardcopy.
F10 - AMI Help - Sends -? to display the list of host commands provided by AMI.
F11 - Send DLE char
F12 - Send ESC char
ALT-X Exit program

The enter setup, type the two characters “-S” . While you type nothing will appear on the screen. After the AMI receives the “S” character, it will respond with the following:

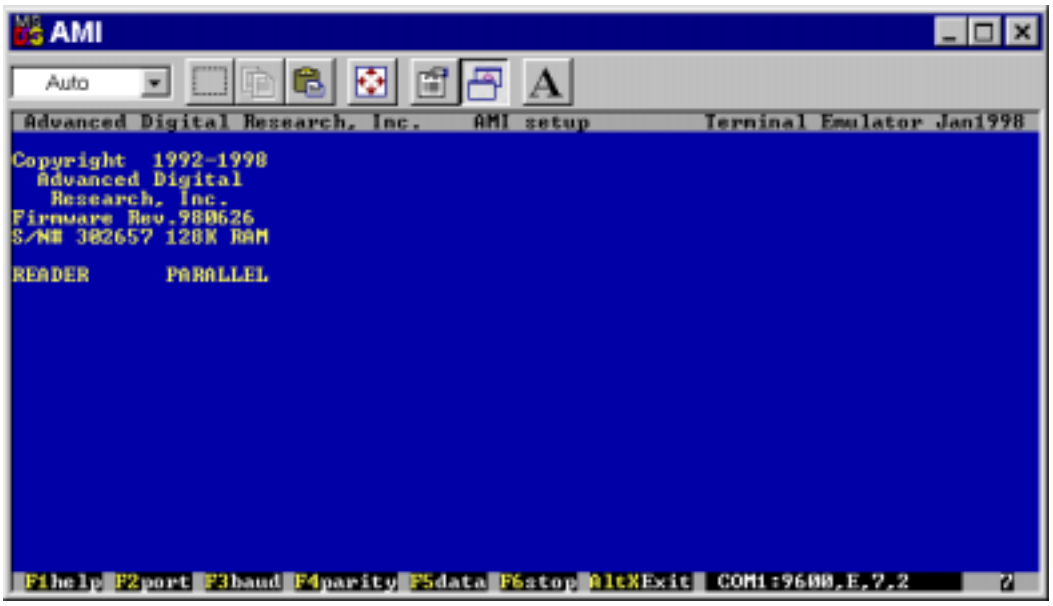


figure: AMI Screen after typing “-S”

You can now press Enter to see the next setup line or change the READER type to SERIAL or NONE by pressing the space bar. Continue viewing the setup items until you see the final one concerning saving the setup.

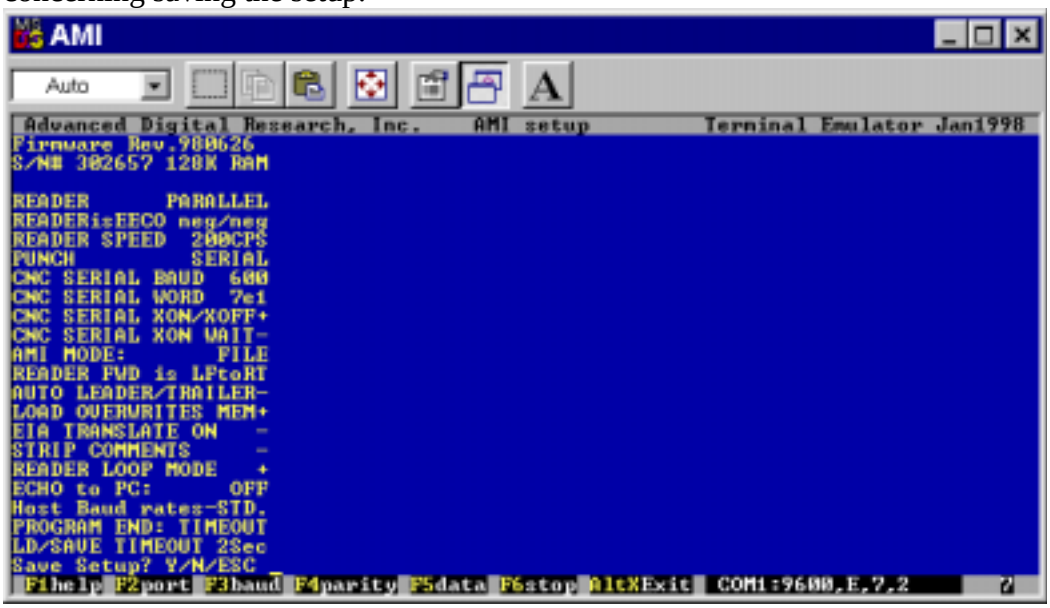


figure Example:AMI program last setup question

You can now press the N key to exit the setup menu - without having changed anything.

Special host configurations

The standard methods of interfacing a control to a host computer is via a serial communication port, but there are other ways to accomplish file transfer: a) Modems. b) LAN. c) Printer ports. d) COM servers. e) Terminal printer ports. f) "walk disks". g) Switch boxes. ADR has installed the AMI to all sorts of devices other than computers. The IBM PC is by far the most popular host, which is why most of this manual relates to working with a PC. If you have a Apple Macintosh or Digital Equipment Corp. VAX, the AMI will offer you new ways to build your DNC system.

The AMI uses XON-XOFF protocol to "talk" to the host, so whatever device is being used as a host only has to be able to support this flow control method to qualify as a host. By using the memory on the AMI the host device is relieved of having to respond instantly to the demand for data.

Chapter 3

CHAPTER 3

Theory of operation

General AMI operation

The AMI gives older controls a serial port that it can dripfeed from.

The purpose of the AMI is to facilitate communication between your computer and one or more computer numerical controls. Distributed Numerical Control (DNC) is a specialized branch of computer communications, often mistaken to be "serial output" from a CAM program. The AMI solves the problem of how to get data into a control without requiring special software (single CNC mode). The AMI also solves the problem of how to remotely get files from a computer that is shared by many operators.

The AMI acts as buffer memory to smooth data flow from the computer. The AMI handles the special hardware protocols used to transfer data in and out of the control. The computer uses XON/XOFF serial protocol no matter what flow control the control is using.

The ATERM enhances the AMI in both single and multi-CNC modes, providing additional control of the AMI. The ATERM also can give your control new capabilities. Older controls do not display the part program, eliminating the ability to review the program prior to running. With the ATERM you can view the part program block by block and read comment lines that may contain important setup instructions.

Using the A-TERM

The ATERM is a very valuable tool. It allows you to "remotely" request files, to monitor file transfers to your control, to view part programs stored in the AMI, to start offset at a specific block, and it allows you to configure the AMI. The ATERM has five menu selections accessed via “F” keys at the top of the keypad. The REMOTE function for example allows access to setup and also allows the operator to compose a file name of up to 80 characters.

AMI Modes

AMI Mode - FILE

The AMI can store multiple FILES if you separate them with STOP codes.

The whole file is stored in the AMI's 128K / 512K RAM / 2Megabyte RAM.

NOTES:

1. The next character received after a file has been loaded into the AMI will cause the AMI's memory to be ERASED if memory protect mode is not selected.
2. The end of a file load is determined by the HOST TIMEOUT value. The AMI is in LOADED state after receiving a file and no data comes for the HOST TIMEOUT period. Normally HOST TIMEOUT is set to two seconds.

File Mode 1ST CHARACTER

The AMI acts just like a tape reader.

The very first character output to the control is placed on the data lines prior to the control issuing a drive command (read from tape). Then the AMI asserts the sprocket and data ready lines. The control may not read the first character - some controls only read after they have asserted the drive line - and the first character is output before this. Note that a tape reader also behaves this way.

AMI Mode - Drip-feed

Dripfeed - or trickle feed data to the control.

As the complexity of your NC programs increases to beyond the limited size memory available in your control, you begin seeking for ways to have your control only hold a portion of the whole part program and automatically load each portion as required. This has become known as "drip feed" transfer mode. Related to this is program “chaining” or “scheduling” where multiple files on the host are seamlessly transferred to the CNC as one large part program. Many CNC offer special modes where the control interprets special characters in the data stream to implement scheduling.

