

Fiberoptic G.703 / X.21 (/ RS530) modem 21-1601 / 21-1651 / "21-16xx"



Technical manual

About this manual

About the contents of this manual

The information in this document may be changed at any time without notice.

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Version and revision history.

Revision history for product:

Revision Rx.

Product released for serial production. 199x-xx-xx.

Revision Rx+.

New power supply manage both DC and AC. 2001-02-27.
From serial number 4258 - .

Revision Rx++.

Port RS530 removed October 2006.
From serial number 13758 - .

Revision history for this document.

Revision x.

199x-xx-xx, RoPa, document created.

Revision R2.2.

2003-xx-xx, AnNy, new logotype.

Revision R3.

2005-06-19, AnNy, new document layout and contents updated. New
logotype.

Revision R4.

2018-05-21, MiLa, document updated with new pictures and logo.

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Author.

Created by Anders Nyström.

Last saved by Mikael Larsson.

General description

Functional

The modem 21-1601 and 21-1651 from Fibersystem are combined fiberoptic synchronous and asynchronous modem with four different interfaces.

The interfaces are:

G.703 unbalanced 2Mbps,

G.703 balanced Nx64Kbps,

X.21

RS-530, not mounted on products produced after October 2006.

The modems are available in 2 versions.

21-1601 runs on 110-230 VAC , +/- 20%, power supply.

21-1651 runs on 48-250 VDC, +/- 20%, power supply.

The modem can be mounted in 19 rack with the mounting brackets included with the product.

In synchronous mode the data rate are settable from 4.8kbps to 2048kbps.

To run the modem in asynchronous mode the data rate must be set to at least 8 times the actual data rate giving a maximum asynchronous rate of 256kbps.

The modem can be configured to use three models of clock generation:

Internal clock, where the modem generates the transmit clock.

External clock, where the modem recovers the clock from the selected interface.

Loop clock, where the modem recovers the clock from the fiber link.

The 21-1601 or 21-1651 can be connected to a telecom network or “back-to-back”.

The front panel is marked 21-16xx and the product is often referred to as “21-16xx”.

History

The 21-16xx has been delivered in 4 versions:

| Product number | Version |
|----------------|---|
| 21-1601 | ST multimode version with 100 –240 Volt AC/DC power supply |
| 21-1651 | ST multimode version with 48VDC power supply |
| 21-1605 | ST singlemode version with 100 –240 Volt AC/DC power supply |
| 21-1655 | ST singlemode version with 48VDC power supply |

Present products

21-1601 Fo modem G703/X.21 (/RS530) 230V

21-1651 Fo modem G.703/X.21 (/RS530)

This manual will describe these products.

For singlemode application we recommend to use Fibersystem’s multimode to singlemode converters, for example 21-203, “Fo MM/SM 4B/5B konv SC-SC 80km”.

Power supply.

Both 21-1601 and 21-1651 are equipped with the same type of power supply.

The power supply accepts a wide range of voltages.

48-250VDC, +/- 20%.

110-230VAC, +/- 20%.

The only thing that differs between 21-1601 and 21-1651 is the type of connector for main power supply.

21-1601 has a IEC 320, 3-pin power connector. It also have a mains filter and a fuse available for replacement.

21-1651 has a 3-pin XLR connector. No filter. Fuse not replaceable.

In addition both 21-1601 and 21-1651 can be powered with 48V to 250V.

Fiber Optic G.703 Codirectional

The ITU-standard "G.703 64kbit/s codirectional interface" describes a galvanic interface. This interface is for example commonly used by teleprotection equipment for connection to telecom multiplexers.

The codirectional interface is transferred at one balanced pair for each direction.

The 21-16xx converts the codirectional interface signals to a proprietary fiber optic protocol.

Fiber Optic G.703 Contradirectional

The ITU-standard "G.703 64kbit/s contradirectional interface" describes a galvanic interface.

The contradirectional interface is transferred at two symmetrical pairs for each direction. One pair carrying the data signal and the other carrying a composite timing signal (64kHz and 8kHz).

The 21-16xx converts the contradirectional interface signals to a proprietary fiber optic protocol.

