SIN 57

Issue 2.5
September 2020

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.

Note: KiloStream Low Speed products (2.4, 4.8, 9.6kbit/s) and 19.2kbits/s KiloStream High Speed (including the X21 bis (V.24) interface option) were withdrawn from new supply in November 2012. All remaining KiloStream products (i.e. 48kbit/s and 64kbit/s services) were withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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.

Note: KiloStream Low Speed products (2.4, 4.8, 9.6kbit/s) and 19.2kbits/s KiloStream High Speed (including the X21 bis (V.24) interface option) were withdrawn from new supply in November 2012. All remaining KiloStream products (i.e. 48kbit/s and 64kbit/s services) were withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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).

Note: KiloStream Low Speed products (2.4, 4.8, 9.6kbit/s) and 19.2kbits/s KiloStream High Speed (including the X21 bis (V.24) interface option) were withdrawn from new supply in November 2012. All remaining KiloStream products (i.e. 48kbit/s and 64kbit/s services) were withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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

Note: KiloStream Low Speed products (2.4, 4.8, 9.6kbit/s) and 19.2kbits/s KiloStream High Speed (including the X21 bis (V.24) interface option) were withdrawn from new supply in November 2012. All remaining KiloStream products (including the 48kbit/s service) were withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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.

Note: The 64kbit/s KiloStream service was withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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**	**lndication**	**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

Note: KiloStream Low Speed products (2.4, 4.8, 9.6kbit/s) and 19.2kbits/s KiloStream High Speed (including the X21 bis (V.24) interface option) were withdrawn from new supply in November 2012. All remaining KiloStream products (including the X21 bis V.35 interface) was withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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

Note: KiloStream Low Speed products (2.4, 4.8, 9.6kbit/s) and 19.2kbits/s KiloStream High Speed (including the X21 bis (V.24) interface option) were withdrawn from new supply in November 2012. All remaining KiloStream products (including the X21 bis V.35 interface) was withdrawn from new supply on 1st September 2016. All KiloStream products (at all speeds) were then withdrawn from service completely at the end of March 2020. Reduced maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service (EOS) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service completely at the end of March 2023.

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	l0-20ms 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	5^0C to 55^0C Relative humidity 90% non-condensing (max) at a temperature range of 20-45^0C

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	5^0C to 55^0C Relative humidity 90% non-condensing (max) at a temperature range of 20-45^0C

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	A metal case with a perspex front cover designed to rest on a desk top

		D 400mm	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 l9in practice rack subject to BT approval.

10. Further information

Please contact either:

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

If you have enquiries relating to this document then please contact: sinet.helpdesk@bt.com

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

SINs are available from https://www.bt.com/about/sinet

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
CDSTL	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.
Issue 2.2	November 2012	Note added about the withdrawal of some speeds and interface options from new supply
Issue 2.3	January 2016	Note added about the timeframes for the withdrawal of the remaining speeds and interface options from new supply and subsequent final closure of KiloStream services. Change SINet site references from http://www.sinet.bt.com to http://www.btplc.com/sinet/
Issue 2.4	May 2018	Editorial changes to the notes on withdrawal timeframes.
Issue 2.5	September 2020	Additional minor phrasing changes in availability text. Change SINet site references from http://www.btplc.com/sinet/ to https://www.bt.com/about/sinet

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