Fill Characters

The AMI's block mode allows an unlimited length file to be sent to the control. The AMI stores 128K bytes of data as a buffer against going empty. The AMI uses Xon-Xoff to attempt to maintain the 128K buffer full. If the control removes data faster from the AMI than the PC can load the AMI. The buffer will eventually become empty, and if the control then requests data the

AMI responds with a "FILL CHARACTER" that prevents the control from generating a “reader not ready” alarm. The "FILL CHARACTER" is programmable to allow for support of any CNC.

AMI MODE - DRIP FEED (BUFFER)

The AMI can handle ANY size program in BUFFER mode.

This mode is used when the file is larger than the memory in the AMI. The AMI stores data in a buffer. The purpose of the buffer is to prevent "data starvation of the control." The buffered used is 128Kbytes or 512Kbytes. When the AMI buffer is full, the AMI sends an XOFF character to stop host output. When the AMI can accept more data, an XON is sent to the host. This mode only applies to parallel reader emulations. Here are some special conditions:

Empty buffer

When the control reads data the AMI will output an XON character to the host and a fill character to the control. The XONs sent to the host have a maximum repeat rate of 1 XONs every 2.5 seconds.

Full buffer

When the AMI has (128K - 256) bytes buffered, it stops the host from sending more data by sending the host an XOFF character. When the control has removed 256 bytes from the AMI, the host output is started by sending it an XON.

EOF Character

When the control reads an ISO or ASCII percent (%) character, an ASCII SYN (16Hex, 22 decimal) character will be sent to the host.

Host in XOFF state

The host has been told to stop sending data to the AMI because the AMI buffer I is full. To begin a new load to the AMI, the Host must send out an ASCII Date Link Escape DLE command (control P).

Interpreting the AMI LEDs

The LED's show you what the AMI is doing.

DS1 ON - whenever DC power is supplied to the AMI adapter.

DS2 BLINKS quickly when the control is reading data from the AMI. Also blinks when AMI is punching data to Host.

DS3 BLINKS quickly indicating that control is requesting data to be read in the forward direction. OFF - the control is requesting data in the reverse direction if and only if DS2 is also ON.

DS4 - BLINKS when there is data being transferred between the AMI memory and the host computer. This also occurs when the host computer polls the AMI board. When the LED is on steady, there is data file in the AMI memory.

One warning: the host software must not time-out and begin sending data to the AMI, overriding the XOFF that the AMI sent to the host. Procomm does this for example.

File types

Executive - BINARY files

The AMI handles executive files as easily as ASCII, EIA and ISO codes, because it strictly adheres to the rule of outputting to the control exactly what was sent to it from the host. The AMI never strips out codes during the download. Some communication packages strip nulls, control characters, carriage returns etc. So beware of being short changed by packages that are meant to drive CRT terminals, punches etc.

BINARY coded files require all eight data bits so the host serial parameters must be eight data bits.

RS-358 (ISO) files

ISO is often confused with ASCII. ASCII is a seven bit code, ISO is an eight bit code. ISO has as its most significant bit, an even parity bit. If your control wants ISO, and you give it ASCII half of the codes in the file will have the wrong parity and will cause alarms. You can make ASCII into ISO by setting the host serial port to seven data bits + even parity. Note: The AMI is set to eight data bits + NO parity.

ISO is NOT ASCII

RS-244 (EIA) files

EIA codes were widely used by older controls. This is an eight bit code, which means the host must be set for eight bits in order to send EIA files.

Only use EIA if the CNC does not support ISO.

Processing done by CNC

Tape leader and trailer

Your control may need to first receive blank tape prior to receiving any part program data. The AMI can automatically append null character leader and trailer to the file so that your DNC software does not have to supply this. The number of characters in the leader varies upon manufacturer, in general the number required had to do with how fast the CNC could stop the reader while rewinding.

Some older controls need blank tape to work.

Automatic detection of ISO & EIA

Some controls detect the parity of data and automatically go into EIA or ISO mode. These controls must be given the correct parity codes right off - not blank leader or man-readable codes.

Man-readable codes

Your DNC software should not output man-readable codes to the AMI. They may confuse the CNC, generating alarms etc. Use comment lines instead, if they are supported by your control! The ATERM shows comment lines during file view.

DO NOT pass MANREADABLE CODES to the AMI.

AMI Host Commands

HOST AMI commands can be issued to the AMI through the Host serial RS-232 port. Each command consists of two characters. The first character is the minus character "-". The second character is a single letter from the list below.

AMI Commands

A) EIA Dump	B) Block Mode	D) Dripfeed Mode
E) Erase Memory	F) File Mode	H) Hex Dump
I) ISO Dump	J) Echo Reader On	K) Echo Reader Off
L) EIA On	M) EIA Off	Q) Query
R) Restart Memory	S) Setup AMI	T) Mem Protect Off
U) Mem Protect On	X) Show NC Block	Y) Make NC File
Z) Reset board	?) Show Commands	

AMI commands may be placed inside a part file as long as they are the beginning two characters of the file. AMI commands will not be passed along to the control. Either lower or upper case characters may be used.

Memory Commands

These Commands are execute “on-the-fly” - immediately.

-E Erase

The file in the AMI’s memory will be erased. This command also will also allow the next file received to be loaded into the AMI’s memory.

-R Restart Memory

The current file in AMI memory will be repositioned such that the next character out to the CNC will be the first character in the file. This is an instantaneous rewind to the beginning of tape (BOT).

Commands affecting AMI Setup

All AMI Setup commands update the boards EEPROM and as such, these command will stick when power is remover from the board. These commands are slow (200mS) and time is required by the AMI to process them. Do not issue data or commands while they are being processed. The AMI will send an XOFF upon receipt of this command and will send out an XON upon completion of the command.

-B Block Mode.

Configures the AMI to operate in it's Block mode of operation. This protocol is a similar to EIA RS-491 level 2.

There are two cases when the AMI will send XON to the PC. First, when the CNC requests data and the AMI's memory is empty. While this condition exists, XONs will be sent to the PC at the rate of 1 every 2.5 seconds. Second, when the CNC has read an EOB character from the AMI's memory. EOB character is 0x0A for ISO, 0x80 for EIA.

An XOFF character (0x8D) will be sent to the PC whenever an EOB character is placed into the AMI memory from the PC.

In the event that there is no data in the AMI memory when the control requests data, a programmable fill character will be sent to the CNC. Typically this is programmed to be a Space character (0xA0).

Note: An DLE character (0x10) from the PC can be used to clear the AMI memory.

-D Dripfeed Mode

Configures the AMI to operate in its Drip-feed mode of operation. This protocol is used to run jobs that are greater than the memory size of the AMI. It is compatible with most standard communication software packages. XON and XOFF characters are used for flow control between the AMI and the PC. Drip-feed Mode is the same setup parameter as "AMI MODE DRIPFEED".

Drip-feed is used when the size of the file is greater that the AMI memory capacity. Data can be sent to the AMI memory until the AMI sends an XOFF to the PC. This typically occurs when there is 32 unused bytes of available AMI memory remaining. Now once the control reads out 128 bytes, the AMI will send another XON to the PC. This process will continue PC has no more data. At such time the AMI times out. The next character to the AMI will be the next file.

-J Echo Reader On

As data that is sent between the AMI and the CNC, it will also be echoed back to the PC. This may be used to view the progress of the current job. Note: When using Buffer mode *and* Echo is ON, the Host baud rate must be no greater that 9600 baud.

-K Echo Reader Off

Turns off the echo of reader data.
This command will send an XOFF followed by an XON to the PC. Do not send data or commands during this period.

-L EIA On

Allows code conversion between ISO (also known as EIA RS-358) and EIA (also known as EIA RS-244. Data sent from the PC to AMI will be converted to EIA as it is stored in

the AMI memory. The control will see EIA codes. If the control has the ability to punch out, EIA codes from the CNC will be translated from EIA back to ISO when transferred back to the PC. This conversion must be turned Off when sending binary (Executive) files or already formatted EIA files.

-M EIA Off

No code conversion will occur in the AMI memory. All data (8-bits) passes through the AMI unmodified. This selection must be used when the PC is sending binary (Executive) files or already formatted EIA files.

-S Setup AMI

Enter the interactive setup menus within the AMI. The internal setup parameters can be displayed, modified and saved. These parameters are normally only changed upon installation of the AMI. All setup parameters are saved when the power is removed from the board.

