



Straight 8

High Density X.21 to G.703 Converter Rack System



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TELTRONIX STRAIGHT 8

HIGH DENSITY X.21 TO G.703 CONVERTER RACK SYSTEM

APPLICATION

The Teltronix Straight 8 high density rack system contains 8 high speed interface converters operating transparently at the speed of 2.048Mbps. The converters are based on the popular Teltronix TR2 product and maintain the TR2's reputation for reliability and ease of installation.

Each converter has an X.21 interface for connection to local high speed DTE equipment. X.21 data is AMI and HDB3 encoded in accordance with CCITT recommendation G.703 for transmission to a remote unit. This allows a high speed link to be set up between two distant sites. X.21 terminal equipment eg Routers, LAN bridges or high end Muxes can then be used to distribute data or voice traffic within each site. Pairs of converters may also be used as line drivers for carrying high speed data on privately owned in-house wiring.

The Straight 8 is supplied with dual redundant PSU as standard, either 4 or 8 converters and an optional rear cable management bar.

Most commonly the Straight 8 unit will be located at a corporate central site or telehouse. G703 links will connect the central site to a number of customer premises where standalone G.703 to X.21 converters will be installed (eg the Teltronix TLM21-703 or Teltronix TS2).

Set Up

This brief description assumes that you are using this sort of set up. If you have a different set up see the TROUBLESHOOTING section on page 12.

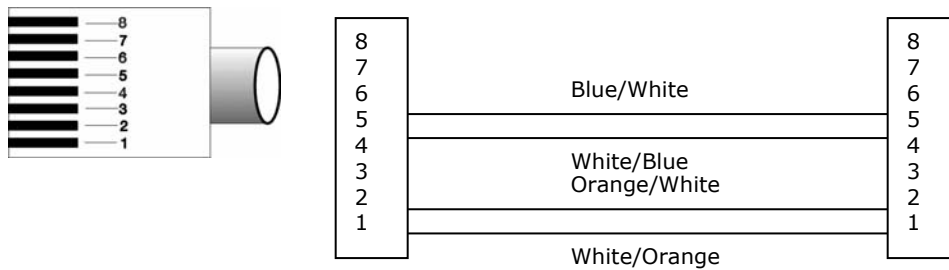
Step 1 Connect the G.703 Link

G703 BNC

- Connect the "TX" ports of the Straight 8 converters to the corresponding Input ports of the 2.048Mbps G.703 links at the central site.
- Connect the "RX" ports of the Straight 8 converters to the corresponding Output ports of the G.703 Links at the central site.

G703 RJ45

- Connect the RJ45 ports of the Straight 8 converters to the RJ45 ports of the G703 links using straight through twisted pair cable.
- The pair connected to pins 4 and 5 are used for transmit and the pair on pins 1 and 2 for receive as shown in the cable diagram below.

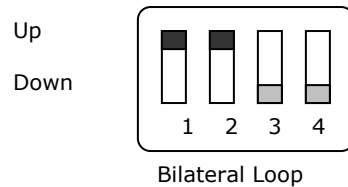


Step 2: Connect the X.21 routers or terminal equipment to the corresponding "X.21" ports of the Straight 8 converters.

- Step 3:** Connect IEC 320 mains leads to the "POWER" connectors.
- Step 4:** Repeat this process with the standalone units at the CPE/remote ends of the links.
- Step 5:** Set the Straight 8 central site converters to MASTER clock (See **SWITCH SETTINGS**)
- Step 6:** Set the CPE/remote standalone to SLAVE clock.
- Step 7:** Power up the Straight 8 and get an assistant to power up the CPE/remote units.

If you encounter problems with any of the links, turn on the LOOP switch at the remote unit associated with that link (See **SWITCH SETTINGS**) to enable a bilateral loop for test purposes.

You can then run an error test from the Straight 8 to confirm the link status. Turn off the switch to clear the loop. Further assistance is in the **TESTING and TROUBLESHOOTING** section.



