application note

X.21 Monitoring for Fault Localization

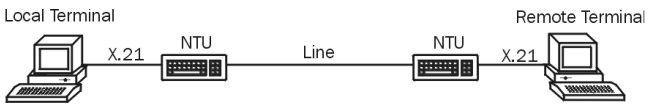
By Paul Blakemore

2843 Digital Communications Analyzer

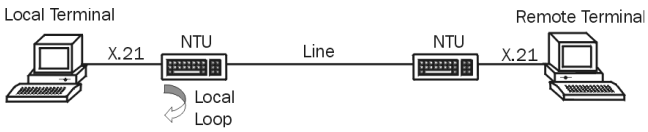
X.21 is a much used means of data transmission for subscribers to carry data across national networks. X.21 also defines test loops which can be invoked automatically on NTUs (Network Termination Units) from the customer terminal equipment to enable local and remote sections of the connection to be tested.

Occasionally spurious loops can appear on NTUs which disrupt customer data. By monitoring the link between the customer terminal equipment and the NTU it is often possible to isolate the cause of the problem to the customer equipment or the network equipment (NTU).

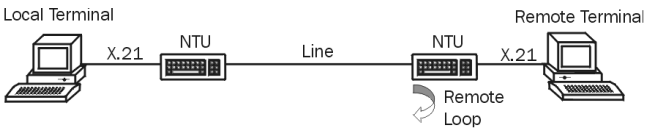
End-to-End Communication between Local and Remote Terminals



Local Loopback Invoked at NTU by Local Terminal

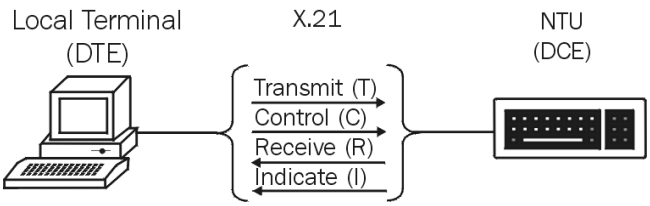


Remote Loopback Invoked at NTU by Local Terminal



LOOP REQUESTS

Lines involved in X.21 Loop Protocol

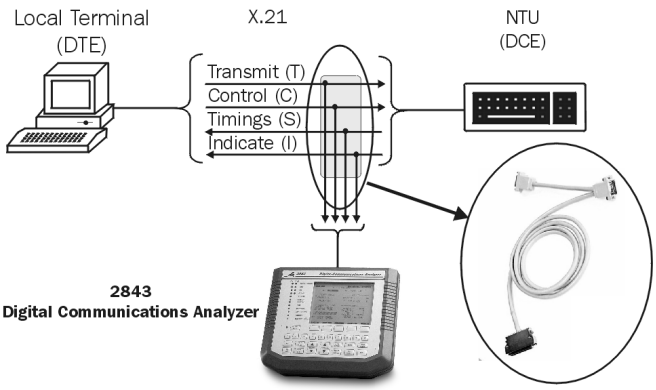


The normal state for the C and I lines is ON (1).
Local Loop command (request) is 11110000.....
Remote Loop command (request) is 1100.....

The DTE (Data Terminal or Termination Equipment) requests a local or remote loop from the DCE (Data Communication Equipment) by transmitting a repeating pattern on the **T** line, at the same time holding the **C** line OFF. The DCE responds by invoking a local or remote loop as appropriate, which causes the looping pattern to be received by the DTE on the **R** line. The DCE also Sets the **I** line OFF to acknowledge the loop. The **C** and **I** lines are now returned to ON during the loop test phase, following which a loop clear request is made by the DTE setting the **C** line to OFF, which causes the DCE to remove the loop.

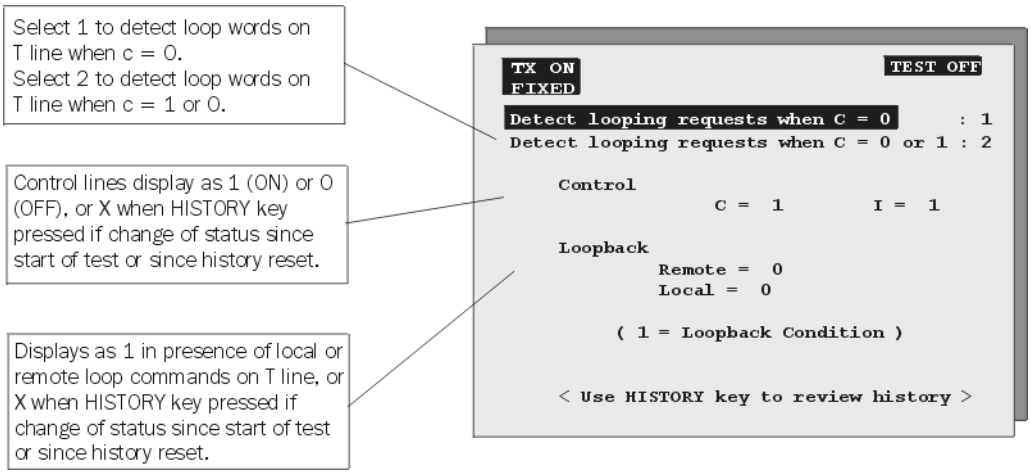
X.21 MONITORING

Lines Monitored



The X.21 line is monitored by using a monitor cable which allows all the X.21 lines to pass transparently between the DTE and DCE. The lines monitored are Transmit (T), Control (C), Indicate (I) and Timing (S), the first three of which are involved in the X.21 loop protocol. The Timing line is monitored to allow the data on the Transmit line to be clocked into the 2843 and lack of a clock signal will cause a line alarm.

X.21 Monitor Page



If spurious loops have been appearing on an NTU then monitoring the link between the terminal and the NTU can isolate the problem.

Detect Loop Commands When C = 0

This is the normal selection since the terminal always sets **C** to 0 (OFF) when requesting a loop from the NTU. If a loop does appear on the NTU and the terminal has requested it, then with the HISTORY key pressed **C** will display X and either REMOTE LOOP or LOCAL LOOP will display X. Also I will display X to show that the NTU has acknowledged the loop. If the display remains unchanged then it is not the terminal that has requested the loop.

Detect Loop Commands When C = 0 or 1

This selection would be used if it were suspected that the NTU is setting a loop in response to loop commands appearing in the data when **C** is set to 1 (ON). If a loop does appear and **C** has remained unchanged, but either REMOTE LOOP or LOCAL LOOP display X with the HISTORY key pressed, this indicates that the NTU is functioning incorrectly. If a loop appears, **C** remains unchanged and neither REMOTE LOOP nor LOCAL LOOP display X with the HISTORY key pressed, then a malfunction of the NTU that does not involve interaction between it and the connected terminal is indicated.

Conclusion

The X.21 monitoring capability in 2843 is a powerful tool for isolating automatic looping problems between terminals and network equipment.

IFR, 10200 West York Street, Wichita, Kansas,
67215-8999, USA. E-mail: info@ifrsys.com
Tel: +1 316 522 4981 Toll Free USA: 1 800 835 2352 Fax: +1 316 522 1360

IFR, Longacres House, Six Hills Way, Stevenage SG1 2AN,
United Kingdom. E-mail: info@ifrsys.com
Tel: +44 (0) 1438 742200 Freephone UK: 0800 282 388 Fax: +44 (0) 1438 727601

As we are always seeking to improve our products, the information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice. All trademarks are acknowledged. Parent Company IFR Systems, Inc. © IFR Ltd. 2001.

Part no. 46891-896
Issue 1