-T Mem Protect Off

Allows AMI memory to be erased when a new program is sent to the AMI. Changes *setup parameter to "LOAD OVERWRITES MEM+"*

-U Mem Protect On

The command protects the memory from inadvertent erasure of AMI memory. This can occur if the cable to the PC in unplugged, or if a switch box is used. A noise spike on an open cable may be interpreted by the AMI as the beginning of a new file. And as such will erase the current AMI memory in preparation for the next file. Changes *setup parameter to "LOAD OVERWRITES MEM-"*

Display commands

Dump commands may be aborted by sending an escape character (27H).

-A EIA Dump

The contents of the AMI memory will be sent to the PC. Each character sent will be translated from EIA to ISO.

-H Hex Dump

The contents of the AMI memory will be sent to the PC. Each character will be displayed as a hexadecimal value in the range of 0x00 to 0xFF. The dump is formatted such that the start of each line shows the offset, followed by up to twenty hexadecimal numbers.

-I ISO Dump

The contents of the AMI memory will be sent to the PC. There is no conversion performed on the data.

-Q Query
Shows information about the current status of the AMI.

-X Show NC Block.
AMI sends the block of data presently being read by the CNC.

Miscellaneous commands

-Y Make NC File
A short dummy program will be placed in the AMI memory. This program allows for a low level checkout of the interface between the AMI and the CNC. The program will be placed into AMI memory as EIA data if the EIA option is On. The program starts out with one NULL (00H), then one blank lines <CR> <LF> and is followed by:

%
N002
N004
N006
N008
N010
%

-Z Reset board
This is like pressing the reset button on the AMI board. An XOFF will be sent at the receipt of the command and an XON will be sent at the completion of this command. It takes the AMI approximately 1 second to perform the command.

Chapter 4

CNC Load Procedures

Loading data into AMI

First load the AMI then load the CNC's memory.

Prepare the host to send data to the AMI before you tell the CNC to "load" from its "READER" (actually the AMI) so that the file is in the AMI before the CNC starts to read. note: This is not required in BLOCK mode, because the AMI can send its "fill" character if necessary.

Note:

The AMI will erase its memory when it receives the first byte of data from the host.

Note:

If a serial reader is being emulated then the CNC may send XON to the host to start it outputting data. Some hosts may not start outputting until this XON is received. See "wait for XON" in AMI setup.

Observing the load via LEDs

How to tell the AMI is loading data from PC

The DS4 LED will flash while the file is being loaded into the AMI. After the file is completely loaded DS4 will stay ON.

How to tell if the AMI has a file in it

If DS4 is on - your control can read.

DS4 will be ON. If the AMI has LOOP- when the CNC reads the last byte in file, the AMI will turn off DS4.

Erasing a file in the AMI

Manual erase

Just send another file. Or press the RESET button on the AMI, Or send the Erase command.

Automatic erase of AMI memory

The AMI will erase its memory when the CNC reads the last byte in its memory, if NOT in LOOP mode. This will be indicated by turning off DS4. If the CNC stops reading the file at the rewind stop character, it may leave the trailer tape un-read which will prevent the automatic erase.

How a CNC gets data from AMI memory

During Parallel READER emulation the CNC pulses its reader drive lines to get data. If the width of these pulses is more than one character time, the AMI goes into SLEW mode which means that it continues to send data to the control while the drive line stays active.

When serial READER emulation is used, the CNC sends XON, or Activates its CTS line. The AMI responds by sending serial data until it receives an XOFF, or the CTS goes inactive.

Running from a specified block

The ATERM can be used to search for a block via the MORE key, and then start the reader emulation at that point.

Do BLOCK SEARCH via ATERM if your CNC does not support searches.

WARNING

If the operator uses the ATERM to look at a program memory be CAREFUL not to force the CNC to jump to the last block viewed when done. This mistake can be costly! and highly dangerous.

Codes stored in AMI memory

Unless EIA translation is enabled the AMI does not modify codes. It outputs via the reader port, exactly what it received from the host serial port. If your CNC uses ISO (RS-358) or EIA (RS-244) then be sure that the host sends files coded in the correct code type. ADR's AdvancedDNC and QuickDNC software can automatically translate from ASCII to RS-358 and RS-244 "on-the-fly" allowing ASCII files to be stored on the host. Note that RS-358 is an EVEN parity code, while RS-244 is an ODD parity code.

Special codes

You should be sure that the files sent to the AMI contain the proper codes needed by your CNC. Typically a file begins and ends with blank leader - your CNC may not work without this. The first command in your CNC program may have to be rewind stop (%), and this may have to be preceded by an end-of-block character (LINEFEED).

AMI and RS-491

RS-491-Level 1

This standard requires the CNC to use RTS & CTS modem controls lines between the CNC and host (AMI). The CNC drives its RTS line to stop the AMI from transmitting. The AMI drives the CTS line to stop the CNC from transmitting.

RS-491-Level 2

This standard does not require modem handshake lines, instead control codes control the data flow:

DC1 READER ON - sent by CNC to **START** AMI transmitting during LOAD.
DC3 READER OFF - sent by CNC to **STOP** AMI transmitting during a LOAD
DC2 PUNCH ON - sent by (host-AMI) to START CNC transmitting during SAVE.
DC4 PUNCH OFF - sent by (host-AMI) to STOP CNC transmitting during SAVE.
EOT End of text character
DLE ABORT transfer
EOB Carriage and Linefeed
Leader/Trailer Nulls are appended to beginning and end of file

Chapter 5

CNC file Saving procedures

Send data back to the PC through AMI.

AMI Saving data in the CNC's memory (upload)

In single drop mode the AMI passes any data its receives from the control directly to the host computer. No special preparation is required at the AMI. In multi-drop mode the AMI stores the saved data in its memory and sends the whole file to the PC after the CNC has finished punching out the whole file.

Preparing host to receive

In single CNC DNC mode, the host must be set to receive data via a serial port, which usually involves selecting a serial port and possibly setting serial port parameters, and naming the file that will receive the data. The host may use XON-XOFF protocol to control data flow from the CNC. The AMI will pass the flow control characters to the CNC during the SAVE. ADR's QuickDNC program automatically prepares the PC to receive data to a unique directory for each machine.

In multi-CNC DNC mode the host does not need any special preparation.

Commanding the CNC to PUNCH

CNC will begin punching when its PUNCH button is pressed, or via a set of menus. When punching starts the CNC may send a PUNCH ON character (parallel punch) which will then go

to the host as the first character of the file. This character will have to be stripped off later by the host.

Observing the SAVE

How to tell if CNC is sending

DS2 will flash while CNC is sending data.

Observing upload at the host

The host program doing the SAVE may show the data on the PC screen, but often this is not done to eliminate having to paint the screen.

AMI data processing during save

The AMI memory is not used as a temporary buffer for the data - one character at a time is processed from the AMI punch input to the AMI host port.

AMI memory at end of SAVE

After the SAVE is complete the AMI memory is not changed

Host receipt of the last byte

The host will close the SAVE file based on a time-out period.

Special EIA codes

The AMI can translate codes during SAVE (EIA TRANSLATION+). Two codes are special in the EIA code set. EOR (0B hex) is translated to ASCII(=). Percent (5B hex) translates to ASCII(%) .

Files too large

The host should have enough free disk space to save the uploaded file. When it runs out of memory, it may truncate the file at that point or discard all data.

Special characters - punch on/off

The AMI does not strip off any characters sent by the CNC. Host software must remove any unwanted characters sent by the CNC. The first character output by a CNC may be a PUNCH ON code. This character (DC3) is output to turn on a mechanical punch unit, and mechanical punch units did not output this code to the punch tape. Likewise at the end of the file a (DC4) may be output to turn off the mechanical punch unit.

Leader tape

Some CNC do not send leader tape, and the host must append leader to the file before it can download saved files. The AMI can be configured to automatically add leader. Leader is always NULL characters (HEX 00).

Trailer tape

Some CNC do not send trailer tape, but require trailer when downloading. The host software must append trailer in this case. The AMI can be configured to automatically add trailer.

Parity errors

Should the control send a byte to the AMI with a parity error, the AMI sends the bad byte to the host during the SAVE, the host software should halt and alert the operator that an error occurred. ADR's AdvancedDNC software does this. The character causing the error is the last character sent by the AMI to the host, the CNC may already have sent another character to the AMI. Over-run of the host

Host Overrun

During SAVE the AMI may send data to the host faster than it can save data to its disk, this is called over-run. To prevent this use XON-XOFF or RTS / CTS protocol option in your DNC software program.

Chapter 6

AMI setup

AMI setup is saved in a NON volatile memory - once it is set correctly, you will not have to go into setup again.

