BT-1

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1. DESCRIPTION

The BT-1 BERT tester is a digital RS-232 test set for modems, DSUs, line drivers, multiplexers, terminals, printers, etc. Test functions include:

- Bit Error, Block Error and Mirrored Bits tests

- Polling tests (proprietary, DNP3 and Modbus)

- The BT-1 can function as a DNP3 or Modbus host or drop.

- Timing tests

- Function tests to toggle RTS, monitor DNP3 or Modbus addresses

- Synchronous or asynchronous operation

2.   SPECIFICATIONS

2.1   General

      DTE Interface with DB-25 male connector
      Input pins: 3, 5, 6, 8, 15, 17
      Output on pins 2, 4, 11, 20, 24 (pin 11 is tied to pin 20)
      Test voltages: +v on pin 9, -v on pin 10
      32 character LCD display (16 characters per line, 2 lines)
      16 character keypad

2.2   DTE Timing

      Asynchronous speeds of 75, 110, 300, 600, 1200, 1600, 1800, 2400,
          4800, 7200, 9600, 14,400, 19,200,and 38,400 bps
      Synchronous speeds to 64,000 bps

2.3   Physical/Electrical

      4" W x 1.75" D x 7" H
      120 VAC, 4 Watts
      External 9 VDC, 500 ma power supply provided

2.4   Environmental

      Operation: 0 to 65° C, 10 to 85% relative humidity
      Storage: -40 to 85° C, 10 to 85% relative humidity

3.   INSTALLATION

3.1   Unpacking

The following is included with each BT-1:

- BT-1 test set
- External power supply, 9vdc, 500 MA
- DB-25 male/female to DB-25 male/female ribbon cable
- DE-9 male/female to DE-9 male/female ribbon cable
- 9 pin and 25 pin adapters and cables for monitor functions
- manual

3.2   Location

Place the BT-1 in an area where you can reach the front panel keypad and where you can reach to connect the cables. The BT-1 has an external power supply that is plugged into a 120 VAC outlet. The power cord length is about 6 feet.

3.3   Setup

The BT-1 is setup using the 16 key keypad. The first step is typically to set the operating parameters (speed, parity, etc) selected by using the "SET PARM" key. Then the test is selected using the "SET TEST" key.

Move around the screen using the arrow keys. The parameter to be changed will flash on the LCD screen. Values are changed using the "INCR" and "DECR" keys.

Some screens have the ">" character on the bottom right hand side. This indicates the screen choices are more than 16 characters wide. Use the right or left arrow keys to view the extended screen.

The BT-1 can often be used to perform a test right out of the box. The defaults are as follows:

    9600 bps, 8 data bits, one stop bit, no parity
    Bert test: async, QBF message, CTS flow control

4. OPERATION

4.1 Keypad

RE-SET	RUN	WAIT	STOP
SET PARM	SET TEST	DNP3	CLR/ZERO
DECR	⬆	INCR	ERR INJ
⬅	⬇	➡	MOD BUS

TOP ROW OF KEYS:
RESET   Resets the unit
RUN   Starts running a test
WAIT   Halts a test without stopping it. "Wait" toggles
                the test off and on.
STOP   Stops the test

SECOND ROW OF KEYS:
SET PARM   Selects test parameters
SET TEST   Selects test to run
DNP3   Direct access to DNP3 tests
CLR/ZERO   Clears counters while test is running

THIRD ROW OF KEYS:
DECR   Decrements a value
UP ARROW   Move up a line on the LCD display
INCR   Increments a value
ERR INJ   Injects an error while a bert test is running

BOTTOM ROW OF KEYS:
LEFT ARROW   Move left on the LCD display
DOWN   Move down a line on the LCD display
RIGHT ARROW   Move right on the LCD display
MODBUS   Direct access to MODBUS tests

5

4.2   LCD Display Screen

The LCD screen is 2 lines, 16 characters per line. Most settings fit on a
single screen. There are, however, a few double wide screens. Under
SET PARM, the RTS HOLDOVER screen is double wide. The polling
set ups for both the host and the drop units, under SET TEST, are also
double wide. The Bert test results and the Polling test results also use
double wide screens. These screens have the ">" character at the
bottom of the screen. Use the right or left arrow to get to the second
half of the double wide setup screens. See example below:

1st screen	2nd screen
SENT RCVD SYNC	BLKER BITER SEC
xxxx xxxx Good **>**	**<**xxxx xxxx xxxx

4.3 Getting Started

Most functions of the BT-1 are done with just a few keys. The SET
PARM is used to set the speed, parity, word length, and test duration.
The SET TEST key selects the test to be performed. The ARROW keys
get you around the screen. The INCR and DECR keys change the
values on a screen. For example, the speed is changed using the INCR
and DECR keys. RUN initiates the test, WAIT halts the test, STOP
stops any test.

4.3.1   Setting Parameters

Use the SET PARM key to set parameters for timing, character length
and parity, RTS Holdover/TXD Holdoff, test time, and Xon/Xoff values.
Press the SET PARM to toggle from one parameter to the next. Use
the ARROW keys to navigate around the screen and use the INCR and
DECR keys to change values

4.3.2   Timing

The timing parameter sets the asynchronous speed from 75 to 38,400
bps, or to external clock. External clock is used when connecting the
BT-1 to synchronous communications devices (synchronous modems,
DSUs, etc.). Use the INCR and DECR keys to change the speed. Note
that it is possible to run a BERTA (async bert) test using external
clock.

4.3.3   Character

Character length can be 5, 6, 7 or 8 data bits. Parity can be even, odd or none. Stop bits can be 1, 1.5 or 2 per character. Use the INCR and DECR keys to change values.

4.3.4   RTS Holdover/TXD Holdoff

The RTS holdover value keeps RTS on all the time if set to CONSTANT ON. If one of the values (from 0 to 100 milliseconds) is picked, then RTS will turn off after each poll or response and between each Bert message, at the end of the message plus the millisecond time value. An example of the use of this function is when testing modems, DSU's or line drivers in switched carrier mode to determine if the modem, DSU or line driver is dropping carrier detect during the transmission of the last character of a message.

TXD Holdoff is the period of time between turning RTS on and sending the Bert message or a poll. The value of the holdoff ranges from 0 to 100 milliseconds.

4.3.5   Stop Test

The stop test parameter can be disabled to allow constant sending of data, or the test can run for from 10 seconds to 30 minutes, or until there is an error. The stop on error will stop a Bert test when the BT-1 sees a receive data error. The stop on error function is an excellent tool to use along with a data line monitor to trap data errors when debugging equipment.

4.3.6   Xon/Xoff

The Xon/Xoff parameter allows for changing the flow control characters of Xon/Xoff from the typical hex 11 and hex 13 to other values.

4.4 Setting tests (SET TEST)

Use the SET TEST key to select the BertA, BertS, Poll, Time or Function tests. Press the SET TEST key to toggle from one test group to the next.

4.4.1   BertA Tests

The BertA is the asynchronous bert (bit error rate test). This test is used to determine if there are bit and/or block errors. When running the BertA tests, the BT-1 expects Data Carrier Detect (pin8) and Clear to Send (pin 5) to be asserted. Parameters include:

QBF – A "Quick brown fox" message. Please note that while many test sets use "quick brown fox", there is no standard message. There is no standard for upper and lower case, spacing, the inclusion (or not) of "0123456789" at the end of the message, concluding the message with a space or no space, or ending a carriage return/line feed or just a carriage return. The QBF message used in the DCB BT-1 is most likely unique to the BT-1.

QBF# – "Quick brown fox" with a block number at the end, where the block number ranges from 000 to 999, then starts again at block number 000. This test is useful when generating data for devices that have buffer memory. If some data is lost due to circular buffer errors, data received out of order, etc, this test plus a data line monitor quickly reveal the out of order data.

ABC – Sends all printable characters

MBit – This Mirrored Bits test has two options: 4-byte (4BYT), the default, and 1-byte (1BYT) test message length. The delay between test messages can be set in 1ms increments between 2ms, and 9ms, the default is 4 ms. Mirrored Bits is a communications protocol developed by Schweitzer Engineering Laboratories (SEL). It is a relay to relay logic communications used by utilities to monitor and control relays.