G.703 2048kbit/s unbalanced

The ITU-standard G.703, E1, 2048kbit/s unbalanced, (75 Ohm BNC), ports are intended to connect to, for example a telecom multiplexer. The 21-16xx transfer HDB3-coded signals with or without frameing.

The 21-16xx converts the G.703 2048kbit/s unbalanced interface signals to a proprietary fiber optic protocol.

X.21

The ITU-standard X.21 is an interface primarily used in telecom for connection of "customers (DTE) equipment" to "carrier's (DCE) equipment".

All signals are balanced.

The 21-16xx converts the X.21 interface signals to a proprietary fiber optic protocol.

RS530 / RS530A

Only available at products produced before October 2006.

The RS530 interface is a generic connector specification. The connector can be used for to support RS422, RS423, V.35 and X.21, depending on the implementation.

Specifications for Fibersystems implementation of the RS530 are given later in this document.

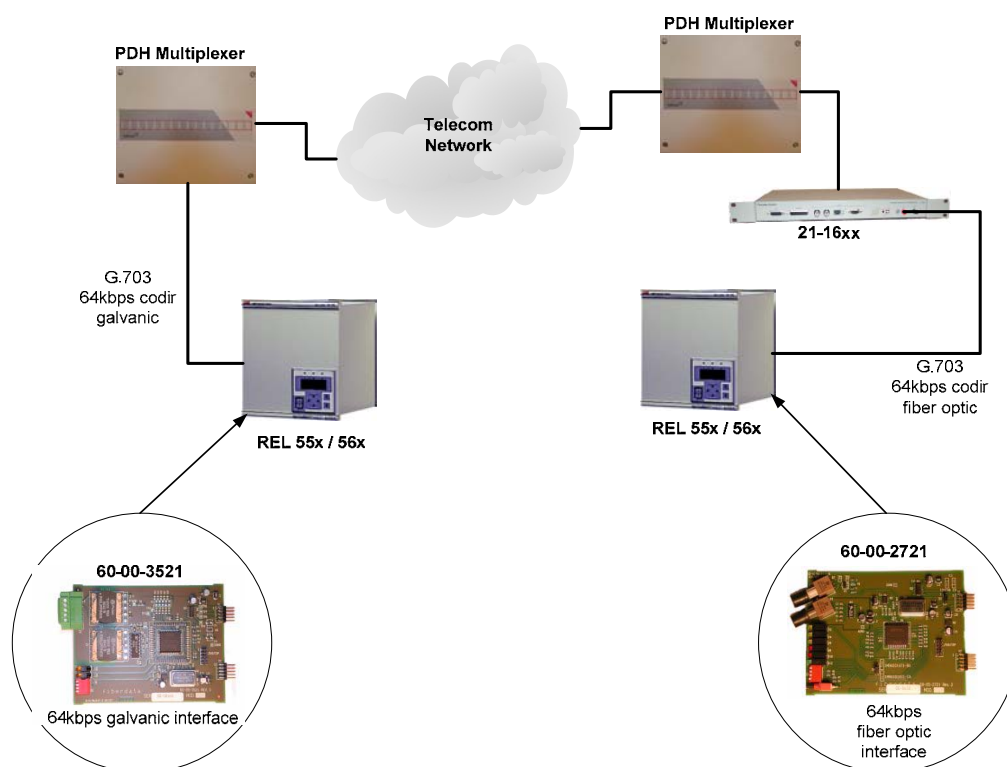
The 21-16xx converts the RS530 interface signals to a proprietary fiber optic protocol.