Your AMI must be configured to match your control. The configuration is stored in an electrically erasable programmable read-only-memory. Once it is set correctly it will never have to be changed. The machine operator should not have to modify AMI settings, so limited training on this topic is required. Unfortunately the first thing a customer must deal with is the most complicated subject. But, ADR has simplified the task by identifying whole sets of reader and punch parameters by the reader and punch manufacturers. Normally all you have to do is select the reader and punch type your control had as standard. Additional parameters that you can set are related to how you want to use the AMI, which had no equivalent when you messing about with punched tape!

How to change the AMI Setup

There are two easy ways to change the AMI setup:

1) Use the ATERM terminal to perform an interactive setup.

At the ATERM: press the "F1" (LOAD) key followed by the "?" key. Follow the directions using the following keys:

"+"	Selects "+", or increments, or selects the next choice.
"-"	Selects "-", or decrements, or selects the last choice.
ENTER	Goes to next setup question.
ESC	Escapes from the setup without saving any changes.

2) In single drop mode, using a terminal emulator software package (QuickDNC, AdvancedDNC, etc.): type "-S". See page 17.

The ATerm screen will appear as follows:

```
••••••••••••••••••••••••••
• Firmware Rev 990825     •
• SN#0942BB 128K RAM      •
•                         •
• READER IS      PARALLEL •
••••••••••••••••••••••••••
```

figure 8-1b AMI setup first question

You can now press Enter on the Aterm to see the next setup line or change the READER type to SERIAL or NONE using the space bar.

AMI Setup Parameters

The very first question you must answer is what type of INPUT port (READER) your control has. This port will be driven by the AMI's "READER" OUTPUT (J5). Your control either inputs data via a tape reader (PARALLEL) or via an RS-232 (SERIAL) port. Some tape readers have RS-232 serial outputs, in this case you select SERIAL.

NOTE:

You can not tell whether a reader is serial or parallel by looking at the connector. The DB25 connector is used by both serial and parallel reader types.

READER

SERIAL	Controls Reader is a serial type
PARALLEL	Controls Reader is a parallel type
PARALLEL+SER	Control Reader is Serial data, using parallel drives
NONE	No reader emulation needed

NOTE:

In case you are not familiar with the SERIAL/PARALLEL terms:

A SERIAL READER uses RS-232 Asynchronous communication. The eight data bits appear as a high or low voltage on a single wire in the connector, each bit lasting for a BAUD time. The control uses a single wire to request more data or to stop the computer (XON/XOFF codes). Sometimes two additional wires are used to control the flow of data (RTS and CTS).

A PARALLEL READER uses a separate wire for each data bit, and additional wires to strobe the data into the control and for the control to command the reader to move forward and backward.

When a standard PARALLEL reader type is selected, the AMI sets all of its internal reader emulation parameters for that reader, saving you from having to learn details such as polarity of signals and reader timing.

When you pick a reader type the AMI sets all the parameters needed to emulate that reader.

READER IS	
ACRAREAD-1	Acramatic control error line = positive
ACRAREAD-2	Acramatic control error line = negative
ADDMASTER601	Addmaster
ADDMASTER612	
AMADA 04PC	
DECITEK262E7	Decitek 262 series readers
DECITEK262X7	Actron CNC
DECITEK342	Decitek 342 series readers
DECITEK442	
DECITEK562	Decitek 562 series readers
DECITEK661	
DIGTRONIC	
EECO neg/neg	Active low data and command lines
EECO neg/pos	Active low data and active high command lines
EECO pos/neg	Active high data and active low command lines
EECO pos/pos	Active high data and command lines
EECO2 neg/neg	Stepmate model Active low data and command lines
EECO2 neg/pos	Stepmate model Active low data and active high command lines
EECO2 pos/neg	Stepmate model Active high data and active low command lines
EECO2 pos/pos	Stepmate model Active high data and command lines
FANUC	All Fanuc with 50-pin readers.
FER 201	Ghielmetti
FER 202	Ghielmetti
GE550/1050	GE 550 and 1050 controls.
GE1050MCL	Mfg. by Toshiba
GNT 28	
INFRANOR2100	
IOMEX 2540	

OKI	OKI readers
OlivettiOSAI	
REMEX	TTL Remex readers
REMEX../651	Special Remex reader with Active High data
RICOM PTR210	Ricom reader
SANYO 2301	Sanyo Denki 2301
SANYO 2302	
SANYO 2401-1	
SANYO 2401-2	
SANYO 2702	
SLO-SYN	Slo-Syn 5 Volt readers
SLO-SYN/GA	Slo-Syn readers on General Automation CNC
TALLY	
TOSNUC	

OTHER Allows custom selection of all reader parameters. Can be used to modified presets of above readers or adapt to readers not listed above.

READER SPEED: nnn

nnn is 50 - 800 characters per second, or CUSTOM. When CUSTOM is selected, the individual t-times can be selected.

It is recommended that you set the reader speed to be the same as the reader you had. Making the AMI run faster may be risky.

NOTE:

If **CUSTOM** reader type is selected then additional questions must be answered. To simply setting up the AMI, first save the setup with the READER type selected and the speed set. Then enter setup again and set the type to OTHER.

PUNCH

PARALLEL	Parallel punch type such as FACIT
SERIAL	Serial punch interface - RS-232
NONE	

NOTE:

If you do not need to save file in your control, set the PUNCH port to NONE. If your control uses a SERIAL reader and punch port then J7 of the AMI is really a bi-directional serial port.

PUNCH MODEL

FACIT	data active high, commands active high
REMEX1	data active low, commands active low
REMEX2	data active low, commands active high
REMEX3	data active high, commands active low

PUNCH SPEED

75CPS	Equivalent to 750 baud
120CPS	Equivalent to 1200 baud
500CPS	Equivalent to 5000 baud
1000CPS	Equivalent to 10,000 baud

DO NOT SET HIGHER THAN HOST BAUD!

AMI MODE

FILE	AMI store whole file in its memory
BLOCK	AMI buffers a single block of NC data
DRIPFEED	AMI buffers 128K / 512K bytes

FILL CHARACTER = nnH

Use the +/- keys to increment or decrement the character code. A0H represents an ISO space character. ISO linefeed would be 0AH. ISO NULL would be 00H. (Only shown if in buffer mode)

VIEW CODE TYPE

ISO	Translate ISO file in AMI memory to ASCII
EIA	Translate EIA file in AMI memory to ASCII
ASCII	Output AMI memory directly - no translation
BINARY	Format AMI memory as HEX ASCII for ATERM Translation used for ATERM display

READER FWD is

LFtoRT	Emulate empty reel on right
RTtoLF	Emulate empty reel on left

AUTO LEADER/TRAILER +/-

+	AMI adds 100 nulls to beginning and end of file
-	No nulls added to file

(Only shown if you select FILE mode)

LOAD OVERWRITES MEM+/-

Setting LOAD OVERWRIITE MEM to - will prevent accidents

+ RX of first char causes AMI memory to be erased
- otherwise operator must press AMI reset

EIA TRANSLATION +/-

+ EIA translation enabled
- No translation enabled

EIA LF to EIA EOB +/-

+ EOB is ASCII LF
- EOB is ASCII CR

SAVE: ADD CR TO LF +/-

+ Send carriage return to host in front of each linefeed received from CNC during SAVE.
- Do not add carriage returns.

STRIP COMMENTS +/-

+ In File Mode comments not stored in AMI memory. Strips everything from and including the first parenthesis "(" OR semicolon ";" through the EOB or ")" which ever occurs first..
- No stripping of comments will occur.

READER LOOP +/-

+ Endless loop ON.
- Endless loop OFF - reading last byte of memory erases file

ECHO READER TO HOST +/-

+ Each character read by CNC is also sent to host.
- No echoing of CNC read is done

HOST BAUD RATE

STD Selects baud rate range 2400, 4800, 9600 and 19,200
ALT Selects baud rate range 600, 1200, 9600 and 38400

LOAD SAVE TIMEOUT nnn Sec

No data from host or NC for this much time indicates end of file

Save Setup? Y/N/ESC

Asks if you want to keep the changes you have made.

Filename Ext. .GCD

Default file name extension used in Multi drop DNC protocol.
(Multi-drop ONLY)

Chapter 7

Reader Emulation

This chapter cover how to emulate any reader - including types not listed in the setup parameter READER IS.

Parallel Reader Input Polarities (J5)

The signals that come from the control to the AMI to request data from it can have two logic levels. The AMI's reader input signals can be inverted (active low) or true (active high). A + signal is active high (0v = off +3v = on).