ALT – Sends alternate mark/space character ("U")

63 – Sends 63 bit pseudo random word

511 – Sends 511 bit pseudo random word

2047 – Sends 2047 bit pseudo random word

ALL – Sends all 256 hex values of an 8 bit character, hex 00 to hex FF

The test pattern selected can be sent continuously (CONT), at a 25%, 50%,or 75% duty cycle, or just once.

Flow control can be set to Clear to Send (CTS), Xon/Xoff, or inverted Clear to Send (CTS-H). These are choices for having the output of the BT-1 halted by the attached communications equipment.

Input flow control can be set to NONE, Busy High, Busy Low, or Xon. Frequency for the bert to stop incoming data can be set to intermittent (INTMT is about 8 seconds off, 2 seconds on in a repetitive cycle), or to frequent (FRQNT is about 2 seconds on, 2 seconds off).

Test results are on 2 screens. The right and left arrow keys are used to move between the screens. Test results are as follows:

```
     1st screen      │     2nd screen
SENT RCVD SYNC        │ BLKER BITER   SEC
xxxx xxxx Good >      │ <xxxx   xxxx xxxx
```

4.4.2   BertS Tests

The BertS is the synchronous Bert (bit error rate test). This test is also used to determine if there are bit and/or block errors. The six BertS choices are the same as the BertA tests. These are QBF, ALT, 63, 511, 2047 and ABC. BertS tests do not include QBF#, Mbit or ALL.

BertS character patterns for QBF, and ABC are externally clocked but use the start and stop bits on the data. The ALT, 63, 511 and 2047 tests do not include the start and stop bits. When running the BertS tests, the BT-1 expects Data Carrier Detect (pin8) and Clear to Send (pin 5) to be asserted.

Test results for the BertS tests are the same as for the BertA tests.

4.4.3   Poll Tests

DCB HOST

The polling tests require one BT-1 to be set as the host unit. The setup screen is a double wide screen, where the 2 halves of the setup screen are accessed using the right and left arrow keys(> and <).

```
     1st screen      │     2nd screen
Poll:DCB HOST-01      │ TMO=2.0s
ASy  9600  1.0s>      │ <LEN=20->29
```

HOST–XX selects the number of remotes to poll, ranging from 01 to 16.

ASy or 2Sy through **6Sy** sets the polling test to be either async with start and stop bits, or synchronous 8-bit data. The **2**, **3**, **4**, **5** or **6Sy** sets

the number of sync characters at the front of the polling message. The value of the sync character defaults to hex 16, which is the ASCII syn character. The value of the sync character can be changed using the SET PARM key, pressing it until the parameter option rolls to **SET: SYNC CHAR**.

1.0s is the default time in seconds for the host to poll another drop after getting a correct response from a polled remote drop. This parameter is used to simulate processing time between polls in a host computer. Values range from 0.0 to 5.0 seconds.

9600, etc., is the async speed of the polling test, if set to **ASy**. The screen shows "—" if set to **xSy**.

TMO is the timeout, and can range from 0.5 seconds to 9.5 seconds. Timeout is how long the host will wait for a poll response before continuing to poll other drops. A timeout typically occurs when a remote unit fails to respond to a poll, usually due to a data error.

LEN=20–>29 is the number of characters sent in the poll. The maximum number is 119. The data is "ABCDEF…". This message is echoed back from the drop as a response to the poll.

Test results are as follows:

1st screen	2nd screen
POLL RESP TMO	POLxx RESP
xxx xxx xxx **>**	**<** xxx xxx

The right hand side of the screen shows the results for each drop unit that is being polled. In the above example, the POLxx refers to one of the drop numbers, which can range from 01 to 16.

DCB DROP

Up to 16 drop units can be set up for polling. Each drop gets a separate number, ranging from 01 to 16.

Screen
Poll:DCB DROP=01
ASy 9600   0m

DROP=xx sets the drop number.

ASy is used to set the polling to async (ASY) or to set the number of sync characters at the front end of synchronous polling (2Sy to 6Sy).

