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Suppliers' Information Note

For The BT Network

BT KiloStream X.21 Interface Service Description

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1. Introduction

This Suppliers' Information Note (SIN) describes the "BT KiloStream" service using the X.21^[1] and X.21 bis^[2] (V.24 & V.35) interfaces. The SIN provides information about this service for terminal equipment manufacturers and developers.

2. Service Outline

The BT KiloStream service enables the exchange of serial binary synchronous data, using point to point private circuits with digital transmission throughout the network. The service incorporates extensive supervisory, alarm, and testing facilities.

The X.21 / X.21 bis interfaces facilitate full duplex transmission of data at 2400, 4800, 9600, 19200 and 48000bit/s over the network. In addition, an 'unstructured' 64000bit/s facility is available which uses Data and Timing circuits only. X.21 bis (V.24 & V.35) interfaces allow connection of Data Terminal Equipment (DTE) which is designed for interfacing to synchronous V series modems. Table 1 illustrates the range of X.21 & X.21 bis interfaces and associated data speed options.

Table 1: Speeds and interfaces

| Speed kbit/s | X.21 | X.21 bis (V.24) | X.21 bis (V.35) |
|-----------------|------|--------------------|--------------------|
| 2.4 | * | * | |
| 4.8 | * | * | |
| 9.6 | * | * | |
| 19.2 | * | * | |
| 48 | * | | * |
| 64 | * | | |

It should be noted that the KiloStream service enables Network Terminating Units (NTU) [*also known as Data Circuit-Terminating Equipment - DCE*] having an X.21 interface to work to an NTU operating at the same data rate but using an X.21 bis interface, thus giving flexibility in the use of DTE.

3. Service Availability

The BT KiloStream service, implementing the X.21 & X.21 bis interfaces, was launched in 1982 throughout the UK (inland only).

4. Enveloping, Line Rates, & Modulation

The NTU will code contiguous, isochronous binary data received from the DTE into envelopes with a 6 + 2 structure. This procedure applies to all data rates except 64kbit/s which is not structured. The data is then modulated using a diphase modulation technique known as WAL 2. The NTU also performs the complementary demodulation and decoding in the receive path.

5. KiloStream X.21 NTU/DTE Interface

The X.21 interface is a 15 way D-type socket (female) and is available at all speeds. The offering is set as shown in Sec. 5.1 & 5.2 with no variable options.

5.1 2.4 - 48kbit/s structured circuits

Local and remote loops may be activated by means of buttons on the NTU or by the Data Terminal Equipment (DTE).

5.1.1 Remote loops

Remote loops can be applied from the DTE if the following conditions are satisfied:

- The Control (Circuit C) is OFF
- The DTE sends a continuous 11001100 pattern
- This pattern must be preceded by at least one Binary 1 within the preceding 16 bit intervals
- Loop activation is indicated by return of the 11001100 sequence. The DTE responds to loop activation within 0.7 seconds by an OFF to ON transition on the Control (Circuit C)
- The loop will subsequently be removed when an ON to OFF transition is placed on the Control (Circuit C) by the DTE

5.1.2 Local Loops

Local loops can be applied from the DTE if the following conditions are satisfied:

- The Control (Circuit C) at both ends is OFF
- The DTE sends on the T circuit a binary pattern consisting of 11001100 with control OFF
- This pattern must be preceded by a continuous Binary 0 pattern persisting for at least 24 bit intervals
- Loop activation is indicated by return of the 11001100 sequence. The DTE responds to loop activation within 0.7 seconds by an OFF to ON transition on the Control (Circuit C)
- The loop will subsequently be removed when an ON to OFF transition is placed on the Control (Circuit C) by the DTE.

The local loop pattern is referred to as Local Loop Code A. All KiloStream NTUs will respond to this code, although those with an LCD display will also respond to Local Loop Code B. This code consists of a continuous 11110000 pattern. All other conditions are the same as for Local Loop Code A activation.

5.2 64kbit/s unstructured circuits

On X.21 unstructured circuits, test loops can only be applied at the NTU.

5.3 X.21 Interchange Circuits

Table 2: X.21 Interchange Circuits

| ITU-T circuit designation | Direction of signalling | Circuit description | PIN number | |
|---------------------------|-------------------------|-----------------------|------------|----|
| | | | A | B |
| G | | Common return | 8 | - |
| T | DTE-NTU | Transmit data | 2 | 9 |
| R | NTU-DTE | Receive data | 4 | 11 |
| C | DTE-NTU | Control | 3 | 10 |
| I | NTU-DTE | Indication | 5 | 12 |
| S | NTU-DTE | Signal element timing | 6 | 13 |

Circuits working at 64kbit/s data rate are 'unstructured' and use G, T, R and S circuits. However, I circuit will be permanently ON except under fault conditions

6. KiloStream X.21 bis (V.24 & V.35) NTU/DTE Interfaces

These interfaces allow connection of data terminal equipment that is designed for interfacing to synchronous V series modems.

