Lucidata Diplomat jr

Model jrNS-IB8

Network Synchronous Server

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Warranty

Lucidata warrants that the products described in this User Guide are free from defects in manufacture and that they meet the specifications and functionality described in this User Guide. Lucidata will replace parts and repair defects in manufacture, on a return to factory basis, for a period of 12 months from the date of our original invoice provided that the product has only been used in the manner and for the purpose described in this User Guide. Lucidata does not warrant that the products described in this User Guide are suitable for any specific application and the purchaser must satisfy him/herself of the suitability of the product for the intended application as best known to him/herself. Lucidata does not accept any contingent liability for any damages whatsoever including direct, indirect, incidental, consequential, loss of business profits or special damages arising from the use of its equipment. Lucidata assumes that if its equipment is used in a business critical or any other essential application, then the system design should incorporate sufficient resilience to ensure that a single failure would not have disproportionate consequences.

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If a unit fails, and you have bought it from a Lucidata appointed dealer, you should contact that dealer. If bought from the manufacturer, return the unit in its original packing to the address on page 2.

You should telephone or fax Lucidata prior to returning the unit to ascertain whether an apparent fault is due to mis-operation rather than to a technical fault within the unit and to obtain a returns number.

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Faults that occur outside the warranty period and are not covered by a separate maintenance contract, will be repaired on a time-and-materials basis. Please telephone Lucidata prior to returning your unit. You will be given an estimate of the repair costs.

Introduction

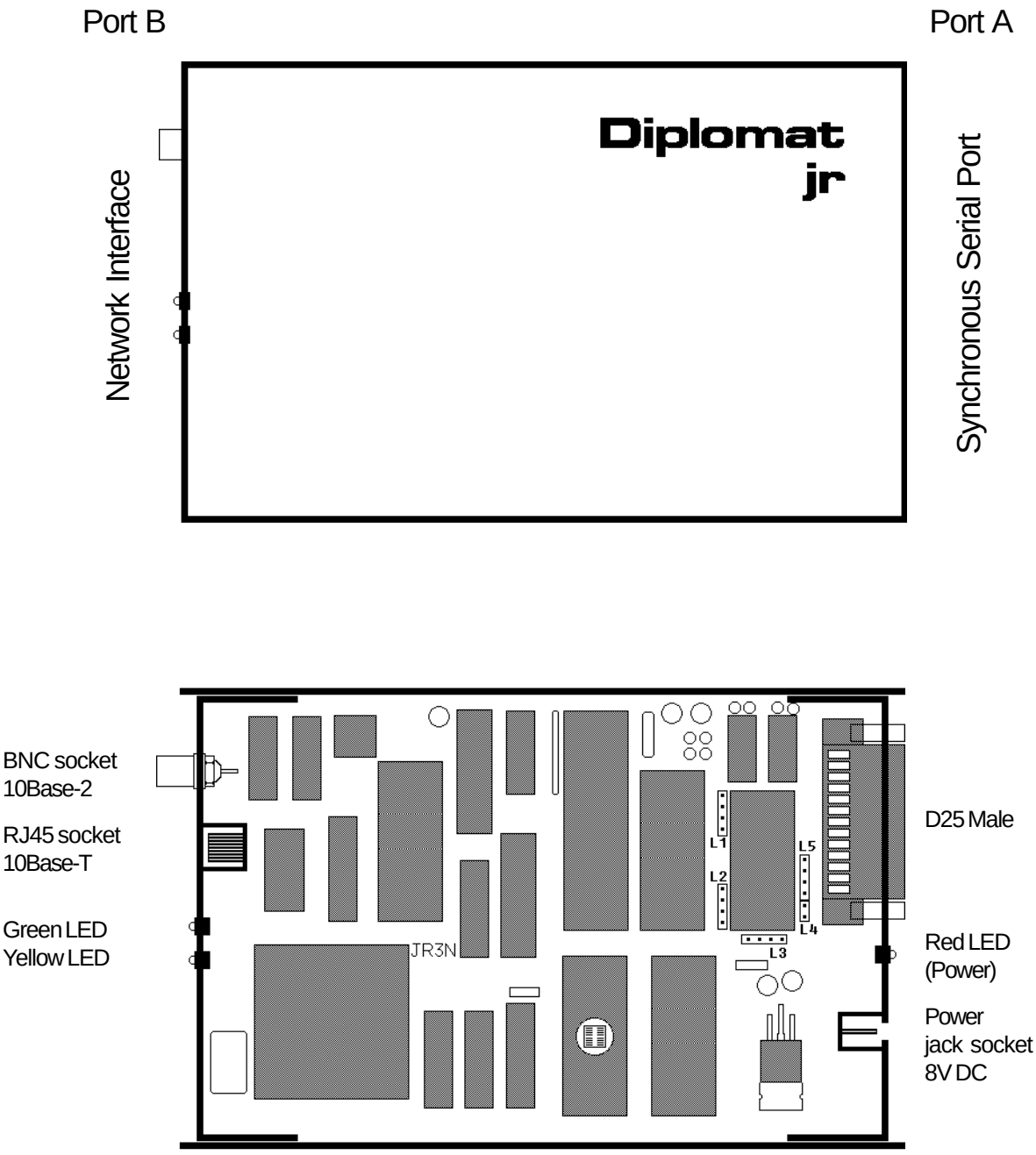
The Lucidata *Diplomat* model *jrNS* is one of a family of simple connectivity solutions built around Lucidata's popular Diplomat jr product. The *jrNS* model has been designed specifically to interface to the most common local area network (LAN) media utilising Ethernet technology and employing the TCP/IP transport level protocols. Despite network technology being rather complex, Lucidata has always sought to make its products easy to use and user friendly. We believe that our products should just be connected up and left to do their job with little or no intervention necessary from the user.

To this end most Lucidata products are supplied with simple menu driven configuration screens that can be accessed with any simple local terminal or emulation. Remote configuration over the network is also possible but due to the inherent security implications of such a method it is not the default method.

The *Diplomat jrNS* is the member of the Diplomat jr family that enables interconnectivity between an Ethernet/IP network and devices running legacy frame synchronous protocols using serial RS232 communications. The protocol supported by a particular model is determined by the firmware installed in the EPROM. The JRN-IB8 firmware supports the IBM2780/3780 BSC protocol and TCP/UDP/IP network protocols over UTP cabling.

This manual is structured to require the minimum of reading to effectively operate the *Diplomat jrNS*. If, as is our usual policy, Lucidata has configured your unit for you, you will only need to read Chapter 2, *Getting Started Quickly*, to discover what plugs into where and you will be on the air.

If your unit is not configured yet you will need to read Chapter 3 on *Configuration* to discover what information you need to get your hands on before starting that process. If you are wondering why you bought a *Diplomat jrNS* then Chapter 4, *Operation*, is where we tell of all the things that the *jrNS* can do and how to drive it. You will probably want to read this chapter anyway. Networks can be complex things and problems can and do arise which may generate many and varied error messages, some coming from within the *Diplomat jrNS* and others from outside but reported to the interface. Chapter 5, *Trouble Shooting and Error Messages*, documents these and gives probable explanations and recommended courses of action. Finally Chapter 6, *Technical Specification*, contains the dry detail of the hardware so you know what pins to use.