9600, etc., is the async speed of the polling test, if set to **ASy**. The screen shows "—" if set to **xSy**.

xxxm Sets the time in milliseconds for the drop to delay the response to the host poll. Values range from 0 to 300ms in 25ms increments.

Test results are as follows:

Screen
POLxx RESP
xx   xx   r

DNP HOST

The DNP host poll is a request for a 16-bit analog input register in group 30, variance 2, with the register address set by the "R:0001" configuration parameter on the right HOST configuration screen.

1st screen	2nd screen
Poll:DNP HOST-01	TMO=2.0s R:0001
ASy 9600 1.0s>	<ADR01=10000

HOST–XX selects the number of drops to poll, ranging from 01 to 16.

9600 is the default async speed of the polling test. The speed can be higher or lower using the INCR and DECR keys.

1.0s is the default time in seconds for the host to poll another drop after getting a correct response from a polled remote drop. This parameter is used to simulate processing time between polls in a host computer. Values range from 0.0 to 5.0 seconds.

TMO is the timeout, and can range from 0.5 seconds to 9.5 seconds. Timeout is how long the host will wait for a poll response before continuing to poll other drops. A timeout typically occurs when a remote unit fails to respond to a poll, usually due to a data error.

R: is the RTU register that will be queried. To change values, use the right or left arrow keys until one of the digits flashes, then use the INCR/DECR keys to change the value. Register 0001 is the default.

ADRxx=xxxxx is the drop number and DNP3 address. The default value for 00 (host) is 10000. The default values for the other drops are 01=10100, 02=10200, and so on up to 16=11600. To change the values, use the right and left arrow keys until a digit flashes, then use the INCR/DECR keys to change the values.

Test results are as follows:

```
     1ˢᵗ screen     │     2ⁿᵈ screen
 POLL RESP   TMO    │  PLxx RESP DATA
 xxxx xxxx xxxx >   │ <xxxx xxxx*xxxxx
```

The right hand side of the screen shows the results for each drop unit that is being polled. In the above example, the **PLxx** refers to one of the drop numbers, which can range from 01 to 16.

The title DATA on the top line of the 2ⁿᵈ screen shows three different status messages: StsOK (status OK), OffLn (off-line), and OTHER (all other status). When the host receives the drop response with the Internal Indicators set to 0 (means the point exists) and the point status on-line bit set to 1, the status shows StsOK. If the on-line bit is set to 0, the status shows as OffLn. If there is no response or the point does not exist, the status shows OTHER. The status messages apply only to DNP3 host mode. The asterisk (*) indicates a poll response.

The DATA value will increment by one each time if the response is from a BT-1, starting at 00000, then 00001, 00002, 00003, etc.

DNP DROP

Up to 16 drop units can be set up for polling. Each drop gets a separate reference number, ranging from 01 to 16. The DNP Drop will respond to any poll from any host address, and the response is returned to the host's DNP address. The poll response reports a DNP 16-bit analog input register in group 30, variance 2, with a register address set by the "R:0001" on the right DROP configuration screen.

```
     1ˢᵗ screen     │     2ⁿᵈ screen
 Poll:DNP DROP=01   │ R:0001    D=00000
 ASy  9600     0m>  │ <ADR01=10100
```

DROP=xx sets the drop reference number. This can be 01 through 16.

9600 is the async speed of the polling test.

0m Sets the time in milliseconds for the drop to delay the response to the host poll. Values range from 0 to 300ms in 25ms increments.

R: is the one and only register address that can be set for the DNP drop

D= is the value of the register. The default value is 00000. When the drop is polled by a Host, the register value increments 1 after each poll. At the Host BT-1, the received values will be 00000, 00001, 00002, etc.

ADR is the drop number and DNP3 address. The default values for the drops are 01=10100, 02=10200, and so on up to 16=11600. To change the values, use the right and left arrow keys until a digit flashes, then use the INCR/DECR keys to change the values.