AMI pin	Setup question	function
J5-17	DRIVE LEFT +/-	Drive left polarity
J5-16	DRIVE RIGHT +/-	Drive right polarity
J5-21	REWIND LEFT +/-	Wind left polarity
J5-20	REWIND RIGHT +/-	Wind right polarity

Parallel Reader Output Polarities (J5)

The AMI reader output signal can have two logic levels. The following table shows the pin associated with the AMI setup parameter

AMI pin	Setup question	Function
J5-9	DATA READY +/-	Data ready polarity
J5-14	SYSTEM READY +/-	System read polarity
J5-1 to 8	DATA +/-	Data line polarities
J5-22	REWINDING +/-	Winding status line polarity
J5-18	BROKEN TAPE +/-	Broken tape polarity
J5-23	DRIVE ACK +/-	Drive line acknowledge polarity
J5-19	SPROCKET +/-	Sprocket signal polarity

OTHER" Type Reader Setup

OTHER allows you to directly control the reader emulation variables - so you can emulate ANY reader.

If none of the standard reader types works with your control, you can modify the reader parameters to duplicate the timing of your reader. With **OTHER** reader type selected the following appear:

STOP ON CHAR FILTER +/-

+ Ignore reader drive command edges (drive is a level)
- Trigger on reader drive command edge (drives are pulses)

DRIVE ON EDGE ONLY +/-

+ Enables AMI to only drive on edges - levels are ignored
- Enables AMI to drive on edges or levels

DUAL SPROCKETS +/-

+ Two sprocket signals are generated out of phase
- Only one sprocket signal is generated

THREE PHASE DRIVE +/-

+ Enables AMI to decode inputs as three phase motor signals
- AMI decodes inputs as drives and rewinds

GNT28 Timing +/-

+ Enables AMI to generate special timing
- Normal reader timing

PULSE THE SPROCKET +/-

+ A brief pulse will be output on the sprocket line when on character.
- A sprocket stays at same level until drive.

DRIVE & DIR PINS +/-

+ J5-16 is drive
  J5-17 is direction.
- J5-16 is drive right
  J5-17 is drive left.

STOP/START PINS +/-

+ J5-16 is start
  J5-17 is stop
- normal drive direction function

DRIVE RIGHT +/-

(only seen if DRIVE & DIRECTION-)

+ Polarity of drive right J5-16 input is active high

- Polarity of drive right input is active low

DRIVE LEFT +/-

(only seen if DRIVE & DIRECTION-)

+ Polarity of drive left J5-17 input is active high

- Polarity of drive left input is active low

TAPE CONTROL(DRIVE) +/-

(only seen if DRIVE & DIRECTION+)

+ J5-16 Drive Active high.

- J5-16 Drive Active low

TAPE DIRECTION +/-

(only seen if DRIVE & DIRECTION+)

+ J5-17 Forward = Active low

- J5-17 Forward = Active high

REWIND RIGHT +/-

+ J5-20 Active high

- J5-20 Active low

REWIND LEFT +/-

+ J5-21 Active high

- J5-21 Active low

SYSTEM READY +/-

+ J5-14 Active high

- J5-14 Active low

DATA +/-

+ J5-1 through 8 Active high

- J5-1 through 8 Active low

DRIVE ACK +/-

+ J5-23 Active high

- J5-23 Active low

SPROCKET +/-

+ J5-19 Active high
J5-15 Active low

- J5-19 Active low
J5-15 Active high

BROKEN TAPE +/-

+ J5-18 Active high
- J5-18 Active low

REWINDING +/-

+ J5-22 Active high
- J5-22 Active low

DATA READY +/-

+ J5-9 Active high
- J5-9 Active low

DOUBLE CHAR @ TURN +/-

+ When the direction reverses from fwd to rev output the same character twice.
- When the direction reverses the next character output is the one before the last one output.

SKIP NO HOLE TIMING +/-

+ Do not generate NOHOLE data between data character
- Generate NOHOLE data between data character

REWINDING +/-

+ Polarity of Rewind is active high
- Polarity of Rewind is active low

CUSTOM Reader Timing Parameters

In order to handle peculiar parallel reader timing conditions, the standard reader speed timings can be overridden.

Set the reader speed to CUSTOM

If the AMI's timing is not a perfect match to your reader, adjust the timing via CUSTOM

READER TACK:dddd	Width of drive acknowledge
READER TSPK:dddd	Drive ack to sprocket leading edge
READER TSETUP:dddd	Data setup/hold to/from Sprocket
READER TNOHOLE:dddd	Min time data off
READER THOLD:dddd	hold time data to sprocket
READER TSLEW:dddd	Slew mode active from

Timing Signal Diagrams

The basic timing comes from the design of the tape that goes through tape readers. The holes in the tape allow light to reach photocells. The output of the photocells went directly to input logic in the control.

Data Signals
Industry standards specify the data hole data holes as .072" diameter, at a spacing of .1". Between the holes is tape, when tape is over the read photocell we say the reader is reading NO-HOLE. Some controls verify that there is some NO-HOLE between holes to insure that the tape is not torn. Other controls have readers that latch the data signals in the reader and there is no NO-HOLE time between characters.

Sprocket Signal
The AMI generates both sprocket and data ready, take your pick when building a reader cable.

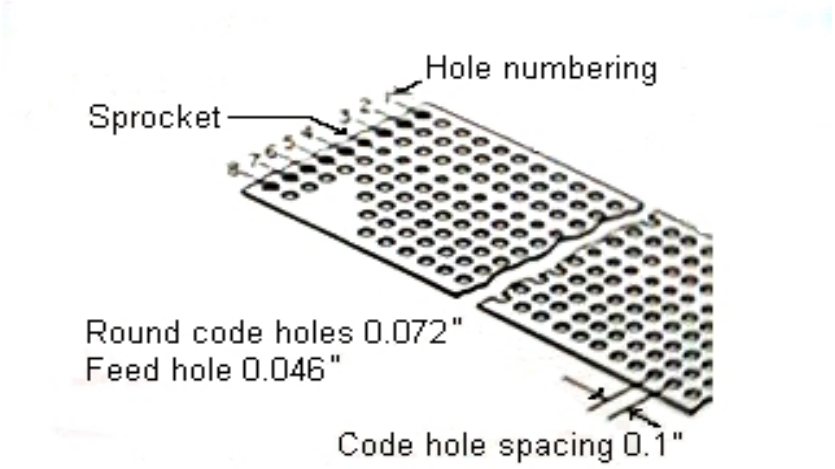
The sprocket hole is smaller (.042" diameter) and is centered in the data hole allowing it to be used to strobe the data into the controls input latch. It is important that the SPROCKET goes NO-HOLE between each data - or the control will alarm with "torn sprocket". Note that when the DRIVE is activated the SPROCKET signal does not immediately go inactive, it takes time for the tape to move, and block light to the sprocket photocell The purpose of the TSETUP and THOLD parameters is to center the sprocket signal relative to the data signals - each is .015"

Data Acknowledge Signal
Some readers use a DACK signal to acknowledge the drive signal. The CNC knows that its DRIVE signal has been accepted by the reader when the DACK is received.

Data Ready Signal
Some readers (REMEX for example) combine the DACK with SPROCKET in the form of a Data Ready DRDY signal. The data ready signal resets immediately when the DRIVE sign is received (acknowledging the DRIVE) and then sets at the same time that SPROCKET would.

Converting holes into timing

The parallel reader timings are proportional to the reader speed selected.



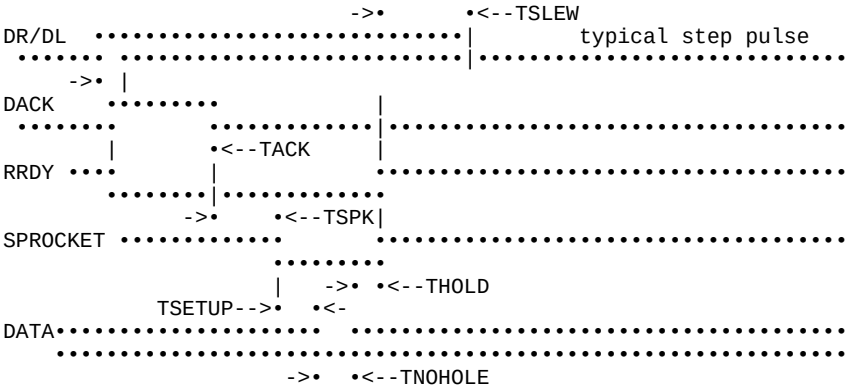
This is the key to picking reader timing values.