Port B
Port A
Network Interface
Synchronous Serial Port
Diplomat
jr
BNC socket
10Base-2
RJ45 socket
10Base-T
Green LED
Yellow LED
JR3N
L1
L2
L3
L4
L5
D25 Male
Red LED
(Power)
Power
jack socket
8V DC

When you hold the *Diplomat jrNS* in your hand so that the Diplomat jr logo is oriented in the normal reading orientation, the Network end is to the left and the Serial interface is to the right. For documentation purposes we refer to the Serial interface as Port A and the selected network interface as Port B.

Port A

Port A is wired as a Serial Synchronous DTE and any cable that was designed to connect a terminal type device to a modem using a 25 pin female D type connector will be suitable to connect your DCE device to Port A.

Port B

Port B has a 10Base-T RJ45 connector and optionally a 10Base-2 BNC connector. If both are present connection should be made to only one of these connectors otherwise the Auto Media Sensing will get confused and probably choose 10Base-2. The Auto Media Sensing only operates at power-up time so changing the connector during operation will not have the desired effect. The 10Base-T connector is wired for direct connection to a hub using UTP cable.

Power

The power lead from the mains adaptor is plugged into the socket on the Port A end. When power is applied to the adaptor the Red LED by the power connector should light. If it does not you probably have a dead mains socket but refer to Chapter 5, *Trouble Shooting* and *Error Messages* to discover what to do.

If you have selected the 10Base-T connector the Green LED by the RJ45 socket should be illuminated to indicate a good link to the hub. If not consult Chapter 5.

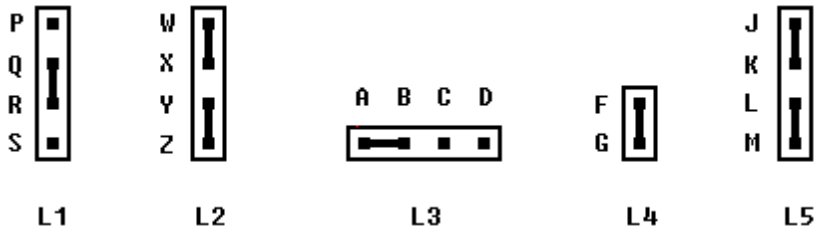
The *Diplomat jrNS* is now operational and should be doing what was expected. If there is traffic on the network then the Yellow LED by the RJ45 connector will be flashing.

If the *Diplomat jrNS* has been configured as a Server then it will just wait until someone makes a connection over the network. If it is configured as a Client then the *Diplomat jrNS* will attempt to make a connection to the remote server defined in its configuration when the configured initialisation condition occurs.

Pinouts and Links

Because the Synchronous Serial interface of the *Diplomat jrNS* has been designed to be general purpose some of the 25 pins on the D25 male plug have a variable function. It is therefore essential that connection is only made to those signals that are needed for a particular application and to no others.

The following table lists all the pins and shows how they are assigned for some standard applications. The default jumpers shown are for the *Diplomat jrNS* to supply the clocks.



Pin No.	Name	Link L1	Link L3	Link L4	Link L5	Function
1	Screen					Connected to groundplane
2	TXD					jrNS Transmits Data
3	RXD					jrNS Receives Data
4	RTS					jrNS Signals Ready to Send
5	CTS					External Cleared to Send
6	DSR					N/C
7	Common					Signal Return
8	DCD	Q+R P+Q	- -	- -	J+K -	Uses DCD Signal from DCE Held High Internally
15	TXC	R+S - -	- B+C A+B A+B	- - - -	K+L - - L+M	Uses External TX Clock from DCE Uses External RX Clock from DCE Uses Internal Clock Outputs Internal Clock on pin 15
17	RXC	- - -	- - C+D	- F+G -	- - -	Uses External RX Clock from DCE Outputs Internal Clock on pin 17 Uses Internal Clock iff IC20 removed.
20	DTR					Held High by Diplomat
24	EXC					Outputs Internal Clock always

Desired Interface	IC2	IC20	Link L2
Serial Synchronous	MC6852	MAX232	W+X,Y+Z
Serial Asynchronous	MC6850	Remove	X+Y

NOTE: L1 MUST have either P+Q or Q+R with J+K. This is because DCD must not be left floating

The two protocols supported by the *Diplomat jrNS* have quite different characteristics arising from their historically separate origins of many decades. The configuration of the *Diplomat jrNS* concerns the configuration of the two protocols, each for their own interface, and then the specification of how they will pass information between themselves. As with all Lucidata products flexibility is the driving force as hardly ever are two customers requirements exactly the same. The price for all this flexibility is an apparently complex configuration mechanism and it the aim of this User Guide to help the user get started. Once configured the *Diplomat jrNS* can be left to do its job quietly in the background without the need for any further attention.

Because the *Diplomat jrNS* does not have an asynchronous port, which is how configuration is normally done, the configuration menus have to be accessed over the network either using a custom program or a Diplomat jrN fitted with an asynchronous port.

Remote Configuration

All *Diplomat jrNx* can be configured remotely using a program or another *Diplomat jrN*. This becomes essential in the case of the *Diplomat jrNS* and *Diplomat jrNP* variants which do not have an asynchronous RS232 port.

JRemote Program

The JRemote program runs on a standard Windows PC and uses MSWinsock to contact the remote Diplomat jrNS. All that is required to initialise the program is to fill in the IP address of the Diplomat it is desired to configure, Tab to the Command text box and enter characters just as described in the following section using a Host jrN. The same displays invoked by the Host jrN will appear in the large window of the program.

Using a Host jrN

The following describes the process from the point of view of the *Diplomat jrN* which is being used to do the remote configuration. We will call this the Host jrN.

The Host jrN should first be configured as a UDP Client with full Error Reporting using the following values for configuration byte A and B.

A=11001100
B=10101010

In the Network Menu, the IP address of the remote jrN to be configured should be substituted for the Remote IP address and the Server port should be set to 12345. This is the reserved UDP port number that all Diplomats use for configuration. Ensure that the Default Gateway is the one required to obtain a route to the remote jrN. Send a few Pings to the remote jrN using the "E" command to verify it is contactable. Then on hitting the Return key three times a new Main Menu display should appear. This Menu is coming from the remote jrN as is shown by the Terminal Profile now showing "Remote Control" instead of "Local Port".

Factory Settings

Should the configuration of the *Diplomat jrNS* become corrupted for any reason so that it no longer responds to the IP address that was assigned to it, it can be reset to the factory configuration. To do this make a D25 female socket with a link between pin 4(RTS) and pin 8(DCD) and plug it into Port A. Power the unit up, wait 5 seconds, and power it down. Remove the special socket and the unit will be reset to the factory defaults.