Test results are as follows:

Screen
PLxx RESP DATA
xxxx xxxx xxxxxr

The "r" flashes to show the test is running. The **PLxx** and **RESP** numbers are the number of polls received and responses sent back to

Link Status Test (V 5.8 firmware and above) When running in DNP DROP mode, the BT1 responds to both the standard DNP HOST poll and the DNP3 Link Status request. The main DNP DROP setup screen includes an option to set the DFC bit flag to 0(default, 0x0B) or 1(0x1B) in the Link Status response.

```
 |---------------------------------+
 | Poll:DNP DROP=01 -----|
 | DFC0 9600 0m>  -------- |
 +---------------------------------+
```

DFC=0 is selected in the display image above. To change the DFC setting, use the arrow keys to access the DFC0 then INC and DEC to toggle between DFC0 and DFC1. When the BT1 is reset, DFC0 is the default setting.

Note that the DNP DROP only decodes two incoming commands: 0xC4 (DCB Host poll) and 0xC9 (Link Status request). The Link Status response is a 10-byte message that includes a Data Flow Control (DFC) bit to signal whether the secondary station is ready for subsequent primary station data commands. All other DNP3 commands are ignored.

MB HOST

The MB host issues a poll to read one 16-bit holding register at the address set by the "R:40001" on the right MB configuration screen. The

actual drop holding register is one less than the number shown in the last four digits of the "R:4xxxx" setting. For the default "R:40001", holding register 0000 is requested.

1st screen	2nd screen
Poll: MB HOST-01	TMO=2.0s R:40001
8N2 9600 1.0s>	<ADR01=101

HOST–XX selects the number of remotes to poll, ranging from 01 to 16.

8N2 sets the character length, parity and stop bits. Other choices are 8E1 and 8O1.

9600 is the async speed of the polling test.

1.0s is the default time in seconds for the host to poll another drop after getting a correct response from a polled remote drop. This parameter is used to simulate processing time between polls in a host computer. Values range from 0.0 to 5.0 seconds.

TMO is the timeout, and can range from 0.5 seconds to 9.5 seconds. Timeout is how long the host will wait for a poll response before continuing to poll other drops. A timeout typically occurs when a remote unit fails to respond to a poll, usually due to a data error.

R: is the register value to be queried by the polling host.

ADR is the Modbus address. Modbus hosts do not have addresses. Only the Modbus drops have addresses. The highest possible Modbus drop address is 247. Default addresses are 01=101, 02=102 and so on up to 16=116. To change the values, use the right and left arrow keys until a digit flashes, then use the INCR/DECR keys to change the values.

Test results are as follows:

1st screen	2nd screen
POLL RESP TMO	PLxx RESP DATA
xxxx xxxx xxxx **>**	**<**xxxx xxxx xxxxx

The right hand side of the screen shows the results for each drop unit that is being polled. In the above example, the **PLxx** refers to one of the drop numbers, which can range from 01 to 16. The DATA field will increments (if the response is from a BT-1) starting 00000, then 00001, 00002, 00003, etc.

MB DROP

Up to 16 drop units can be set up for polling. Each drop gets a separate number, ranging from 01 to 16. When polled, the MB DROP always responds with the configured holding register address and data contents.

1st screen	2nd screen
Poll: MB DROP=01	R:40001 D=00000
8N2 9600 0m>	<ADR01=101

DROP=xx sets the drop number.

8N2 sets the character length, parity and stop bits.

9600 is the async speed of the polling test.

0m Sets the time in milliseconds for the drop to delay the response to the host poll. Values range from 0 to 300ms in 25ms increments.

R: is the register value to which the drop will respond if queried.

D= is the value of the register. The default value is 0000.

ADR is the Modbus address. The highest possible Modbus drop address is 247. Default addresses are 01=101, 02=102 and so on up to 16=116. To change the values, use the right and left arrow keys until a digit flashes, then use the INCR/DECR keys to change the values.

Test results are as follows. The data value increments one per poll during the test. The value starts at 00000 and then increments to 00001, 00002, etc.

```
        Screen
PLxx RESP DATA
xxxx xxxx xxxxxr
```

4.4.4   Time Tests

Time tests are a collection of measurements, ranging from Request to Send/Clear to Send delay measurements, to round trip echo timing, to character counting. The results of the tests are in milliseconds, number of characters or positive or negative (high/low) signal levels. The test are as follows:

RTS/CTS DLY measures the time from the BT-1 asserting RTS (pin 4) until CTS (pin 5) is returned from the attached equipment.