PORT 1

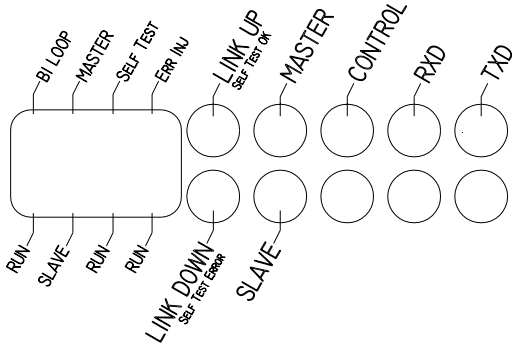


Figure 1 - Front Panel LEDs and Switches (one port only)

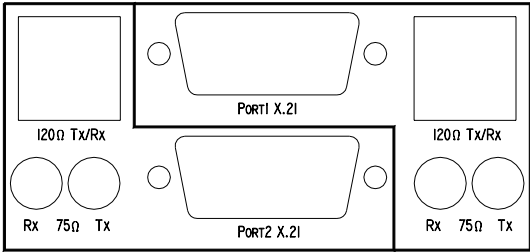


Figure 2 - Rear Panel Connectors (two ports only)

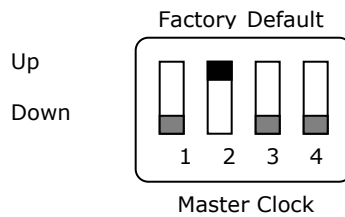
TECHNICAL SPECIFICATION

1. Switch settings.

It is not necessary to power the unit down before changing the front panel switches. They are recessed to prevent accidental operation. Use a plastic tool or small screwdriver to change the switches, **not** a pen or pencil. See figure 1 for location.

Reset Button.

The Reset button is located in the middle of the front panel in-between Port 4 and Port 5 indicators. It is recessed to avoid accidental operation. Pressing the Reset button will result in all of the converters being hardware reset.



	FUNCTION	UP	DOWN
1	Selects Bilateral loop diagnostics	Bilateral loop on	Running Normally
2	Selects master or slave G.703 clocking	Master clocking	Slave clocking
3	Selects Self Test mode	Self test mode on	Running Normally
4	Selects Error Injection (when Self test is ON)	Error inject on	Running Normally

2. Indicators.

There are 5 dual row LED indicators per converter on the front panel - see figure 1.

LED	STATUS	FUNCTION
TXD(top)	Green	X.21 transmit data - Mark
TXD(bottom)	Green	X.21 transmit data - Space
RXD(top)	Green	X.21 received data - Mark
RXD(bottom)	Green	X.21 received data - Space
CONTROL	Green	Indicates when X.21 CONTROL signal is ON
CONTROL	Red	Indicates when X.21 CONTROL signal is OFF
CONTROL	Flashing Red	Indicates a Test mode has been selected - Bilateral Loop or Self Test
MASTER	Green	Indicates when MASTER G.703 clocking has been selected
SLAVE	Green	Indicates when SLAVE G.703 clocking has been selected
LINK UP	Green	Shows when valid G.703 encoded data is received.
LINK DOWN	Red	Shows when no data or invalid G.703 encoded data is received.
SELF TEST OK	Green	Indicates when Self Test mode is operating correctly.
SELF TEST ERROR	Flashing Red	Flashes if an error is detected in Self Test mode.

In normal use you should see only Green LEDs. If there's a red LED you probably have a problem.

The LEDs are also used in blocks to indicate Power Supply faults.

LED BLOCK	STATUS	INDICATION
Port 1 and 5	Flashing	PSU 1 under voltage / failed
Port 2 and 6	Flashing	PSU 1 over voltage
Port 3 and 7	Flashing	PSU 2 under voltage / failed
Port 4 and 8	Flashing	PSU 2 over voltage

3. Control and Indicate.

The status of the Control input on the X.21 interface is reflected on the Indicate output. If the power fails or the unit is switched off, Indicate will go to the off condition.