Fiber optic protocol

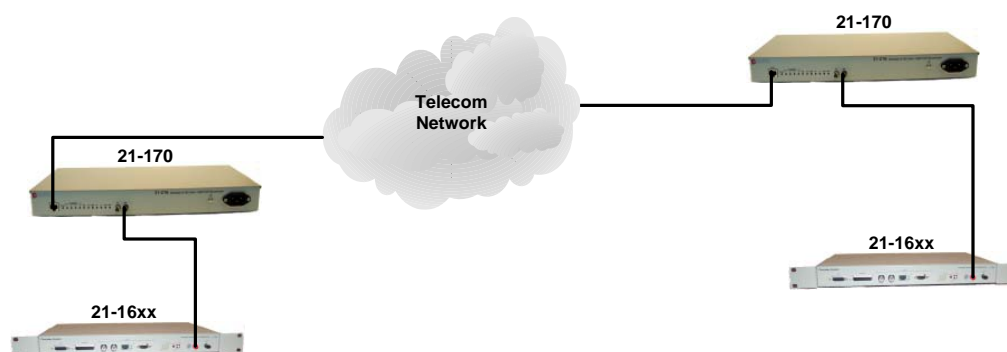
Fibersystems proprietary protocol is used in a number of our products, enabling interface conversions. For example, configure one 21-16xx for G.703 codir interface and configure the other 21-16xx , (remote unit), in the link to X.21.

Applications

The fiberoptic port of the ABB REL55x/56x , Line Differential Protection Terminals, is directly connected to the fiberoptic port of 21-16xx. The 21-16xx Codir-port is then connected to a PDH multiplexer.



Or connect to another Fibersystem product using the same fiber optic protocol.



Features

Fiberoptic and data transfer protocol
Between differential relay and 21-16xx.
Data speed/protocol

Fibersystem proprietary protocol.

Optical data

Wavelength
Fiber optical connector
Optical System budget

820nm
ST
13dB with multimode fiber,
(62.5/125 um)
9dB with multimode fiber,
(50/125 um)

Typical distance

2km (6dB systemmargin for 62.5/125
and 3dB margin for 50/125).

G.703 – 2048kbit/s unbalanced
Interface
Protocol

2 BNCs, unbalanced 75 Ohm.
HDB3, 2048 kbit/s.

G.703 – balanced, codirectional
Interface
Protocol

9-pin female D-sub or RJ45.
G.703 codir, 64, 128, 192 or 256 kbit/s.

G.703 – balanced, contradirectional
Interface
Protocol

9-pin female D-sub or RJ45.
G.703 contradir, 64, 128, 192, 256, 384
or 512 kbit/s.

X.21
Interface
Protocol

15-pin female D-sub.
RS-422 compatible signal levels, 4.8, 9.6,
19.2, 38.4, 64, 128, 192, 256, 384, 512,
768, 1024, 1536, 2048 kbit/s.
In asynchronous mode up to 256
kbps/s.

RS530
Only available at products produced before October 2006.

Interface
Protocol

25-pin female D-sub.
RS-422 compatible signal levels,
(pin 5 and 6 – RS423).
4.8, 9.6, 19.2, 38.4, 64, 128, 192, 256,
384, 512, 768, 1024, 1536, 2048 kbit/s.
In asynchronous mode up to 256
kbps/s.

Power Supply.

48V DC to 250V DC, $\pm 20\%$

110V AC to 230V AC, 50Hz, $\pm 20\%$.

AC connector IEC 320, 3 pin.

Power consumption <20W.

Physical size

The unit can be mounted in a 19" rack.

By adjusting, the rack mount brackets, the unit can also be mounted on a wall or similar.

Height 44 mm

Width 483 mm (380 mm without rack mount brackets).

Depth 238 mm (from front to back, connectors excluded).

Weight 3 kg

Environmental conditions

Operating temperature 0 - 50 °C

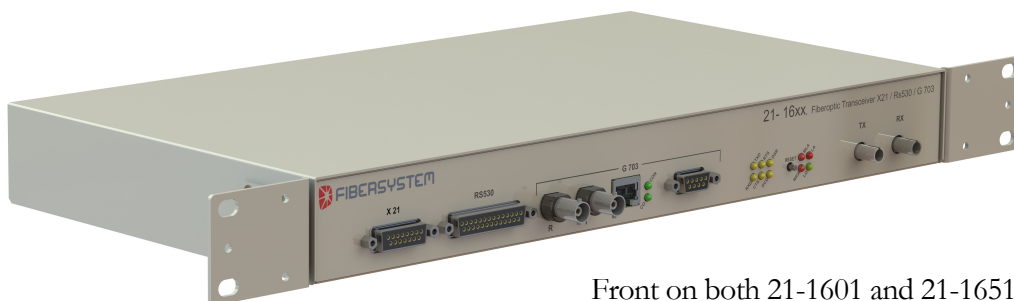
Unpacking.