ECHO 1 CHAR measures the time it takes for a single character to be sent from the BT-1 and echoed back to it.

ECHO CONT measure the time it takes for characters to be sent from the BT-1 and echoed back to it.

CHAR COUNT counts the number of characters received over a number of seconds.

CHAR LOOP counts the number of characters received on the RXD input and keeps track of the number of parity and framing errors detected.

SHORT BREAK sends out a break, or positive voltage level, on the transmit data lead for 1/2 second.

16

LONG BREAK sends out a break, or positive voltage level, on the transmit data lead for 2 seconds.

MARK/SPACE sends out a constant mark (negative voltage), constant space (positive voltage) or alternating mark/space. The INCR and DECR keys can be pressed while the test is running the change between the three values.

MODEM RATE measures the data rate of the clock input to pin 15, rounded off to the nearest typical modem speed. Typical speed results are 1200, 1800, 2400, 4800, 7200, 9600, 19200, 38400.

CLOCK RATE measures the data rate of the clock input to pin 15 based on a 100 microsecond internal timer. The BT-1 sends out a fixed number of characters, measure the time it takes to send them and then calculates the rate of speed. At 9600, the BT-1 gives a result of 9597 or 9606. At 1200 bps, the resolution is .14 bps, and at 56000 bps the resolution is 314 bps.

BIT SLIP is used to detect bit error in synchronous systems where the errors are the result of bit slippage. The test measures bit slip or bit gain. The BT-1 sends out a pattern of 001100110011, etc. and looks for a gain or loss of one of the bit pairs. The bit slip test can specifically isolate bit gain or slip. The bit slip test can be run in loopback or from one BT-1 to another. The BIT SLIP test is useful for detecting timing problems. For example, if one were using 56Kbps DS-0 RS232 channels on a channel bank, and the channel banks were independently timed, rather than one channel bank drop timed to the other, it is likely that there will be bit slips, as the 2 independent clocks move in and out of phase with respect to each other.

4.4.5   Function (**FCN**) Tests

The Function, or **FCN** tests, tests are a collection of measurements, ranging from Request to Send/Clear to Send delay measurements, to round trip echo timing, to character counting. The results of the tests are in milliseconds, number of characters or positive or negative (high/low) signal levels. The test are as follows:

DNP TO is a monitor function. It shows the DNP "TO" address in a poll. If it is monitoring a host, this test will show all the DNP address that are being polled. If the BT-1 is monitoring a drop, it will show the address of the host that is being answered.

DNP FROM is a monitor function that shows the DNP "FROM" address. If monitoring the host, it shows the host address. If the BT-1 is monitoring a drop, it will show the drop address.

MB RTU is a monitor function. It shows the Modbus addresses that are being polled.

RTS+ toggles the RTS lead (pin 4) from an off state to an on state for a period ranging from 0.5 milliseconds to 30 milliseconds. It does this once, or 1, 2 , 5 or 10 times per second.

RTS– toggles the RTS lead (pin 4) from an on state to an off state for a period ranging from 0.5 milliseconds to 30 milliseconds. It does this once or 1, 2, 5 or 10 times per second.

5. INTERFACE SIGNALS

5.1 RS-232D / V.24 Interface (DB-25P)

Pin	Signal Name	In/Out
1	Frame Ground	---
2	Transmit Data	OUT
3	Receive Data	IN
4	Request to Send	OUT
5	Clear to Send	IN
6	Data Set Ready	IN
7	Signal Ground	---
8	Data Carrier Detect	IN
9	+ test voltage	OUT
10	– test voltage	OUT
11	Busy (tied to pin 20)	OUT
15	Transmit bit clock	IN
17	Receive bit clock	IN
20	Data Terminal Ready	OUT
24	External Transmit Clock	OUT

> **Note:** Pin 24 external clock rate is 16 times the async rate set in the "Set Parm" menu. For example, if the async rate is set to 1200, then the clock rate on pin 24 is 16 times 1200, or 19,200 bps.

5.2 Accessories

The following accessories are included with each BT-1 test set. They provide the versatility required for connection in DNP3 and Modbus polling or monitoring applications as well as more conventional RS232 BERT tests.