Main Menu

```
Lucidata Diplomat C 1995-2001
Model JRN-IB8 rev 1.02:1062

Terminal Profile is <Remote Control>
Type Single Digit to Select, <CR> to Exit

  <A> Set Port A Configuration Byte
  <B> Set Port B Configuration Byte
  <C> Set Character Configuration Byte
  <D> Set Data Rate Configuration Byte
  <T> Transfer Control Byte, IP to IBM
  <I> IBM2780/3780 Control Byte
  <S> Enter Statistics Menu
  <M> IBM2780/3780 Message Summary
  <N> Enter Network Control Menu
  <R> Reset Diplomat Softly

Select < >
```

For all intents and purposes the Local Terminal is connected to the remote *Diplomat jrNS*. All menu driving commands work in the usual way with the exception that no control characters are sent to the remote *Diplomat jrNS*. Make very sure of the changes that are made because they will be remembered by the remote *Diplomat jrNS* when the Main Menu is left and if the IP address has been changed erroneously you may not be able to contact the *Diplomat jrNS* again without following the reset procedure described earlier.

The remote *Diplomat jrNS* will also perform a soft restart after saving the new configuration and any existing TCP connection will be lost.

It must be emphasized that typing Return when in the remote Main Menu is necessary for new configuration values to be stored, but typing CTRL/P at any time will return to the Host jrN Main Menu. The remote *Diplomat jrNS* will be left in whatever state it was in. Although the remote menu displays look the same as if the configuration was being done locally they are actually performed in parallel with whatever the remote *Diplomat jrNS* was doing at the time. If no configuration values are changed because you only viewed the statistics or got the remote *Diplomat jrNS* to Ping its Server then that will not force a restart and any existing TCP session will be preserved.

Configuration Bytes

The current generation of *Diplomat jr*s grew from a generation that had lots of configuration switches on the PCB to set up options. This required taking the lid off the box to make changes and in addition the switches occupied valuable PCB space that could be better utilised for extra functionality. The jrN has non-volatile memory so it can remember any configuration details that it is given. For simplicity we have introduced the concept of 'Silicon Switches' to select low level options. They are directly analogous to ordinary switches but only exist in the Diplomat's memory.

In the *Diplomat jrNS* there are six sets of Silicon Switches associated with six Configuration Bytes. Configuration Byte A controls the major characteristics of Port A and Configuration Byte B controls the major characteristics of Port B. Configuration Byte C allows specification of the character format to be used on Port A and Configuration Byte D determines the internal serial clock rate. More detailed characteristics of the way the Synchronous Data Stream is processed are determined by Configuration Byte I and rules for controlling the data flow between Port A and Port B are selected with Configuration Byte T.

Selecting A, B, C, D, I or T from the Main Menu will cause the appropriate Configuration Byte to be displayed and the cursor will be positioned under the first bit. At this stage the following characters can be typed in to change the configuration byte:

CR - Return to Main Menu with the value of the configuration byte set to the displayed value.

Space - move cursor to the right without changing the byte.
BS - move the cursor to the left without changing the byte.

0 - Change the 'Switch' above the cursor to 0 and move cursor right.
1 - Change the 'Switch' above the cursor to 1 and move cursor right.

Note - if any operation moves the cursor off either end the system returns to the Main Menu.

Because the configuration bytes set low level properties of the Diplomat they should be set up prior to attempting to configure the Network parameters.

By convention the switches or bits of a configuration byte are numbered as follows

7	6	5	4	3	2	1	0

Configuration Byte A Specifies Protocol on Port A

Bit	Name of Switch	Description
0	BPRIMA	[0] - Act as Secondary BSC station [1] - Act as Primary BSC station
1	BTURBO	[0] - Line turnaround set to 40mS [1] - Line turnaround controlled by RTS/CTS delay
2	BPADIT	[0] - Strip trailing space characters [1] - Pad output data to record length with space characters
3	BRECLN	[0] - Record length is 80 [1] - Record length is 132
4	BBLOCK	[0] - Block output stream by buffer content [1] - Block output stream according to 2780 or 3780 protocol
5	BEBCHC	[0] - Host character code is ASCII [1] - Host character code is EBCDIC
6	B3780	[0] - Protocol is 2780 [1] - Protocol is 3780
7	BEXREP	[0] - Do not report locally detected exception conditions [1] - Report locally detected conditions to remote

Note (i) A Primary BSC station will not try to bid for the line again for at least 1.2 seconds after it has given up the line. A secondary BSC station will not try to bid for at least 3 seconds after it has given up the line.

Configuration Byte B defines Protocol on Port B

Bit	Name of Switch	Description
0	BRSTAH	[0] - Only allow current Host to Reset current TCP session [1] - Allow any Host to Reset a current TCP session
1	BRSTAP	[0] - Only allow current Port on current Host to Reset current TCP session [1] - Allow any Port on current Host to Reset current session
2	BPEER	[0] - Only allow Client/Server relationships [1] - Allow Client/Client relationships
3	BTXTIO	[0] - Ignore TX timeout on Port A [1] - Force TCP session drop on timeout on Port A
4	BSERVR	[0] - Behave as a Client device [1] - Behave as a Server device
5	BSEND	[0] - Send on selected criteria [1] - Flush Network buffer after no new data received for 50mS
6	BTCPUD	[0] - Use TCP protocol [1] - Use UDP protocol
7	BEXREP	[0] - Do not report network originated errors [1] - Report ICMP network messages in text form to Port A

Note (i) If BPEER=1 the unit will allow a remote host to establish a TCP session with it if, and only if, the IP address and the Port address of the remote host are the same as those declared in the Network Menu for Remote IP Address and Remote TCP Server Port.

Note (ii) If BTXTIO=1 a timeout will be recorded if any of the following occur
a) Port A has been unable to start sending within 1 second
b) Port A has exceeded the retry count (3) for a valid response

Configuration Byte I qualifies Port A behaviour

Bit	Name of Switch	Description
0	BDLESD	[0] - Do not send DLE EOT on session drop (TCP CLOSE or RST) [1] - Send DLE EOT on session drop (TCP CLOSE or RST)
1	BEOTSD	[0] - Do not send EOT on session drop (TCP CLOSE or RST) [1] - Send EOT on session drop (TCP CLOSE or RST)
2	BAUTET	[0] - Do not automatically send EOT after ETX frame sent [1] - Automatically send an EOT after an ETX frame sent
4,3	BMSKEF	[11] - Mask to extract EOF action bits [00] - No EOF characters sent to Port B [01] - Forward ETB, ETX, EOT and RVI characters to Port B [10] - Convert ETX to SUB and forward to Port B [11] - Convert ETX to EOF text message and forward to Port B
5	BCRLF	[0] - Leave CR as CR [1] - Expand CR to CR LF if filtering
6	BFILTR	[0] - Do not filter data [1] - Apply filters to translated data
7	BTRANS	[0] - Do not perform ASCII/EBCDIC translation [1] - Perform ASCII/EBCDIC translation of data

Note (i) The unit will always filter out characters that would cause the BSC protocol to fail, unless Transparent Text Mode has been selected.