4. X21 Connector Interface.

A 15 Way 'D' type socket connector (see figure 2) is fitted for each converter with the following pin connections:-

DTE<>DCE		DTE<>DCE	
Pin 1. Frame Ground	↔	Pin 8. Ground	↔
Pin 2. Transmit A	→	Pin 9. Transmit B	→
Pin 3. Control A	→	Pin 10. Control B	→
Pin 4. Receive A	←	Pin 11. Receive B	←
Pin 5. Indication A	←	Pin 12. Indication B	←
Pin 6. Signal Timing A	↔	Pin 13. Signal Timing B	↔

Pin 7, 14 & 15 - No Connection

5. G.703 Interface Connection.

- Connection to the G.703 interface is via either a pair of SMB sockets for send and receive or by an RJ45 socket for each converter on the rear of the unit (see figure 2).
- The SMB terminations are matched for 75 ohm coaxial cable and are isolated from each other. Cables 3 metres long are provided on request to adapt from SMB to standard BNC sockets.
- Transformers are used to isolate the G.703 interface connections.
- The "TX" connector is G.703 transmit data from the converter to the line.
- The "RX" connector accepts G.703 data from the line to be converted to X.21 data.
- The RJ45 connectors are provided for alternative connection to 120 ohm dual twisted pair cable. Pinout will be as structured cabling, Tx on 4 and 5, Rx on 1 and 2.

6. Line Transmission.

Transmission type:

HDB3 encoded Alternate Mark Inversion to CCITT G.703 Recommendations.

75ohm Transmit Level:

2.2 volts nominal, 2.37 volts max., 60% duty cycle. 1mW into 75 ohm RG59 coax. Master/slave timing selected by front panel switches.

120ohm Transmit Level:

2.8 volts nominal 3.05 volts max 60% duty cycle. 1mW into 120ohm twisted pair. Master/slave timing selected by front panel switches.

One end of the link should be set to master (internal) timing. The other end should be set slave (external) timing.

Frequency limits for an external clock provided to the converter are +/- 50ppm max.

7. Data Transmission

Synchronous Data Rate:- 2.048Mbps +/- 50ppm max.

8. Power Supply.

Dual Redundant PSU

45 Watt AC/DC adapters.

Universal input: 90 - 264 Vac

Input frequency: 47-63 Hz

Conductive EMI meets FCC/CISPR 22 Class B

9. Physical Details.

Size: Standard 19" rack
84HP wide
1u high
360mm depth

Weight: 4 card system: 2.4 Kg
8 card system: 3.2 Kg

10. Environmental Limits.

Storage:	0 - 70°C.
Operational:	0 - 40°C.
Rel. Humidity:	Up to 95% non condensing.
Altitude:	-50 to 3000 Metres.

11. Testing and Troubleshooting.

G.703 is a very robust transmission protocol with some major advantages- whereas X.21 will only run about 3 metres at 2Mbps and needs 5 twisted pairs, G.703 will normally run 300metres over 2 cables, greatly simplifying in-building equipment location and wiring. To make the most of these advantages correct G.703 clocking setup is vital.

A G.703 link may contain many repeaters between the connected premises and the ideal clocking scenario is to have one **and only one** clock master for the entire system.

The Straight 8 includes a Bit Error Rate Tester (BERT) which allows the user to verify that the link is fully operational.

Most commonly the Straight 8 unit will be set to master mode and located at a central site or telehouse. G.703 links will connect the central site to a number of customer premises where standalone G.703 to X.21 converters set to slave mode will be installed (eg the Teltronix TLM21-703 or Teltronix TS2).

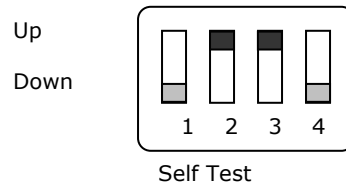
Assuming that you have this setup then the first part of testing the link is to ask an assistant to put a loop on the remote equipment:-

- If the remote equipment is a **Teltronix TLM21-703**, press the button on the rear of the unit and check that the **“loop” LED is lit** on the front panel.
or
- If the remote equipment is a **Teltronix TS2**, move the front panel switch to **“bi-loop”** and check that the **test LED is flashing**.
or
- If the remote equipment is from another manufacturer, look at the documentation to see how to set up a test loop. If the equipment doesn't allow this then either:-

◇Use one of the BNC cables to link Tx to Rx on the G.703 link
or

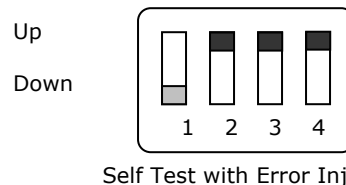
◇Use an RJ45 adapter which links pin 1 to pin 4 and also links pin 2 to pin 5 on the G.703 link.