Check that the packing material has no damage. If damages are discovered on packing material, contact your shipping company, before unpacking.

The delivered product consists of several parts. Check that all parts are present according to the list below, and have no damage.

Product 21-1601 consists of:

| | Quantity | Part number | Description |
|---|----------|-------------|--|
| 1 | 1 | 21-1601 | Fo modem G703/X.21/RS530 230V (<i>Part number includes all parts in this list</i>). |
| 2 | 1 | 50-65-0106 | Power cord, 1.8m European connector. |
| 3 | 1 | 90-20-0 | This manual |



Front on both 21-1601 and 21-1651.



Back 21-1601.

Product 21-1651 consists of:

| | Quantity | Part number | Description |
|---|----------|-------------|--|
| 1 | 1 | 21-1651 | Fo modem G.703/X.21/RS530 (<i>Part number includes all parts in this list</i>). |
| 2 | 1 | 50-55-0191 | Connector 3-pin XLR for cable. |
| 3 | 1 | 90-20-0 | This manual |



Front on both 21-1601 and 21-1651.

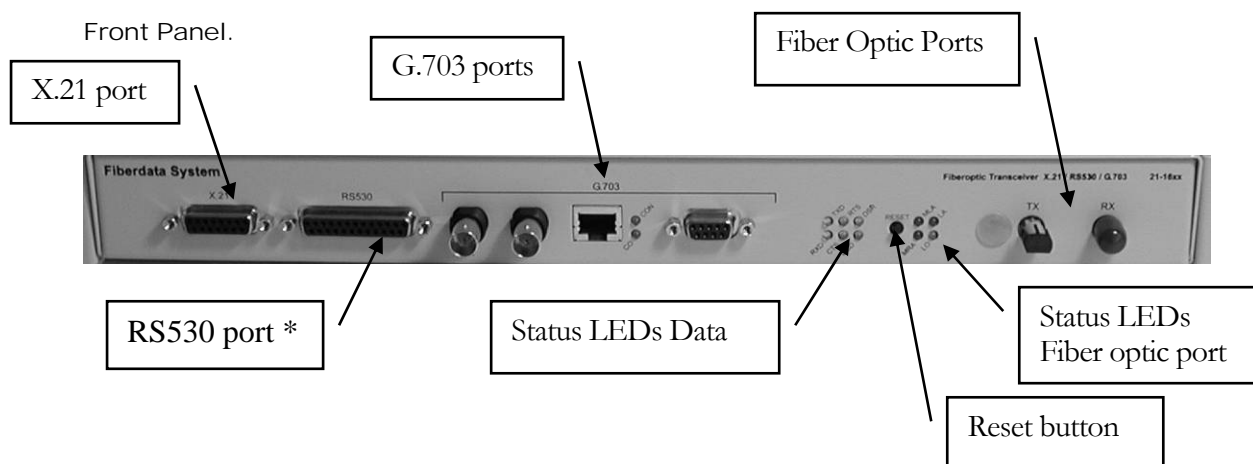


Back and power connector for 21-1651.

Installation.

Serial number.

The products serial number is the best way for Fibersystem to identify the product. If the serial number is not noted on your delivery notes, please add the serial number to your own product documentation. This will be useful at future contact with Fibersystem.



*RS530 port is only available at products produced before October 2006.

Back Panel.



Power connector on 21-1601



Power connector on 21-1651

Mounting

The products can be used stand alone or rack mounted.

Power - DC

DC power is feed via a XLR connector.



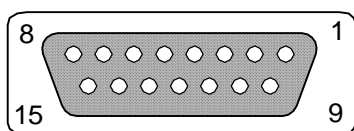
X.21



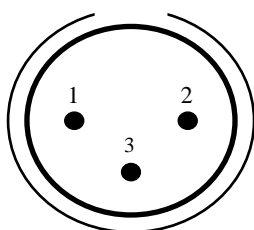
Contact D15 female, (15-pin D-sub).

The X.21 interface is defined as a digital signaling interface between customers (DTE) equipment and carrier's equipment (DCE). And is primarily used for telecom equipment.