6.1 X.21 bis (V.24 & V.35) Circuit Options

V.24 presentation can be supplied for speeds up to and including 19.2kbit/s using a 25 way D-type socket (female). There are further sub-options on electrical interchange circuits 106, 107 and 108/1 (See Sec. 6.3).

V.35 presentation can only be supplied for a speed of 48kbit/s, using a MRAC 34S-J2 socket (female). There are further sub-options on electrical interchange circuits 106 and 107 (See Sec. 6.3).

6.1.1 Local and Remote Loops

Remote and local loops may be activated from either the NTU or the DTE.

Remote loops are controlled via circuit 140. If this circuit is ON, a remote loop is applied. When the condition on circuit 140 is removed, the loop is deactivated.

Local loops are controlled in a similar manner; but utilise circuit 141.

6.2 X.21 bis (V.24 & V.35) Interchange Circuits

Table 3: Interchange circuits X.21 bis (V.24) [2.4 - 19.2kbit/s]

| ITU-T circuit number | Direction of signalling | Circuit description | PIN number |
|--|-------------------------|--|------------|
| 102 | - | Common return | 7 |
| 103 | DTE-NTU | Transmit data | 2 |
| 104 | NTU-DTE | Receive data | 3 |
| 105 | DTE-NTU | Request to send | 4 |
| 106 | NTU-DTE | Ready for sending | 5 |
| 107 | NTU-DTE | Data set ready | 6 |
| 108/1 | DTE-NTU | Connect data set to line | 20 |
| 109 | NTU-DTE | Data channel received line signal detector | 8 |
| 114 | NTU-DTE | Transmitter signal element timing | 15 |
| 115 | NTU-DTE | Receiver signal element timing | 17 |
| 140 | DTE-NTU | Remote loopback | 21* |
| 141 | DTE-NTU | Local loopback | 18* |
| 142 | NTU-DTE | Test indicator | 25* |
| * If these circuits are not used by the DTE they must be correctly terminated or disconnected (see note 1) | | | |

Table 4: Interchange circuits X.21 bis (V.35) [48kbit/s only]

| ITU-T circuit number | Direction of signalling | Balanced circuit | Unbalanced circuit | Circuit description | PIN designation | |
|--|-------------------------|------------------|--------------------|--|-----------------|---------|
| | | | | | A | T |
| 102 | - | | x | Common return | B | |
| 103 | DTE-NTU | x | | Transmit data | P | S |
| 104 | NTU-DTE | x | | Receive data | R | T |
| 105 | DTE-NTU | | x | Request to send | C | |
| 106 | NTU-DTE | | x | Ready for sending | D | |
| 107 | NTU-DTE | | x | Data set ready | E | |
| 109 | NTU-DTE | | x | Data channel received line signal detector | F | |
| 114 | NTU-DTE | x | | Transmitter signal element timing | Y | AA(a)** |
| 115 | NTU-DTE | x | | Receiver signal element timing | V | X |
| 140 | DTE-NTU | | x | Remote loopback | N* | |
| 141 | DTE-NTU | | x | Local loopback | L* | |
| 142 | NTU-DTE | | x | Test indicator | NN*(m)** | |
| * If these circuits are not used by the DTE they must be correctly terminated or disconnected (see note 1) | | | | | | |
| ** Letters in brackets () indicate alternative connector labelling | | | | | | |

note 1: Interchange circuits not used by the DTE

It is important that all conductors connected to pins listed in the tables are either:

- Correctly terminated at the DTE as specified in the relevant ITU-T recommendation at all times, or
- Disconnected on the interface cable at the NTU connector end.

This avoids spurious conditions on interchange circuits causing incorrect operation of the NTU. This is especially important on loop control circuits 140 and 141.

6.3 X.21 bis (V.24 & V.35) sub-options

The table below shows the various option codes used by BT to ensure a new circuit is correctly configured. The first options shown in each case are the most likely to be used.

Table 5: X.21 & X.21 bis sub-options

| ITU-T interface | Interchange circuit with an option | BT suggested defaults | Customer alternatives |
|-----------------|--|-----------------------|----------------------------------|
| X.21 bis (V.24) | Circuit 106 Ready for send delay (RFS) | Zero delay | 10-20ms delay |
| | Circuit 108/1 Connect data set to line (CDSTL) | Permanently ON | Controlled by terminal equipment |
| | Circuit 107 Data set ready (DSR) | To follow CDSTL | Set OFF under fault conditions |
| X.21 bis(V.35) | Circuit 106 Ready for send delay (RFS) | Zero delay | 10-20ms delay |
| | Circuit 107 Data set ready (DSR) | To follow CDSTL | Set OFF under fault conditions |

7. Network Terminating Equipment

A KiloStream circuit is provided with an NTU at either end. These units provide the correct interfaces to ITU-T standards and are connected to a mains power supply

The NTU consists of a single printed circuit card, which can be housed in one of two ways.