Configuration Byte T controls transfer of data from Port B to Port A

Bit	Name of Switch	Description
0	BDCDF	[0] - DCD is constant (dropping will close TCP session) [1] - DCD is controlled
1	BTTEXT	[0] - Use Text Mode - STX, ETB/ETX framing [1] - Use Transparent Text Mode - DLE STX, DLE ETB/ETX framing
2	BDRDLE	[0] - Ignore DLE EOT from Port A [1] - Drop TCP session on detected DLE EOT from Port A
3	BDREOT	[0] - Ignore EOT from Port A [1] - Drop TCP session on detected EOT from Port A
4	BRXTIO	[0] - Ignore RX timeout on Port A [1] - Force TCP session drop on timeout on Port A
5	BEFLEN	[0] - Data stream starts on first data byte of first TCP/UDP packet [1] - Length of packet is given in first two bytes of TCP/UDP packet
6	BEFETX	[0] - EOF is determined by the TCP session closing [1] - EOF is determined by SB or ETX character at end of a packet
7	BFILEP	[0] - Each packet is part of a data stream [1] - Each packet contains a complete file

Note (i) In general BEFLEN=1 should only be used in conjunction with BTTEXT=1 to avoid generation of invalid BSC characters.

Note (ii) BEFETX=1 only has effect if Bits 3 and 4 of Byte I=00, otherwise Bits 3 and 4 determine the signalling criteria.

Note (iii) BFILEP=1 is usually used in conjunction with BAUTET=1 in Byte I. Thus each TCP packet that arrives from the network causes the Diplomat to bid for the BSC line, send an ETX terminated block containing all the TCP packet data, and then drop the line with EOT.

The meaning of the bits in Configuration Byte C are given in the following table.

Data Bits	Parity Bits	Bit 5	Bit 4	Bit 3
6	E	0	0	0
6	O	0	0	1
7	N	0	1	0
8	N	0	1	1
7	E	1	0	0
7	O	1	0	1
8	E	1	1	0
8	O	1	1	1

Where the Parity Bit Codes mean None, Even or Odd

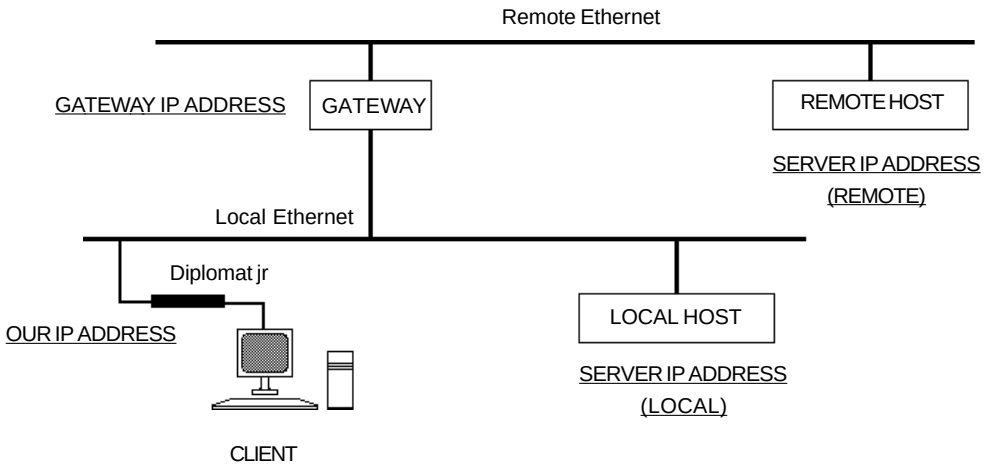
The meaning of the bits in Configuration Byte D are given in the following tables.

Clock 1 (T1) is controlled by bits 0 to 3

Speed (bps)	Bit 3	Bit 2	Bit 1	Bit 0
75	0	0	0	0
150	0	0	0	1
300	0	0	1	0
600	0	0	1	1
1200	0	1	0	0
2400	0	1	0	1
4800	0	1	1	0
9600	0	1	1	1
19200	1	0	0	0
38400	1	0	0	1
76800*	1	0	1	0
153600*	1	0	1	1
317200*	1	1	0	0
317200*	1	1	0	0
317200*	1	1	0	1
317200*	1	1	1	0
317200*	1	1	1	1

** Special conditions apply*

Network Parameter Configuration



Now that the basic configuration of the *Diplomat jrNS* has been performed we can safely move on to setting up the Network Parameters.

Typing 'N' at the Main Menu will bring up the Network Control Menu.

```
Network Control Menu  -
Diplomat is configured as a TCP Server

Our Ethernet Address is  - 00 A0 EF 00 00 0C
Our Diplomat IP Address is  - 128.18.18.12
Default Remote  IP Address  - 128.18.18.255
Default Gateway IP Address  - 128.18.18.255
Default Sub-Net Address Mask  - FFFFFF00
Default TCP/UDP  Service Port Id.  -   7000
Status of TCP Session  - CLOSED

  <O> Set Our IP Address
  <S> Set Remote/Server IP Address
  <G> Set Gateway IP Address
  <M> Set Sub-Address Mask
  <P> Set Server Port Id.
  <C> Set Client Port Id.
  <F> Firewall Definition Menu
  <A> Broadcast ARP Request
  <B> Broadcast BOOTP Request
  <R> Broadcast RARP Request
  <E> Send ECHO Request to Remote

<CR> Returns to Previous Menu
```

In the above screen the Diplomat has been configured as a Server. In a later screen the slight differences when it is configured as a Client will be obvious.

The Ethernet Address is unique to the unit and cannot be changed. It is displayed for information only.

The three IP Addresses are all changed in the same way. First a key letter is selected:

'O' to set the Local IP Address of the Diplomat itself, 'S' for the Remote host and 'G' for the local Gateway. If there is no local gateway then the gateway address should be set to the same as the remote host. The following is a typical prompt:

```
Enter New IP address in Decimal Dot Notation
Address of this Diplomat (Client/Server) -
```

If the Return key is entered no changes are made and the screen refreshes to show the current values. Fields may be skipped by typing a '.' until the field you want to change is reached and then simply typing the new decimal value and hitting Return will update the value.

At this point, contact will be lost with the remote *Diplomat jrNS*. The Host jrN should now be re-configured so that it uses the new Remote IP address to re-establish contact with the remote *jrNS*.

Whether you are using Sub-Networking on your network or not the Sub-Net mask should be such that when applied (perform a bitwise AND operation) to both the Local IP Address and the Remote IP Address the masked values match. If a local gateway is used then the masked Gateway IP Address should match the masked Local IP Address. ie communicating devices must be on the same conceptual sub-net.

Typing 'M' will invoke the following response:

```
Enter Sub-Address Mask in hex
```

You should now enter the full eight hex characters to specify the 32 bit mask.

The TCP/UDP Local Service Port is the port number that a Client host will use to make a connection to the Diplomat when it is acting as a Server. The Diplomat will not respond to attempts to communicate with any other port number.

Typing 'C' will invoke the following response:

```
Enter TCP Port Address in Decimal -
```

Care should be taken to ensure that the value chosen is within the range allowed by the remote host TCP/IP stack. Some systems impose restricted ranges ie.2000 to 4000.

When the Diplomat is configured as a Client there are two port addresses required. This time the Service Port is the Server Port number that the Diplomat will try to establish a connection with on the Server and the Client Port number is the Diplomat's own local port ID.