All signals are balanced (RS422). There is always a pair (+/-) for each signal.



| Pin | Signal | Function | DTE | DCE |
|-----|--------|--------------------------|-----|-----|
| 1 | Shield | Shield – Chassies ground | - | - |
| 2 | TxD A | Transmit (A) | Out | In |
| 3 | | Control (A) | Out | In |
| 4 | RxD A | Receive (A) | In | Out |
| 5 | | Indication (A) | In | Out |
| 6 | | Signal Timing (A) | In | Out |
| 7 | - | Unassigned | - | - |
| 8 | SGND | Signal Ground | - | - |
| 9 | TxD B | Transmit (B) | Out | In |
| 10 | | Control (B) | Out | In |
| 11 | RxD B | Receive (B) | In | Out |
| 12 | | Indication (B) | In | Out |
| 13 | | Signal Timing (B) | In | Out |
| 14 | - | Unassigned | - | - |
| 15 | - | Unassigned | - | - |



Chassi side
 1 = 48 – 350V
 2 = 0 V
 3 = Shield

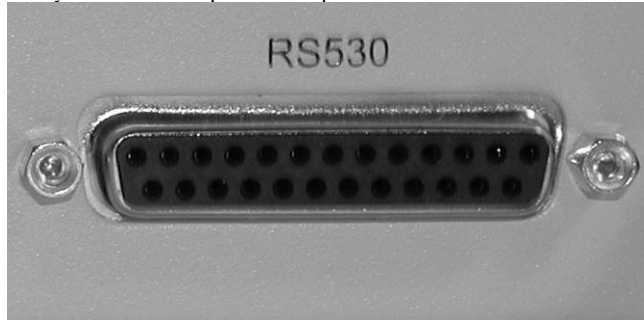
The 21-16xx can be configured for DCE or DTE operation by internal straps. See chapter “Configuration”.

Note 21-16xx shall be seen logically more as an extension cable than as a modem. Both data and control signals are mirrored to the remote side 21-16xx. Control signals of the X.21 interface are not used for control of the 21-16xx traffic.

Both data and control signals are clocked in and out of the 21-16xx with the chosen clock source. See chapter “Configuration”.

RS530 Port

Only available at products produced before October 2006.



RS530 is a standard for a connector more than an interface standard.

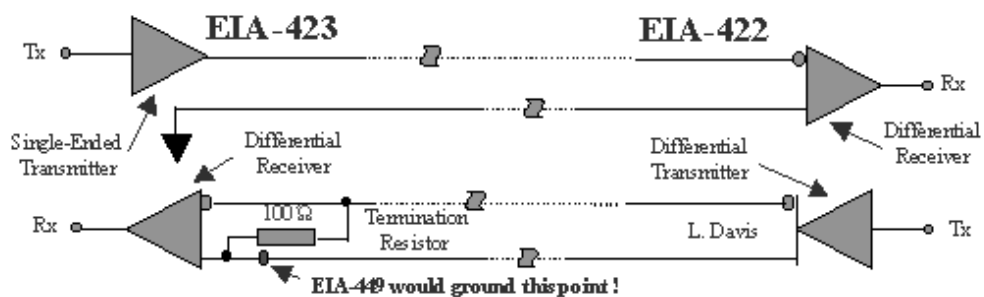
The connector pinning can be used to support RS422, RS423, V.35 and X.21 and more.

Fibersystems RS530 implementation is a differential/balanced communications interface with some single-ended/unbalanced signals normally used by modem control signals, CTS and DSR.

Balanced signals use RS422 signaling levels.

Unbalanced signals, CTS pin 5 and DSR pin 6, use RS423 signal levels.

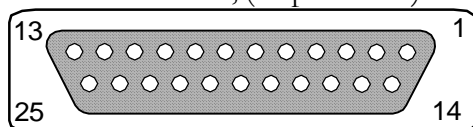
Both CTS and DSR are outputs from 21-16xx. A RS423-output can be connected to a RS422-input by simply connecting the other input to signal ground.



Note 21-16xx shall be seen logically more as an extension cable than as a modem. Both data and control signals are mirrored to the remote side 21-16xx. Control signals of the RS530 interface are not used for control of the 21-16xx traffic.