5.2.1 Cables

25 pin MF/MF ribbon cable, DCB P/N: 9801003
9 pin MF/MF ribbon cable, DCB P/N: 9801035
RJ45 to RJ45 patch cable, 3 ft., black, DCB P/N: 9500056
RJ45 to RJ45 crossover cable, 5 ft., red, DCB P/N: 9500105

5.2.2   Adapters

DNP Rx, DCB P/N: 9802084

RJ45   DB-25S

    3 ———— BLK ———— 3
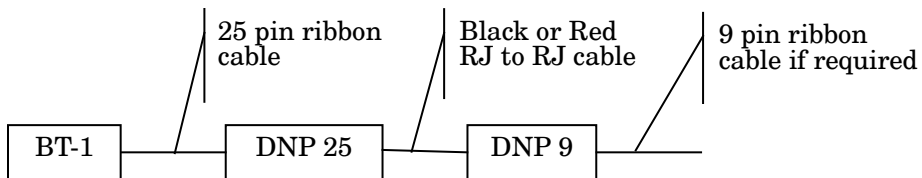   4 ———— RED ———— 7

DNP 25, DCB P/N: 9802083

RJ45   DB-25P
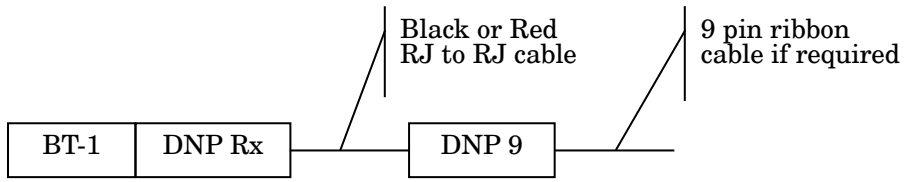
    1 ———— BLU ———— 2
    3 ———— BLK ———— 3
    4 ———— RED ———— 7

DNP 9, DCB P/N: 9802085

RJ45   DE-9P

    1 ———— BLU ———— 3
    3 ———— BLK ———— 2
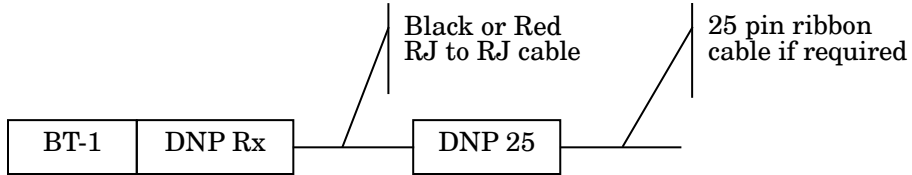   4 ———— RED ———— 5

5.2.3   Applications

9 pin Connection as Host or Drop

25 pin ribbon cable   Black or Red RJ to RJ cable   9 pin ribbon cable if required

| BT-1 | — | DNP 25 | — | DNP 9 | — |

9 pin Monitor Only

Black or Red
RJ to RJ cable

9 pin ribbon
cable if required

| BT-1 | DNP Rx | | DNP 9 | |

25 pin monitor only

Black or Red
RJ to RJ cable

25 pin ribbon
cable if required

| BT-1 | DNP Rx | | DNP 25 | |

6.   WARRANTY

DCB products are warranted to be free of defects in materials and workmanship for two years. Data Comm for Business, Inc. will repair or replace any equipment proven to be defective within the warranty period. All warranty work is F.O.B. Dewey, IL. This warranty is exclusive of abuse, misuse, accidental damage, acts of God or consequential damages, etc. DCB liability shall not exceed the original purchase price.

All equipment returned for repair must be accompanied by a Returned Material Authorization (RMA) number. To receive an RMA number, call (217) 897-6600 between the hours of 8 AM and 5 PM central time. Equipment must be shipped prepaid to DCB and will be returned at DCB's expense.

Ship returned items to:

Data Comm for Business
2949 County Road 1000E
Dewey, IL 61840
ATTN: RMA#

Data Comm for Business, Inc.
PO Box 6329
Champaign, IL 61826-6329

Tel: (217) 897-6600
Fax: (217) 897-1331