If the value of 23 is chosen for the Service Port the Diplomat will perform Telnet control character processing by adding or removing NUL characters after CR characters.

The Port value 12345 should not be used as it is reserved for remote interrogation of the *Diplomat jrNS*.

Typing 'F' will invoke the Firewall Definition Menu

```
Firewall Definition Menu - feature activated by non-zero
values

Acceptable Hosts and Ports

1.   0.0.0.0 :      0
2.   0.0.0.0 :      0
3.   0.0.0.0 :      0
4.   0.0.0.0 :      0
5.   0.0.0.0 :      0
6.   0.0.0.0 :      0
7.   0.0.0.0 :      0
8.   0.0.0.0 :      0


<C> Clear All entries, Disable feature
<A> Add an entry, <D> Delete an entry, <E> Edit an entry

<CR> Returns to Previous Menu
```

The feature only has effect if the *Diplomat jrNS* has been configured as a Server or Peer. The Firewall is activated by defining a non-zero IP address. When activated the remote host IP address defined in the Network Control Menu is ignored and only those hosts defined in the firewall list will be able to start up a TCP session or enter into a UDP exchange. IP and port values are entered in exactly the same manner as described for the previous menu.

The Status of the TCP session is shown for information purposes and will be unaffected provided that no changes are made to the network parameters. Therefore it is possible, during an active session, to interrogate the Network Control Screen without causing any damage to the active session.

Normal Network Operation

As long as the *Diplomat jrNS* is properly configured and is not in Network Monitor mode it is in the Normal Mode of operation. It will process the following Ethernet message types:

ARP messages addressed to the local IP address
RARP messages containing the local Ethernet address
ICMP messages addressed to the local IP address
UDP messages addressed to the local IP address and the local port or the configuration port
UDP messages addressed to the Broadcast IP address and the local port or the configuration port
TCP messages addressed to the local IP address and the local port

Responses to ARP, RARP and ICMP are performed automatically and the user will in general be unaware of the activity. ARPs have no effect other than providing or giving essential information about Ethernet and IP addresses but a RARP request can cause the *Diplomat jrNS* to change its IP address to the value contained in the RARP reply.

When the *Diplomat jrNS* is configured as a Client it checks to see if it has a good Ethernet address for either the Default Gateway or Remote Server and issues an ARP if it does not. If the *Diplomat jrNS* determines that the Remote Server Address is on a different Sub-Network to itself it will address the ARP to the Default Gateway. The Ethernet address contained in the ARP reply will be used subsequently to address packets to the Remote Server. This process is repeated every 2 seconds until a valid reply has been received.

The *Diplomat jrNS* cannot send data until it has a valid ARP entry in its tables. For this reason an entry is preset into the ARP table for the Sub-Network broadcast IP address (host address of all ones) together with an Ethernet address of all ones. This is to enable a UDP client to generate UDP broadcasts if the Remote Server IP Address is set equal to the Sub-Network broadcast IP address. In this case the *Diplomat jrNS* does not issue any automatic ARP requests.

The *Diplomat jrNS* may be set up as a UDP Client or Server, or a TCP Client or Server. The following paragraphs describe the properties of each set up.

UDP Client/Server

When configured as a UDP Server the *Diplomat jrNS* will wait until a UDP packet is received from a remote host which is addressed to the local IP address and Server Port held in the jrN. The *Diplomat jrNS* cannot send any data over the network until it has received a packet containing a Source Port and IP address for it to use as a return address.

If a UDP packet arrives from another host before the *Diplomat jrNS* has sent a reply to the previous host, the new packet will be ignored unless switch BRSTAH = 1. If BRSTAH = 1 the new packet's Source IP and Port addresses become the new Destination addresses for any *Diplomat jrNS* reply.

When the *Diplomat jrNS* is configured as a UDP Client it will transmit a UDP packet over the network as soon as it has some qualified data to send. It will use the Remote Host address and Server Port address held in its tables to address the packet and will use its own Client Port address for the Source Port address field in the transmitted packet.

If switch BPEER=1 then the *Diplomat jrNS* will accept an initial contact as if it were configured as a Server, provided that the packet came from the Remote IP address and Server Port held in its tables.

The UDP service is a connectionless service with no guarantee of delivery. Only data contained in UDP packets whose header checksums are correct are passed on transparently to Port A.

TCP Client/Server

When configured as a TCP Server the *Diplomat jrNS* will wait until a remote host attempts to establish a TCP Session with it. This requires a proper three way handshake and matching Destination IP and Port Addresses to those held within the jrN. The Source Port address and IP address of the remote host are stored locally for use as a return address. Should a new attempt to initiate a TCP session be detected from the same IP address and port, then the existing session is considered broken and the *Diplomat jrNS* returns to its initial waiting state after first issuing a Reset to the old session. Similarly if the remote host sends a Reset or Close command then the *Diplomat jrNS* terminates the current session and returns to the waiting state.

These rules are relaxed if switch BRSTAH = 1. If BRSTAH = 1 any new host attempting to initiate a TCP session will cause the current session to issue a Reset to the old session and close down. The second attempt by the new host will be successful. In addition if BRSTAP = 1 any Reset packet received will be actioned if it comes from the current host IP address but need not be from the same port.

Neither switch has any effect if the Firewall feature is enabled as this alone will determine who is able to talk to the *Diplomat jrNS*. New session requests or Reset commands from any Firewall qualified host/ports will be accepted and actioned as described above. The *Diplomat jrNS* cannot initiate a TCP session when in Server mode.

Opening TCP Sessions

When configured as a TCP Client the *Diplomat jrNS* will attempt to initiate a TCP session with the Remote Server on the declared Server Port as soon as it has qualified data to send. Only packets from the Remote Server IP address and Port address will be processed.

Closing TCP Sessions

In both modes the user has control over the closing of active TCP sessions.

Normal BSC Operation

In IBM terminology the *Diplomat jrNS* can act as a Primary station or a Secondary station using either the IBM 2780 or IBM 3780 Binary Synchronous Protocol (BSC) operating in Point to Point Data Link Mode.

Idle State

Assuming direct connections on both Port A and B the system will remain idle with no traffic flowing over either interface. There are two states that can be entered.

Master State

Characters arrive over the Network and cause the *Diplomat jrNS* to bid to become link master. It will bid 3 times before logically dropping the line with an EOT frame and then freshly discover that it has data to send and start bidding again. This process will repeat for ever or until some control action is taken via Port B. When it receives an acknowledgement from the remote system the *Diplomat jrNS* enters the Master state. All characters that are not interpreted as commands by the *Diplomat jrNS* are processed and packaged up in BSC envelopes for transmission over the link.

Slave State

The system on the other end of the BSC link bids to become Master of the link and the *Diplomat jrNS*, being idle, acknowledges the bid and enters the Slave state. As each data block is extracted from a correctly received BSC envelope the characters are processed and sent to the output buffer of Port B.

IBM 2780 and IBM 3780

In the following sections it can be assumed that any description applies equally to 2780 or 3780 unless indicated to the contrary.