Both data and control signals are clocked in and out of the 21-16xx with the selected clock source. See chapter “Configuration”.

Contact D25 female, (25-pin D-sub).



| Pin | Signal | Function | Signal direction on D-sub |
|-----|----------|--------------------------|---------------------------|
| 1 | Shield | Shield – Chassies ground | - |
| 2 | TxD A | Transmit Data (A) | In |
| 3 | RxD A | Receive Data (A) | Out |
| 4 | RTS (A) | Request To Send (A) | In |
| 5 | CTS | Clear To Send | Out |
| 6 | DSR (A) | Data Set Ready (A) | Out |
| 7 | SGND | Signal Ground | - |
| 8 | DCD (A) | Data Carrier Detect (A) | Out |
| 9 | RxC (B) | Receive Clock (B) | Out |
| 10 | DCD (B) | Data Carrier Detect (B) | Out |
| 11 | TxCE (B) | Transmitt Clock (B) | Out |
| 12 | TxC (B) | Transmit Clock (B) | Out |
| 13 | | | |
| 14 | TxD B | Transmit (B) | In |
| 15 | TxC (A) | Transmit Clock (A) | Out |
| 16 | RxD B | Receive (B) | Out |
| 17 | RxC (A) | Receive Clock (A) | Out |
| 18 | - | - | - |
| 19 | RTS (B) | Ready To Send (B) | In |
| 20 | DTR (A) | Data Terminal Ready (A) | In |
| 21 | - | - | - |
| 22 | - | - | - |
| 23 | DTR (B) | Data Terminal Ready (B) | In |
| 24 | TxCE (B) | Transmitt Clock (A) | In |
| 25 | | | |

“Out “ sends data out from 21-16xx, “In” receives data.

G.703 2048kbps, E1 Port - BNC 75 Ohm



The connectors are BNC. Tx-port sends data out from 21-16xx, Rx-port receives data.

The BNC-connectors are isolated from chassis and both TIP and RING are isolated from any ground with an input and output transformer.

This gives the opportunity to set up any grounding philosophy.

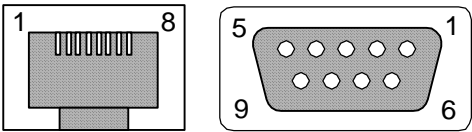
Best is to use double shielded coax cables as RG81.

In practice grounding the shield to chassis/protective earth/ground, (PE), has given the best performance, but proper grounding philosophy varies from installation to installation.

G.703 Codir/contra Port.



The RJ45 connector and the 9-pin D-sub connector are connected in parallel. Codir and contra are selectable by strapping pins. See chapter “Configuration”. LEDs CO and Con shows the selected mode. CO → Codir. CON → Contra.

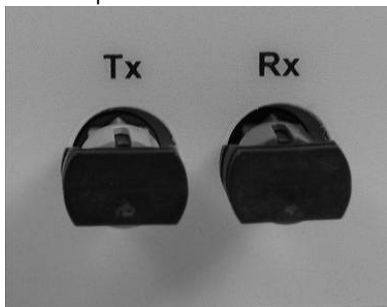


| Pin RJ45 | Pin 9-p D-sub | Signal | Function | Signal direction |
|----------|---------------|-----------|-----------------|--|
| 1 | 1 | Tx A | Transmit data A | Out |
| 2 | 2 | Tx B | Transmit data B | Out |
| 3 | 3 | Rx A | Receive data A | |
| 4 | 4 | Rx B | Receive data A | |
| 5 | 5 | TxCA/RxCA | Clock | Selectable by straps |
| 6 | 6 | TxCB/RxCB | Clock | Selectable by straps |
| 7 | 7 | TxCA/RxCA | Clock | Selectable by straps |
| 8 | 8 | TxCB/RxCB | Clock | Selectable by straps |
| Shield | 9+Shield | Shield | Shield | - (Internally connected to chassies ground). |

Clock is only used in Contra mode. The direction of clock signals are selectable by straps. See chapter “Configuration”.

Always use cables with a good shield. For example S/FTP.

Fiber Optic Port.



The fiber optic connector is of 'ST' type.