The following AMI setup parameters control reader timing.

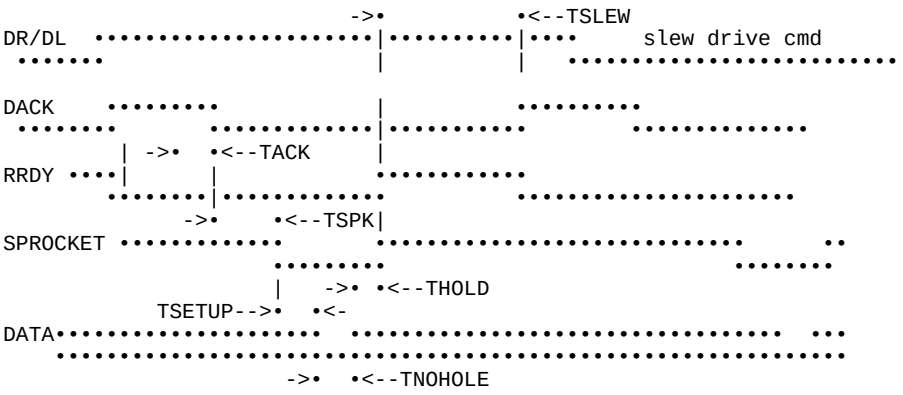
Signal	Theoretic	Period@200cps	Description
TACK	12%	625us	Width of drive acknowledge
TSPK	12%	625us	Drive acknowledge to sprocket leading edge
TSETUP	15%	750us	Data to Sprocket inactive
TNOHOLE	28%	1500us	Time data "no hole"
TSLEW	*	350/750us	Slew decision point
THOLD	15%	750us	Data valid prior sprocket active

Note: * TSLEW is not proportional to reader speed - it has two values - slow/fast.
Note: Timing for some reader types requires non proportional timing.

Below is a timing diagram of the parallel reader signals stopping in time to output only one character. All signals are shown active high.



Below is a timing diagram of the parallel reader signals requesting two characters.



Example: REMEX reader 200 CPS

As an example of how to set the timing parameters consider a REMEX 7200 reader running at 200 character per second, each character has a period of 5 milliseconds. Since 100% is 5 milliseconds, that data is “on hole” for 72% or 3.6 milliseconds. The sprocket signal should lasts for 28% or 1.4 milliseconds, but REMEX does not output a sprocket - instead it outputs Data Ready.

READER TACK	950 us	*
READER TSPK	200 us	
READER TSETUP	650 us	
READER TNOHOLE	1400 us	
READER THOLD	650 us	
READER TSLEW	1150 us	
total	5000 us	

*Note: This sign is not present in Remex I/O connector

STOP ON CHAR TIMING

If the stop on character time is not right your control can DROP characters - highly dangerous to your health!

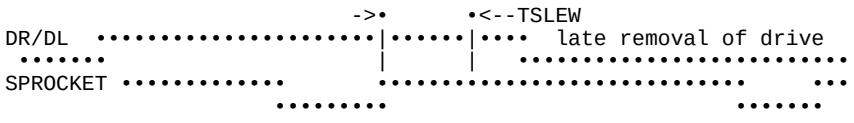
Stop on character time is critical to correct operation of the control. The control needs a fixed amount of time after reading a byte to decide whether to continue reading data. For example when an End Of Block character is read the control has to stop the reader while it executes the block. The TSLEW parameter is used to set the STOP ON CHARACTER time.

At the end of TSLEW the drive line is sampled and the either another byte is output or not. CNC using slow readers (less than 400 CPS) need 750usec for the CNC to stop. CNC using fast readers (more than 400 CPS) only need 350 microseconds (usec).

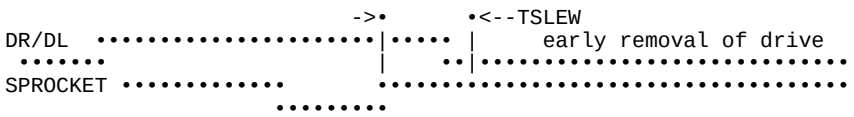
Some controls use pulses to drive the reader - a pulse any time during the TSLEW period is taken as a request for an additional byte.

Some controls use glitchy logic in their stop on character decision logic - this leads to edges during the TSLEW period. The stop on character filter can remove them.

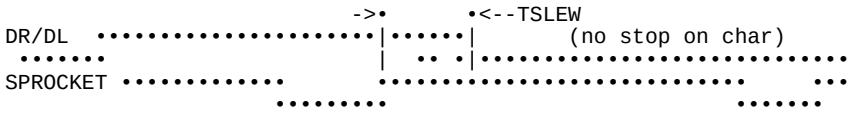
Stop on char filter + or - [NONE stop on char drive timing example]



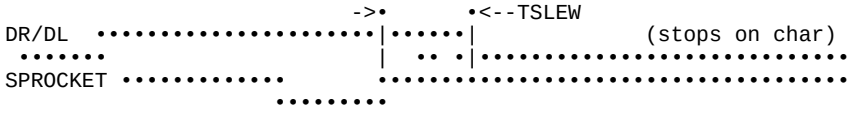
Stop on char filter + or - [stop on char drive timing example]



Stop on char filter - [with noisy drive command]



Stop on char filter + [with noisy drive command]



Slew versus Step Timing

Some controls use step timing when running from TAPE and slew timing when loading memory.

When the drive lines are held active for more than a character time, the AMI goes into SLEW timing from the STEP mode.

STEP timing includes:
TACK + TSPK + TSETUP + TNOHOLE + THOLD + TSLEW

SLEW timing includes:
TSPK + TSETUP + TNOHOLE + THOLD + TSLEW+TACK

For reference:
sprocket signal is active for TSETUP + TNOHOLE + THOLD
data is "no hole" for TNOHOLE. At end of TSLEW drives are checked.

Chapter 8

AMI Punch Emulation

General punch emulation

The AMI inputs data from the control three ways: 1) emulating a parallel punch. 2) emulating a serial punch. 3) acting as a bi-directional serial link to a computer. If you do not want to save edited files in your control, you can set the AMI to not allow upload by setting PUNCH to NONE.

PUNCH

SERIAL	RS-232
PARALLEL	Parallel punch.
NONE	No punch capability

Parallel Punch Parameters (J6)

The control uses several signals to "handshake" with the AMI. The speed of transfer is determined by how fast each party responds to the others handshake. Setting the punch speed too low will cause you to spend too much time saving a file. Setting it too high, might cause the control to miss an acknowledgment from the AMI which could result in the control halting the save. During the transfer of data from the control to the host computer the computer may slow the transfer of data due to its need to write the data to its disk. The computer may have to stop for a short time between each character. Setting the punch speed to say 500cps does not insure data will move at that rate - the control and computer may slow it down.

PUNCH SPEED

75	75 CPS maximum
120	120 CPS maximum
500	500 CPS maximum
1000	1000 CPS maximum

Serial CNC Interface (J7)

The serial punch transfer rate is related to the baud rate used by the control to output data. 1200 baud is equivalent to 120cps. The AMI acts as a baud rate translator where the baud rate to the computer is different than the baud rate used by the control to output.

CNC SERIAL BAUD:

300
600
1200
2400
4800
9600
19200

Be careful when setting the number of bits in the CNC serial word - BINARY, ISO and EIA codes all require 8 data bits.

CNC SERIAL WORD: Serial word format

7e2	7 data bits, even parity, 2 stop bits.
7o2	7 data bits, odd parity, 2 stop bits.
7n1	7 data bits, no parity, 1 stop bit.
7e1	7 data bits, even parity, 1 stop bit.
7o1	7 data bits, odd parity, 1 stop bit.
8n2	8 data bits, no parity, 2 stop bits.
8n1	8 data bits, no parity, 1 stop bit.
8e1	8 data bits, even parity, 1 stop bit.
8o1	8 data bits, odd parity, 1 stop bit.

CNC SERIAL XON/XOFF +/- XON / XOFF protocol Enable/Disable

CNC SERIAL XON WAIT +/- Wait for XON before transmit

Chapter 9

Troubleshooting

General

1) Check AC power - DS1 LED should light up.

2) Check system ground wiring.