ASCII and EBCDIC

The BSC protocol is defined for both EBCDIC and ASCII code sets although the most usual one found in practise is EBCDIC. The data transported by the protocol can be either printable characters and selected control codes taken from the same code as the BSC envelope, or encoded as Transparent (Binary) Data. Thus ASCII coded data may be transported within an EBCDIC envelope by sending it in Transparent mode and vice versa. The Network side always works in units of 8 bits.

Transparent Mode

If switch BTTEXT=1, the *Diplomat jrNS* operates in Transparent mode. In the Slave state all data characters enclosed within the BSC envelope are delivered unchanged with nothing added and nothing taken away. In the Master state the *Diplomat jrNS* will package all data arriving in a TCP/UDP packet between DLE STX and DLE ETB/ETX delimiters.

Control Codes

In the Master state there are certain characters that can be used to control the behaviour of the *Diplomat jrNS*. There are also a limited set of control codes that may be transported within the BSC envelope when operating in plain Text mode. These are shown in *Table 1* for both protocols. This does not prevent the sending of other codes across the link but they have to be sent in Transparent Text mode.

CR and SUB

The two most important codes in Text mode are CR (ASCII value 13) and SUB (ASCII value 26) as these cause the *Diplomat jrNS* to try to transmit a data frame over the link. The CR is used to terminate each line or block of characters input from Port B and results in a BSC envelope terminated with an ETB character. The SUB is used to terminate the last data block and causes a BSC envelope terminated with an ETX character to be sent. The *Diplomat jrNS* will then give up the link by issuing an EOT frame, if so configured.

Table 1. Legal Control Codes

Symbol	ASCII value	EBCDIC value	2780 mode	3780 mode
BEL	7	47	✓	✓
HT	9	5	✓	✓
VT	11	11	✓	✓
FF	12	12	✓	✓
EM	25	25	✓	
ESC	27	39	✓	✓
FS Newline	28	21	✓	✓
GS	29	29		✓
RS	30	30		✓
US	31	31	✓	✓

Filtering the Data Stream

If switch BFILTR=1, then the translated data stream is modified by various filters. The process is asymetric and is designed to simplify the processing of the data stream by the recipient of the data.

When the *Diplomat jrNS* is in the Master state the data stream from Port B is filtered to pass only the printing characters and the control characters listed in Table 1. Some special ones are processed in the following manner.

Newline — An FS (ASCII value 28) character is translated to the EBCDIC Newline (NL) character.

ITB in 2780 Mode — In 2780 mode an ITB (ASCII value 31) character is translated to EBCDIC but then causes the *Diplomat jrNS* to follow it with the currently computed CRC value prior to resetting the CRC and placing further characters onto the link.

GS in 3780 Mode — In 3780 mode the Space Compression (GS) code (ASCII value 29) is translated to EBCDIC and the following space count character recomputed before being sent as its EBCDIC equivalent.

Note: In the following descriptions, the symbol CRLF means the CR (ASCII value 13) character by itself if switch BCRLF=0, or followed by the LF (ASCII value 10) character if BRCLF=1.

When the *Diplomat jrNS* is in the Slave state the data removed from the BSC envelope is examined for control characters. The characters listed in the first part of Table 1 are passed on directly but the rest are processed in the following manner.

Newline — The EBCDIC Newline character (EBCDIC value 21) is converted to CRLF.

Escape sequences — ESC followed by '/','S', or 'T' are converted into 1, 2, or 3 CRLF characters and ESC followed by 'A' is converted to the Form Feed (FF) character (ASCII value 12)

Device control — Codes DC1, DC2, DC3 and DC4 (EBCDIC values 17, 18, 19, 60) are removed from the data stream as is the NUL (value 0) character.

2780 Mode — In 2780 mode the ITB (EBCIDIC value 31) character is converted to CRLF as are all other unrecognized codes.

The frame terminating character ETB (EBCDIC value 23) is also converted to a CRLF to delineate transmission blocks.

3780 Mode — In 3780 mode the RS (EBCDIC value 30) character is converted to CRLF as are ITB (EBCDIC value 31) and EM (EBCDIC value 25) characters. If switch BPADIT=1, then the Space Compression sequence GS (EBCDIC value 29) 'count' is expanded to spaces. If switch BPADIT=0, then the Space Compression (GS) code (EBCDIC value 29) is translated to ASCII and the following space count character recomputed and output as its ASCII equivalent.

EOF Text Message — When the last data frame arrives with its terminating ETX (EBCDIC value 3) character the data is followed by a SUB (ASCII value 26, CTRL/Z) character or the text string - "*** END OF DATA ***", dependant on the setting of switch BMSKEF. The master station will then logically drop the line by sending an EOT or DLE EOT frame.

Reverse Interrupt (RVI) — If the link slave has an urgent message to send, the link master may be temporarily forced to give up its control of the link by sending it an RVI message. This is treated as a positive acknowledgement of the last block received and the link master is expected to issue an EOT frame to show its compliance. The sender of the RVI then bids for link mastership, sends its urgent message (usually an error message) and gives up the line by sending an EOT frame. The original link master then bids to re-establish its mastership and continues its transfer from where it left off. The *Diplomat jrNS* responds to a received RVI in this way.

Signalling over the Network

If Bits 4 and 3 of Configuration Byte I are set to 01, a special character is added to the end of the data sent in TCP/UDP packets. The special character notifies the remote application what the BSC frame type was that held the data in the current packet. Similarly, when a TCP/UDP data packet is received, the last character is stripped off the data and used to determine one of the following:how to terminate the BSC frame that will surround the data or drop the line if in Master Mode or request an RVI if in Slave Mode.

The following four characters and their interpretation are shown below. The coding is always ASCII for signalling, but determined by BEBCHC for Port A.

Character	*Value*	*Meaning*
		Master Mode (Data going from Network to Port A)
ETB	23	Send data packet with ETB or DLE ETB termination
ETX	3	Send data packet with ETX or DLE ETX termination
EOT	4	Drop line with EOT frame
NAK	21	Send EOT back to sender as we are already master
		Slave Mode (Data going from Port A to Network)
ETB	23	Preceding data block was terminated with ETB or DLE ETB
ETX	3	Preceding data block was terminated with ETX or DLE ETX
EOT	4	An EOT or DLE EOT frame was received
NAK	21	Issue an RVI request and send back an EOT frame when line relinquished

Examples

There are many ways to configure the *Diplomat jrNS* but we will restrict ourselves to two common applications that highlight the logic of operation.

Example 1 Periodically a Unix system needs to send a file of lines of ASCII text to an old EBCDIC 80 column cheque printer fitted with an IBM2780 interface. The Unix system does not expect a reply.

The *Diplomat jrNS* should be configured as a TCP server and setup with the expected IP address and Service Port number. This will allow the Unix system to initiate a Client session on that Service Port.

Configuration Byte B would be set to 00011010

Port A should be setup for IBM2780 and perform EBCDIC to ASCII translation

Configuration Byte A would be set to 00110111
Configuration Byte I would be set to 10000100

The Unix system will Open a session, send the whole file and Close the session so we want to map that to an IBM2780 file.