Now move the front panel switch of the Straight 8 from the "RUN" position to "Self Test". This channel of the Straight 8 then starts sending a pseudo-random G.703 pattern and the G.703 receiver begins looking for that pattern.



- The **red** control LED now **flashes** to show that the unit is in **test mode**.
- The "Link Up" led now shows **green** when the received pattern is **error free** and **red** if there is a **data error**.

If the "Link Up" led shows **continuous green** then this is a good sign but there could still be a hidden problem, so set the "error inject" switch. The transmit test pattern now includes a deliberate one bit error every one second. The "Link Up" LED should now **flash red** once per second and it should **stop flashing red** if you turn "error inject" back to "RUN".



If the above test operates as described then your G.703 link is correctly set up and operational, so ask your assistant to remove the remote loops, **MAKE SURE THAT THE REMOTE EQUIPMENT IS SET TO SLAVE MODE** and proceed to commission the rest of the system.

If there's a problem the "link up" LED may not behave as described above in test mode:-

If the "link up" LED **flashes red** in a **random** fashion in self test mode, there is a data problem somewhere in the G.703 link and you should ask the link provider for assistance.

If the "link up" LED **flashes red** in a **regular "beating"** fashion, there is probably a second clock master somewhere else in the G.703 link. Select "slave" mode on the Straight 8 and repeat your testing.

If the link now checks out OK then it's most likely that your Telco has provided a master clock on the link (this is not usual practice). Check this out with the Telco documentation and if this is what they've done it's perfectly satisfactory to use the link with both G.703 to X.21 converters set to slave.

If the "link up" LED still **flashes red** in a **regular "beating"** fashion, you need to ask the link provider for assistance.

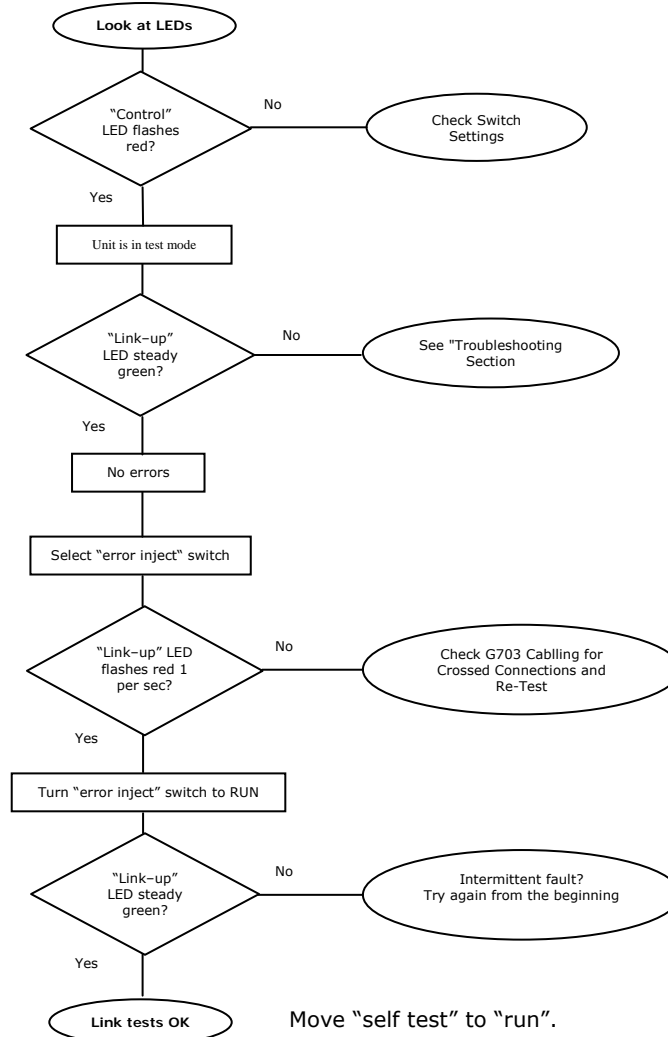
If the "link up" LED doesn't show **red** at all (even when you've selected "error inject"), you've probably got a cabling problem- the channel that you are trying to test may be connected to another channel that is already in self test mode.

If you've tried all the above and you're not 100% convinced that things are working as described then please contact Teltronix for technical support- we understand this stuff and we want to help. If you want to know more about G.703 clocking then we can provide white papers on this and related subjects.