3) Check cables:
- Be sure pin-out of both ends are correct.
- Check for broken wires.
- Check for pins missing in the connectors.
- Check that pins are seated in connectors.

4) Check setup file contents against host and control setup.

Problems with your PC software

a. Baud rate is set wrong - change via PC software.
b. Baud rate of AMI is set wrong - change in SETUP.
c. Host COM adapter has PC port address conflict - see your PC supplier or use BIOS setup to disable adapter.
d. 7 data bits used for ISO, EIA or BINARY - change to 8 data bits.
e. Parity Enabled with 8 data bits - The AMI does not use parity in addition to 8 data bits.
f. Host software using modem lines not XON/XOFF - Reconfigure software to use XON/XOFF.
g. File coded in wrong code type ASCII rather than EIA - translate file before sending to AMI.

h. File missing leader/trailer or rewind stop (%) - edit file to add required codes.

Problems with PC hardware

a. Cable missing or not installed correctly - get the right cable.
b. RS-232 / RS-422 miss selected at AMI - move jumper on AMI.
c. Short in host cable - replace cable.
d. Open pin in host cable - replace cable.
e. Cable goes to wrong port on host - move cable.
f. Host requires RTS / CTS jumper in cable - open cable connector shell, rewire.
g. Tx and Rx crossed in cable - need null modem - install null modem box, or open cable and swap wires on pins 2 & 3.
h. Serial mouse using AMI's COM port - remove mouse adapter.
i. Serial port disabled by COM adapter jumpers - get COM adapter manual out and enable the port.
j. Serial port disabled by BIOS - run PC setup and Enable COM port.

Problems with CNC loading its memory

The symptom here is that a file gets into the AMI, but control does not take the data out.

General problems:

a. AMI setup wrong - change AMI setup.
b. Wrong cable between AMI READER port and CNC- get right cable.
c. Reader cable built wrong - open cable connector shells and wire it right.
d. Operator is pressing wrong button on CNC - get out the control manual and read section on how to load the control memory from "reader" or other device.

Specific problems:

a. CNC using wrong code type (EIA/ISO/ASCII) - change control setup to right code type.
b. CNC requires special codes in file - read control manual section on programming.
c. CNC timing is critical - parallel readers - reconfigure AMI to more closely match timing required by control.
d. Data polarity is wrong - change AMI setup.
e. Drive signal polarity is wrong - change AMI setup.
f. AMI Reader speed set too high or low - change AMI setup.
g. Control I/O board bad - have CNC serviceman replace.
h. Your using the wrong commands at the CNC panel - read the operator manual.
i. You are selecting the wrong source to load from - be sure to select READER if you are replacing a reader.

j. Control's serial port parameters are set wrong - go into controls setup to configure its serial port.
k. Reader adapter board not installed correctly - see AMI installation notes provided by installer.

Problems with CNC executing from "Tape"

a. Same as 10-4.
b. Timing of single character wrong (step timing) - change AMI setup via CUSTOM timing.
c. Control reading faster than AMI loads (block mode) - AMI will run out of data if the computer does not supply data fast enough. Increase the computer output rate - increase host baud rate.
d. Rewind or drive reverse not wired correctly - control generates an alarm due to falling off the beginning of the TAPE due to starting off driving the wrong direction. Change wiring in reader cable - swap drive left/right. Or change polarity of drive direction via AMI setup.

Problems saving an edited file

General problems:
a. AMI setup wrong - punch parameters incorrect.
b. Wrong cable between AMI PUNCH port and CNC- get right cable.
c. Punch cable built wrong - open cable connector shells and re-wire.
d. Operating pressing wrong buttons on CNC - read the controls operator manual.

Specific problems:
a. Wrong punch signals - control hangs after output of one character - miss wired punch cable.
b. Punch speed set too high data intermittent- lower punch speed.
c. PC not sending XON to start upload -type XON at PC keyboard by holding down CTRL and typing Q.
d. PC not configured to use XON/XOFF - change settings of PC software.
e. PC serial port parameters set wrong - change settings of PC software.
f. Control does not punch out codes required for loading - your control may not be able to punch out useful tapes.
g. Cable requires serial handshake lines - get different cable.

Other
Single-drop / Multi-drop AMI used as Multi-drop / Single-drop -install correct PROM on AMI.

Built in diagnostics

The AMI has built in tests that it performs each time it is powered on or the RESET switch is pressed. These tests insure that the processor, and memory devices are working correctly. When the board is first powered up all LEDs are turned on during the self-diagnostics. In the event that the self diagnostics detects an error, either all LEDs will stay on, or they will keep blinking.

Loop Test

The AMI can be loop tested using a special cable and port terminator plugs. With the loop cable and terminators in place the AMI performs extensive loop tests, verifying operation of each of the external interfaces. Faults are indicated by flashing the LEDs.

ASCII CHART

0	NUL	10	DLE	20	SP	30	0	40	@	50	P	60	`	70	p
1	SOH	11	DC1	21	!	31	1	41	A	51	Q	61	a	71	q
2	STX	12	DC2	22	"	32	2	42	B	52	R	62	b	72	r
3	ETX	13	DC3	23	#	33	3	43	C	53	S	63	c	73	s
4	EOT	14	DC4	24	$	34	4	44	D	54	T	64	d	74	t
5	ENQ	15	NAK	25	%	35	5	45	E	55	U	65	e	75	u
6	ACK	16	SYN	26	&	36	6	46	F	56	V	66	f	76	v
7	BEL	17	ETB	27	'	37	7	47	G	57	W	67	g	77	w
8	BS	18	CAN	28	(	38	8	48	H	58	X	68	h	78	x
9	HT	19	EM	29	)	39	9	49	I	59	Y	69	i	79	y
A	LF	1A	SUB	2A	*	3A	:	4A	J	5A	Z	6A	j	7A	z
B	VT	1B	ESC	2B	+	3B	;	4B	K	5B	[	6B	k	7B	{
C	FF	1C	FS	2C	,	3C	<	4C	L	5C	\	6C	l	7C	|
D	CR	1D	GS	2D	-	3D	=	4D	M	5D	]	6D	m	7D	}
E	SO	1E	RS	2E	.	3E	>	4E	N	5E	^	6E	n	7E	~
F	SI	1F	US	2F	/	3F	?	4F	O	5F	_	6F	o	7F	DEL

Notes:
1) DC1 = XON

2) DC3 = XOFF

3) ASCII is a seven bit code. The most significant bit of an eight bit byte should be zero.

ISO (RS-358) CHART

```
 MSB            LSB
•••••••••••••••••••••••••
• 7  6  5  4• 3  2  1  0•   Data byte
•••••••••••••••••••••••••
 high nibble  low nibble
```

```
00 NUL 90 DLE A0 SP 30 0  C0 @  50 P  60 `  F0 p
81 SOH 11 DC1 21 !  B1 1  41 A  D1 Q  E1 a  71 q
82 STX 12 DC2 22 "  B2 2  42 B  D2 R  E2 b  72 r
03 ETX 93 DC3 A3 #  33 3  C3 C  53 S  63 c  F3 s
84 EOT 14 DC4 24 $  B4 4  44 D  D4 T  E4 d  74 t
05 ENQ 95 NAK A5 %  35 5  C5 E  55 U  65 e  F5 u
06 ACK 96 SYN A6 &  36 6  C6 F  56 V  66 f  F6 v
87 BEL 17 ETB 27 '  B7 7  47 G  D7 W  E7 g  77 w
88 BS  18 CAN 28 (  B8 8  48 H  D8 X  E8 h  78 x
09 HT  99 EM  A9 )  39 9  C9 I  59 Y  69 i  F9 y
0A LF  9A SUB AA *  3A :  CA J  5A Z  6A j  FA z
8B VT  1B ESC 2B +  BB ;  4B K  DB [  EB k  7B {
0C FF  9C FS  AC ,  3C <  CC L  5C \  6C l  FC |
8D CR  1D GS  2D -  BD =  4D M  DD ]  ED m  7D }
8E SO  1E RS  2E .  BE >  4E N  DE ^  EE n  7E ~
0F SI  9F US  AF /  3F ?  CF O  5F _  6F o  FF DEL
```

Notes:

1) RS-358 is similar to ASCII, but the most significant bit (bit 7) is used to establish EVEN parity.

2) Any code not in the above table is an illegal code - PARITY ERROR

3) You can fake RS-358 via the host serial port, by setting up the host to send 7 bit bytes with EVEN transmission parity, and setting up the AMI host port to be 8 bit NO parity.