This is done with Configuration Byte T set to 00000101

Having the bit BTXTIO=1 means that if the printer is not ready and the *Diplomat jrNS* is unable to become master, the *Diplomat jrNS* will reset the TCP session. Furthermore, if during the file transfer the printer goes off-line and ceases to respond, the *Diplomat jrNS* will close the TCP session from its side thus indicating to the Unix system that the file transfer had failed.

Example 2 A cash register uses IBM3780 to receive credit card control information and to report on the transactions it has performed. Two way data flow is required. The network host might be an NT server for example. The data is ASCII treated as binary in an EBCDIC envelope so translation is not needed but selection of Transparent Text Mode is.

Configuration Byte B would be set to 00011010
Configuration Byte A would be set to 01100011
Configuration Byte I would be set to 00000001
Configuration Byte T would be set to 10000111

Once the NT system has initiated a TCP session it will stay up until one side or the other closes it. If the NT system closes the session the cash register will be sent a DLE EOT which should abort the line. If the cash register sends DLE EOT at any time the Diplomat will close the TCP session. Each packet sent by the NT system is sent as a file to the cash register and the cash reqister uses RVI commands to request a line turn around from the Diplomat if it has something to send.

LED Indicators

The *Diplomat jrNS* has three LED indicators to provide basic operational status. The red LED by the power socket indicates that +5 volts is available internally. The other two LEDs are by the network connectors.

The green LED illuminates if a good 10Base-T connection has been made.

The yellow LED blinks whenever a packet is received from the network. If 10Base-2 is selected then it also blinks when a packet is transmitted.

Basic Error Conditions

There is very little that can fail on the *Diplomat jrNS* that will not result in complete unit failure necessitating return of the unit to the factory for repair. Most trouble shooting will revolve round the units relationship with the network it is connected to. Extensive tools have been provided to assist in the tracking down of network problems. However we will first of all deal with the identification of the cause of a units failure to operate.

a) Red LED is not illuminated - no volts

i) Check mains power by plugging in another device eg. desk lamp
ii) Check volts at end of power lead.
If <+7volts DC power adaptor is dead
Return unit and adaptor to supplier (see page 4)

b) Green LED is not illuminated when using UTP cable

i) Try different port or hub, power-up unit
ii) Try different cable, power-up unit
iii) Try 10Base-2 port if possible, power-up unit
Return unit and adaptor to supplier (see page 4)

c) Cannot get Remote Menu up

i) Check that the configuring Host jrN or program is able to reach the default declared IP address of the *Diplomat jrNS*.
ii) Reset the Diplomat to default settings and try again. (See Page 9)

Return unit and adaptor to supplier (see page 4)

Statistics Display Port A

Typing 'M' from the Main menu will produce a list of statistics about the traffic observed on the BSC link.

```
Collected Statistics since last Reset.

False Starts             :       0
Line bids rejected by us :       0
Hardware Errors          :       0
Communications Aborts    :       0
Received Text Blocks     :       0
Received Blocks in Error :       0
WACKs sent by us         :       0
Number of RVIs received  :       0
Files Received           :       0
Transmitted Text Blocks  :       0
Repeat requests received :       0
Response failed to arrive:       0
TTDs sent by us          :       0
Files Transmitted        :       0
Current State 3780 Idle

<CR> Returns to Previous Menu
```

Statistics Display Port B

Typing 'S' from the Main Menu will produce a list of statistics which can give a clue as to where the problem could be coming from.

```
Diagnostic Display of Monitored Counters

All counters except the clock are now reset

Number of Seconds since last initialisation - 19

Number of Packets for this unit  -          0
Number of Multicast Packets seen -          0
Number of Broadcast Packets seen -          0
Number of Transmitted Packets    -          0

Count of Unknown Ethernet Types  -      0
Count of Bad IP Datagrams -      0
Count of Bad TCP Segments -      0

Count of Receive Buffer Overruns -      0
Count of Failed DMA Transfers    -      0
Count of Aborted Transmissions   -      0
Count of Hardware Exceptions     -      0
Number of Free Buffers -   16
Lowest number of buffers - 14
Count of Software Ints. - 0
No Current TCP Session

<CR> Returns to Previous Menu
```

Any significant counts in the Hardware Exceptions, Aborted Transmissions or Bad Asynch inputs could be an indication that the unit was beginning to fail.

Counts of Bad IP Datagrams, TCP Segments and Unknown Ethernet types is an indication of a failing network which could also generate some of the other counts already mentioned.

If the number of free buffers ever reaches zero then there is a serious internal problem.

Network Trouble Shooting

Typing 'N' at the Main Menu brings up the Network Control Menu which we have seen before.

```
Network Control Menu  -
Diplomat is configured as a TCP Server

Our Ethernet Address is  - 00 A0 EF 00 00 0C
Our Diplomat IP Address is  - 128.18.18.12
Default Remote  IP Address  - 128.18.18.255
Default Gateway IP Address  - 128.18.18.255
Default Sub-Net Address Mask  - FFFFFF00
Default TCP/UDP  Service Port Id.  -   7000
Status of TCP Session  - CLOSED

<O> Set Our IP Address
<S> Set Remote/Server IP Address
<G> Set Gateway IP Address
<M> Set Sub-Address Mask
<P> Set Server Port Id.
<C> Set Client Port Id.
<F> Firewall Definition Menu
<A> Broadcast ARP Request
<B> Broadcast BOOTP Request
<R> Broadcast RARP Request
<E> Send ECHO Request to Remote

<CR> Returns to Previous Menu
```

There are two commands that are most useful in probing the network to find out if the Remote Host that the *Diplomat jrNS* is trying to work with is actually reachable.

If the Remote Host is on another network segment and it is necessary to go via the Default Gateway then the link to the Gateway should be tested first. To do this it is necessary to temporarily change the Remote Server IP address to be the same as the Default Gateway. When the path to the Default Gateway has been verified then the Remote Host IP Address can be entered into the Remote Server IP address again to test its reachability.

Typing 'A' causes the *Diplomat jrNS* to send an ARP packet to the Remote Server Address. The time it takes to receive a reply is displayed in microseconds but is only accurate to ten microseconds. If no reply is forthcoming and no error messages have appeared (see later) then either the IP address was wrong or the network has failed between the *Diplomat jrNS* and the destination.

Depending on the amount of knowledge that is available about the topology of the network other IP addresses can be used to test various segments of a longer path.

If a reply is received this shows that at least the low level drivers at the Remote Host are functioning. To test that there is an IP stack loaded on the remote host and that it is alive type ‘E’. This sends an ICMP echo request (ping) to the Remote Host and if there is a reply the *Diplomat jrNS* will display a transit time.

The BOOTP option remains undefined.

Typing 'R' causes the *Diplomat jrNS* to broadcast a RARP request. If a RARP server exists on the network and if it responds with an IP address for the *Diplomat jrNS*, then that address will be used as the *Diplomat jrNS's* IP address.