Single unit

The NTU is housed in a moulded plastic case that is designed to rest on a desktop. The customer's Data Terminal Equipment interface is located at the rear of the case, together with a line connection card and a 3 metre long mains cable complete with a BS1363^[3], 3 pin moulded plug top.

Multiple installation

The NTU can be mounted in a KiloStream shelf. The shelf is in 19 inch rack equipment practice, 6 vertical units (VU) high. It can provide for up to 12 KiloStream circuits of any combination of types.

8. Power supply

Single unit

The socket must meet the requirements of British Standards Specifications BS1363 and be wired in accordance with the 15th edition of the IEE wiring regulations. Subject to building fire regulations, this unit must be powered at all times.

Shelf Mounted

The external power supply should be connected on installation and the shelf power unit switched ON. Again, subject to building fire regulations, this unit must be powered at all times.

9. Operating Environment

Table 6: Shelf mounted NTU specifications

| | |
|--------------------|--|
| Dimensions | H 261 mm x W 25mm x D 248mm |
| Weight | 0.55kg |
| Power requirements | 240V at 50Hz |
| Power consumption | Approximately 7 watts (100 watts fully loaded shelf) |

Table 7: Shelf mounted NTU specifications Single unit specifications

| | |
|-----------------------|--|
| Dimensions | H 55mm x W 251 mm x D 274mm |
| Weight | 2.9kg |
| Power requirements | 240V RMS AC -10% to +6% 45Hz to 55Hz |
| Power consumption | Approximately 8 watts |
| Operating environment | 5°C to 55°C Relative humidity 90% non-condensing (max) at a temperature range of 20-45°C |

Table 8: KiloStream shelf specifications

| | |
|-----------------------|--|
| Dimensions | H 266mm x W 482mm x D 269mm (6VU) |
| Weight | 16.12kg |
| | 240V RMS AC 45Hz to 55Hz |
| Power consumption | Approximately 100 watts fully equipped |
| Operating environment | 5°C to 55°C Relative humidity 90% non-condensing (max) at a temperature range of 20-45°C |

The shelf can also be housed in one of two ways:

Table 9: Further shelf housing options

| Housing | Number of shelves/circuits | Dimensions | Description |
|--------------------------------|----------------------------|--------------------------------|---|
| Case | Up to 1/12 | H 270mm W 540mm D 400mm | A metal case with a perspex front cover designed to rest on a desk top. Power, line & data interface connectors are provided at the rear. |
| Cabinet | Up to 4/48 | H 1730mm W 600mm D 600mm | A metal cabinet with full length doors fitted front and rear. Power and line connectors are permanently cabled in. Interface connectors are situated at the bottom of the cabinet at the front or as advised. |
| Customer owned rack or cabinet | | | The shelf can be fitted into any suitable 19in practice rack subject to BT approval. |

10. Further information

Contacts for further information can be found at <http://www.sinet.bt.com/usenum.htm>

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- Your Company's BT account manager
- For business customers, BT sales on 0800 800152 for product and service information, sales and rental enquiries.

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11. References

| | | | |
|-----|--------------------|--|--------------|
| [1] | ITU-T Rec.X.21 | Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks | 1992 |
| [2] | ITU-T Rec.X.21 bis | Use on public data networks of Data Terminal Equipment (DTE) which is designed for interfacing to synchronous V-Series modems | 1988 |
| [3] | BS1363 | Specification for 13 A fused plugs and switched and unswitched socket-outlets | Latest Issue |

For further information or copies of referenced sources, please see document sources at: <http://www.sinet.bt.com/usenum.htm#docsources>

SINs are available from www.sinet.bt.com

12. Glossary

| | |
|--------------|---|
| CCITT | International Telegraph and Telephone Consultative Committee |
| DCE | Data Circuit-terminating Equipment (aka NTU) |
| DTE | Data Terminal Equipment |
| ITU-T | International Telecommunications Union - Telecommunication standardisation sector (formerly CCITT). |
| NTU | Network Terminating Unit (aka DCE) |
| SIN | Suppliers' Information Note |
| RFS | Ready For Service |
| CDSL | Connect Data Set To Line |
| DSR | Data Set Ready |
| VU | Vertical Unit |

13. History

| | | |
|-----------|---------------|--|
| Issue 1.0 | April 1982 | SIN 57, 58, and 59 first Issued. |
| Issue 2.0 | November 2002 | X.21 & X.21 bis SINs (57/58/59) rationalised into one document. |
| Issue 2.1 | December 2003 | Approval Requirements statement removed, information available via SINet Useful Contacts page. |

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