Confirm that the attenuation of the fiber optic cable, including splices and patch cables, doesn't exceed the system budget. Don't forget to add a safety margin. Minimum safety margin is 3dB.

Make sure that the local fiber optic transmitter, marked 'Tx', is connected to the remote units fiber optic receiver, marked Rx. And local Rx shall be connected to remote Tx.

Configuration

Factory settings

The most common configuration is set at delivery.

- S1 – Signal ground and Chassie ground are connected. Chassie is connected to Protective Earth(PE)/Ground with the Power supply cord.
- S5 – Codir/Contra
- S6 – Codir
- S11 – 64kbps , (Position 9).
- S2, S3, S4, 15, S16 – DTE, (Only X.21).
- S13 – No synchronization of received fiber clock.
- S14 – External clock, (Received from electrical interface).
- S14 – Phase not used, (No strap).
- S6 – Codir
- S7, S8, S9 - Contra clock → Receive clock.

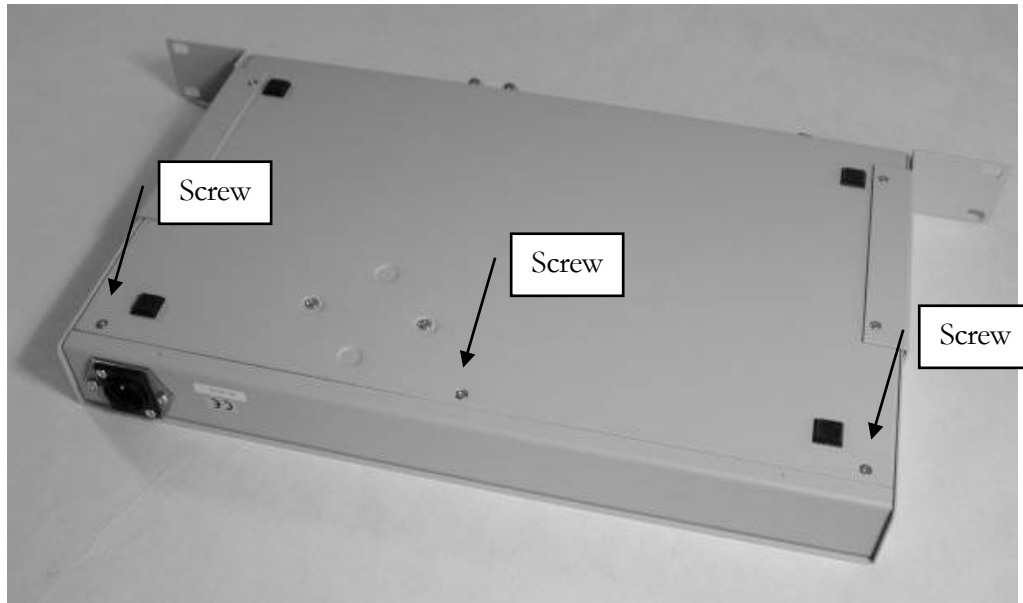


When two 21-16xx are connected back-to-back, one of the 21-16xx should be set to “Master mode”.

Configuration – remove top lid.

For configuration the 21-16xx must be open by removing the top lid.

Remove power supply cord and turn the unit up-side down.



Remove 3 screws.



Gently bend with a screwdriver to push out and remove the backpanel.
Don't remove the cables attached to the backpanel.