Error Messages

There are three types of messages, those originating from error conditions detected by the *Diplomat jrNS* itself and those that are reported by the network and are translated into a readable text for the user. Internal error messages are bracketed by three asterisks and remote messages by three plusses. Simple informative messages are not bracketed.

The display of local and informative messages is controlled by switch BEXREP in Configuration Byte A and the display of remote messages by switch BEXREP in Configuration Byte B.

The following table lists all messages which should explain themselves.

Informative Messages
Coax Cable detected
UTP Cable detected
Establishing TCP Connection - Please Wait
Local Error Messages * message*** **
No Destination IP on local Subnet
Trying to Contact IP Address
Cannot Initiate in Server Mode
Failed to Open a link
Run out of buffers
Could not send Option (Telnet)
No TCP Session Established
Failed to Send Data
Failed OPEN
Remote Error Messages +++message+++
Network Unreachable
Host Unreachable
Protocol Unreachable
Port Unreachable
Fragmentation Needed
Source Route Failed
Destination Unreachable

If enabled, these messages are sent as ASCII or EBCDIC text, depending on the value of BEBCHC, using an ETX terminated frame. If the *Diplomat jrNS* is in Slave Mode it issues an RVI to become bus master.

Synchronous Port A

The table below shows the pin connections to this port connector. This port is normally connected to a modem or other synchronous peripheral and is a male 25 pin D-type configured as a serial synchronous DTE.

PIN NO.	**RS232 SIGNAL**	
1	G	Protective Ground connects to chassis and power supply ground
2	TX	Diplomat Transmits serial synchronous data on this line
3	RX	Diplomat Receives serial synchronous data on this line
4	RTS	Diplomat asserts RTS when it wants to transmit data
5	CTS	Must be high to enable Diplomat to Transmit
7	SG	Signal Ground is connected to power supply ground
8	DCD	Must be held high before data is received by the Diplomat
15	TXC	Transmit clock internal/external determined by links
17	RXC	Receive clock internal/external determined by links
20	DTR	Held high by Diplomat when powered up
24	EXC	Internal clock always available

The use of screened cable is recommended with the screen being connected to the metal shell of the connector at both ends. It should also be verified that the screen is connected to the pin 1 conductor at least at one end of the cable. On installation it is good practice to verify that the case of the Diplomat is at the same nominal potential as the rack in which it is mounted.

The mating connector must be fixed to the mounting pillars provided to avoid accidental removal and to provide ground continuity for the screen. The above measures are important to minimize susceptibility to electrical noise and radiated RF interference.

The DTR signal from the Diplomat has a source impedance of 1Kohm to +5VDC. This means that it can drive one standard RS232/V28 input (>3Kohm) with a safety margin of 0.75V over the 3V minimum. If it is used to drive two inputs there is zero margin and if the load presented to the pin is less than 1.5Kohm the state of the pin will be indeterminate. It is recommended therefore that all the Port A outputs on the Diplomat jrNS be used to drive a single RS232/V28 input only.

Network Interface Port B

Optional 10 Base-2 Coax Connector

10Base-T UTP Connector

Green LED

Yellow LED

Flashes for every packet transmitted or received

Illuminates when the link is enabled (UTP only)

10Base-T Connection

Pin 1	Tx+
Pin 2	Tx-
Pin 3	Rx+
Pin 6	Rx-

Product Details

Product name	Diplomat™ jr
Model	jrNS
Serial Number	
Configuration Code	
Firmware Reference	JRN-IB8 Rev. 1.30
Issue Date	25/11/02
Special features/notes	
Default IP Address	. . .

Technical Data

Weight & Dimensions

Height x width x depth	25mm x 175mm x 110mm
Weight	350g

Electrical Requirements

Power to Diplomat jr	8±1 Volt DC 500mA
Power to adaptor	220-240 VAC 50Hz or 90-120VAC 60Hz

Operating Environment

Temperature	0-50°C
Humidity	0-90% non-condensing

External connectors

Power	3.2mm jack socket positive tip
Network	10Base-T UTP or (optionally) 10Base-2 Coax
Serial Port	25 pin male D-type RS232

External Indicators

Red LED	indicating +8Volts present
Greed LED	indicating UTP link enabled
Yellow LED	indicating packet transmitted or received

Configuration

Menu driven, remotely

Data Rates

Synchronous up to 38.4 Kbps
Network 10Mbps Half Duplex

ASCII	EBCDIC
0	0
1	1
2	2
3	3
4	55
5	45
6	46
7	47
8	22
9	5
10	37
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	60
21	61
22	50
23	38
24	24
25	25
26	63
27	39
28	21
29	29
30	30
31	31
32	64
33	90
34	127
35	123
36	91
37	108
38	80
39	125
40	77
41	93
42	92
43	78
44	107
45	96
46	75
47	97
48	240
49	241

ASCII	EBCDIC
50	242
51	243
52	244
53	245
54	246
55	247
56	248
57	249
58	122
59	94
60	76
61	126
62	110
63	111
64	124
65	193
66	194
67	195
68	196
69	197
70	198
71	199
72	200
73	201
74	209
75	210
76	211
77	212
78	213
79	214
80	215
81	216
82	217
83	226
84	227
85	228
86	229
87	230
88	231
89	232
90	233
91	77
92	224
93	93
94	95
95	109
96	121
97	129
98	130
99	131

ASCII	EBCDIC
100	132
101	133
102	134
103	135
104	136
105	137
106	145
107	146
108	147
109	148
110	149
111	150
112	151
113	152
114	153
115	162
116	163
117	164
118	165
119	166
120	167
121	168
122	169
123	192
124	106
125	208
126	161
127	7

EBCDIC	ASCII
0	0
1	1
2	2
3	3
4	0
5	9
6	0
7	127
8	0
9	0
10	0
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	0
21	6
22	8
23	0
24	24
25	25
26	0
27	0
28	0
29	29
30	30
31	31
32	0
33	0
34	28
35	0
36	0
37	10
38	23
39	27
40	0
41	0
42	0
43	0
44	0
45	5
46	6
47	7
48	0
49	0

EBCDIC	ASCII
50	22
51	0
52	0
53	30
54	0
55	4
56	0
57	0
58	0
59	0
60	20
61	21
62	0
63	26
64	32
65	163
66	164
67	165
68	166
69	167
70	168
71	248
72	170
73	171
74	163
75	46
76	60
77	40
78	43
79	124
80	38
81	186
82	187
83	192
84	193
85	189
86	188
87	196
88	197
89	198
90	33
91	36
92	42
93	41
94	59
95	152
96	45
97	47
98	199
99	200

EBCDIC	ASCII
100	201
101	208
102	209
103	210
104	211
105	212
106	153
107	44
108	37
109	95
110	62
111	63
112	213
113	154
114	155
115	156
116	157
117	224
118	226
119	227
120	228
121	96
122	58
123	35
124	64
125	39
126	61
127	34
128	181
129	97
130	98
131	99
132	100
133	101
134	102
135	103
136	104
137	105
138	161
139	230
140	231
141	232
142	233
143	240
144	241
145	106
146	107
147	108
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EBCDIC	ASCII
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EBCDIC	ASCII
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EBCDIC	ASCII
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254	254
255	255