4) SP represents SPACE.

EIA (RS-244) CHART

```
 MSB            LSB
•••••••••••••••••••••••••
• 7  6  5  4• 3  2  1  0•   Data byte
•••••••••••••••••••••••••
 high nibble  low nibble

 hex code
 |  EIA symbol
 |  |  IBM PC display symbol
 |  | |
00      10 SP Ø  20 0    30      40 - @  50      60      70 + r
01 1 J  11       21      31 / 1  41      51 J Q  61 A a  71
02 2 J  12       22      32 S 2  42      52 K R  62 B b  72
03      13 3 !   23 T #  33      43 L C  53      63      73 C u
04 4 ¨  14       24      34 U 4  44      54 M T  64 D d  74
05      15 5 §   25 V %  35      45 N E  55      65      75 E w
06      16 6 n   26 W &  36      46 O F  56      66      76 F x
07 7 •  17       27      37 X 7  47      57 P W  67 G g  77
08 8 _  18       28      38 Y 8  48      58 Q X  68 H h  78
09      19 9 ¯   29 Z )  39      49 R I  59      69      79 I {
0A      1A       2A      3A bs : 4A      5A      6A      7A lc |
0B eor_ 1B       2B      3B , ;  4B      5B % [  6B . k  7B
0C      1C       2C      3C      4C      5C      6C      7C uc ~
0D      1D       2D      3D      4D      5D      6D      7D
0E &    1E       2E      3E tab> 4E      5E      6E      7E
0F      1F       2F      3F      4F      5F      6F      FF rub_
80 cr
```

Notes:

1) RS-244 uses seven bits to define codes, and an ODD parity bit. Bit 4 establishes ODD parity over the byte.

2) Any blank location in the table above is an illegal code which will cause a parity error or reader error in the control.

3) The host serial communication must use 8 bit data if it sends/receives RS-244 codes.

RS-232 description

Terminology

Data 0 = "ON" Control line = Space = +12v

Data 1 = "OFF" Control line = Mark = -12v

7n1:

```
Space ••••••••••••••••••••••••••  ••
       •St• 0•1 •2 •3 •4 •5 •6 •Sp•
Mark •••  ••••••••••••••••••••••••
```

7e2 or 7o1:

```
Space
•••••••••••••••••••••••••••••  ••
 •St• 0•1 •2 •3 •4 •5 •6 •Pe•Sp•
••  •••••••••••••••••••••••••••••
Mark
```

8n1:

```
Space
•••••••••••••••••••••••••••••  ••
 •St• 0•1 •2 •3 •4 •5 •6 •7 •Sp•
••  •••••••••••••••••••••••••••••  Mark
```

8e2 or 8o1:

```
Space
••••••••••••••••••••••••••••••••
 •St• 0•1 •2 •3 •4 •5 •6 •7 •Pe•Sp•
 •  ••••••••••••••••••••••••••••••
Mark
```

AMI Host Cable : 25 Pin RS-232

```
   COMPUTER          AMI
    DB25P            DB9P  (to J3)

Tx   2 >---->-----< 2 RX in

Rx   3 >----<-----< 3 TX out

Gnd  7 >----------< 5 Gnd

DSR  6 >--+
          |
DCD  8 >--+
          |
DTR  20>--+

RTS  4 >--+
          |
CTS  5 >--+
```

AMI Host Cable: 9 Pin RS-232

```
    TO "AT"
    COMPUTER COM     TO AMI J3
    DB9S             DB9P

RX   2 >----<-----< 3 TX out

TX   3 >---->-----< 2 RX in

Gnd  5 >----------< 5 Gnd

DTR  4 >-->- +
             |
DCD  1 >--<--+
             |
DSR  6 >--<--+
             |
CTS  8 >--<--+
```

Cable: AMI to AMI RS-422

```
    AMI J4         AMI J3
    DB9S             DB9P

+RX  1 >-------------< 1
        Twisted pair
-RX  4 >-------------< 4


Gnd  5 >-------------< 5 Gnd


+TX  6 >-------------< 6
        Twisted pair
-TX  9 >-------------< 9
```

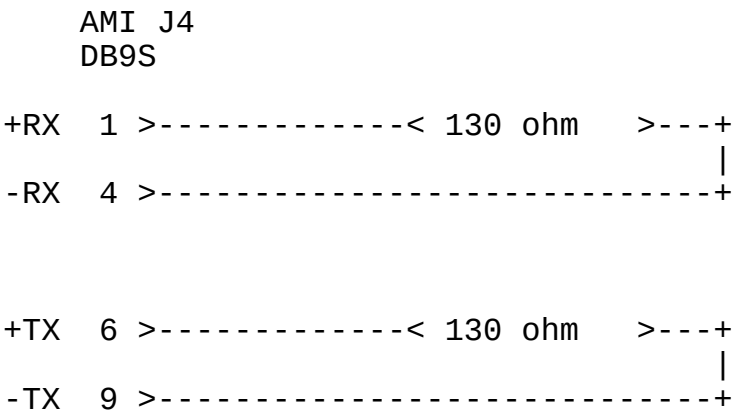
Cable: AMI to RS-422 converter

The converter should be set to always drive its output - not controlled by RTS.

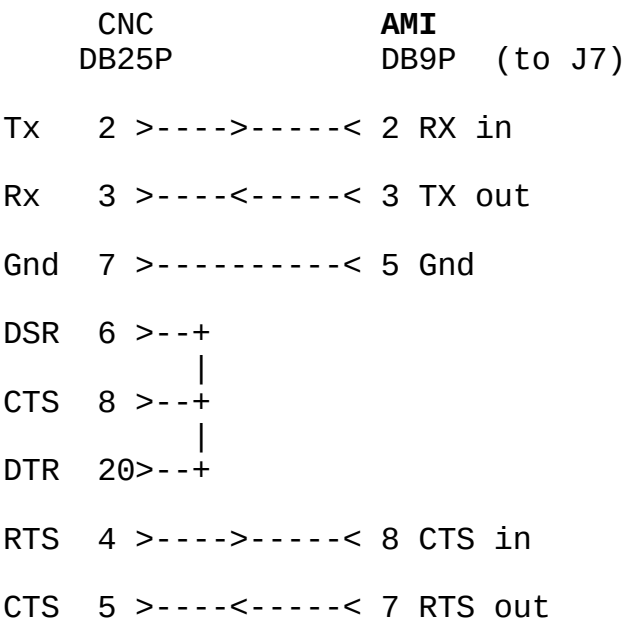
```
   AMI J4               Converter
    DB9S                   RS-422

+RX  1 >-------------<   output +
        Twisted pair
-RX  4 >-------------<   output -


Gnd  5 >-------------<   ground/shield


+TX  6 >-------------<   input +
        Twisted pair
-TX  9 >-------------<   input -
```

AMI RS-422 terminator plug

A terminator plug can be used to prevent reflections from causing data corruption. It also increases the current flow and minimizes the effect of stray cable capacitance.



Cable: AMI to 25 Pin Serial CNC



Cable:RS-232 Macintosh 8 Pin DIN

The “RS-232” serial port on a Macintosh is an adaptation of what is really an RS-422 port. You can buy a cable with a DIN plug on one end and a DB25 connector on the other. This cable usually works on Modems and Printers, but as you can see from the diagram below the lack of a ground connection between computer and serial device can be problematic. Apple designed this interface to work only if the reference for the RS-232 is provided by a chassis connection - assuming that the logic power supply is connected to chassis.

```
     MAC             DCE
    DIN              DB25

TD-  3 >---->-----< 2 TX
RD-  5 >----<-----< 3 RD
DTR  1 >----------< 4 RTS
CTS  2 >----------< 5 CTS
Gnd  4 >--+       < 7 Gnd  <--- interesting missing connection
          |
TD+  6 >--+
          |
RD+  7 >--+  <----
```

Apple's shorting RS-422 positive to Gnd results in the negative side appearing to go negative.

Cable:RS-422 Macintosh 8 Pin DIN to AMI

Use the Macintosh RS-422 serial port the RIGHT WAY!

```
     MAC             AMI
    DIN              DB9P

DTR  1 >--+
          |
CTS  2 >--+

TD-  3 >---->-----< 4 Rx-

Gnd  4 >----------< 5 Gnd

RD-  5 >----<-----< 9 Tx-

TD+  6 >---->-----< 1 Rx+

RD+  7 >----<-----< 6 Tx+
```

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