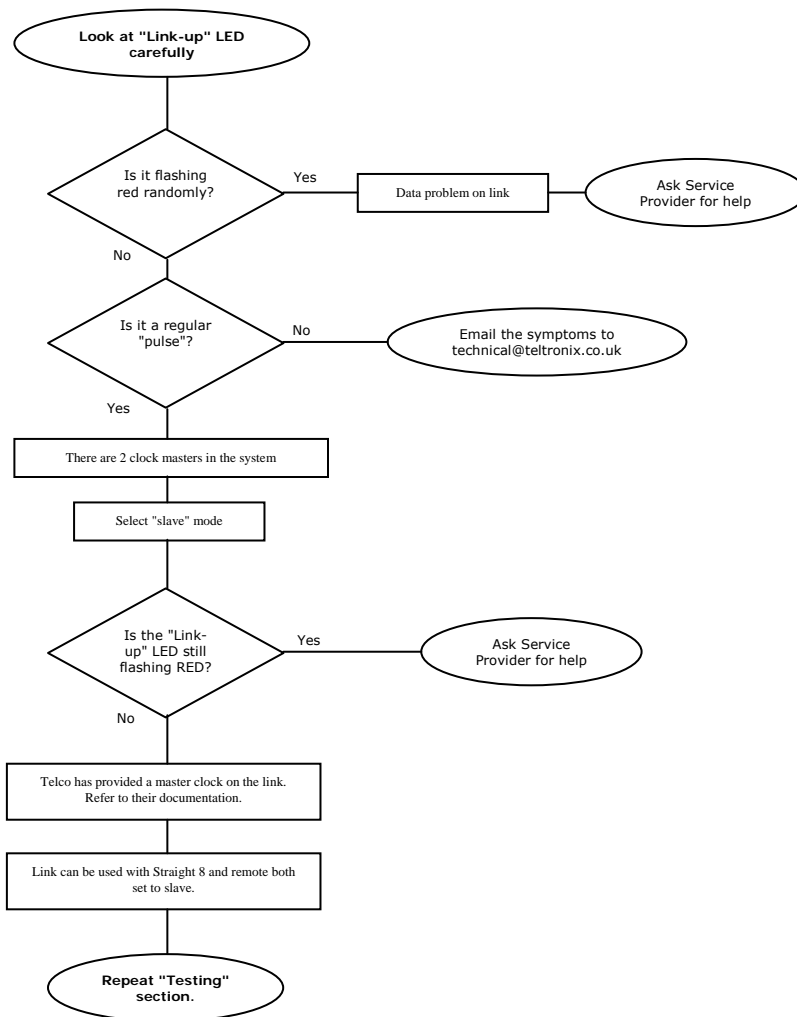
Testing and Troubleshooting

1. Testing

Move the front panel switch on the Straight 8 from "run" to "self-test" and set remote unit to G.703 loop.



2. Troubleshooting



12. UK Regulatory Information.

The unit is designed for direct connection to G.703 MegaStream™ provided by British Telecommunications PLC, or any similar service provided by other Public Telecommunications Operators, or to a relevant branch system for those digital circuits which accord to CCITT recommendation G.703.

If any other apparatus, including cable or wiring, is to be connected between the apparatus and the point of connection to the digital circuits detailed above, then all that other apparatus must conform to the following:-

- 1) The overall transmission characteristics of all that other apparatus shall be such as to introduce no material effect upon the electrical conditions presented to one another by the apparatus and the digital circuit.
- 2) All the other apparatus shall comprise only:-
 - i) Apparatus approved (see note) for the purpose of connection between the apparatus and the digital circuit, and
 - ii) cable or wiring complying with a code of practice for the installation of apparatus covered by this standard or such other requirements as may be applicable.

Note: Such apparatus may have been approved subject to limitations on its use.

All apparatus connected to this unit and thereby connected directly or indirectly to the British Telecom circuits must be approved apparatus as defined in Section 22 of the British Telecommunications Act 1984. The safety status of the ports marked DTE, SEND and RECEIVE on the rear panel is SELV, only connect apparatus complying with SELV interface requirements to these ports.

Power Supply modules conductive EMI meets FCC/CISPR 22 Class B standard.