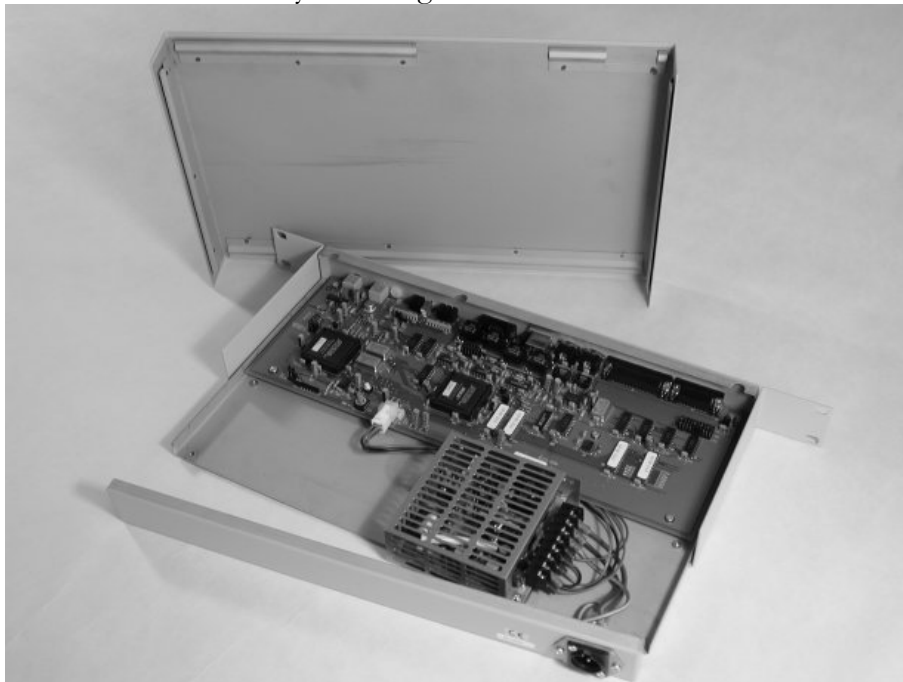
Turn the unit so top lid is facing up.



Press/slide the top lid backwards so it loosens from the frontpanel.



Lift the top lid in back. And remove the top lid.
Now the 21-16xx is ready for configuration.



Disassembled 21-16xx.

Configuration

Interface – S5

Codir/Contra – S6

Clock source – S14

Clock speed/data rate – S11

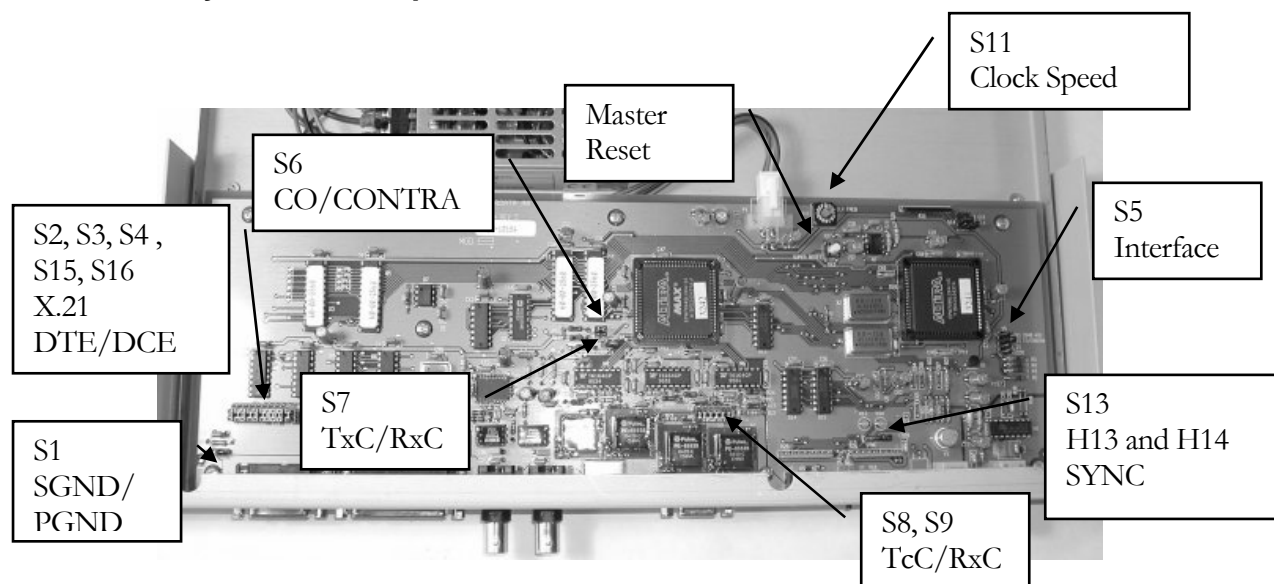
Synchronization of clocks – S13

Contra clock mode – S7, S8 and S9

X.21 DTE or DCE pinning – S2, S3, S4, S15 and S16

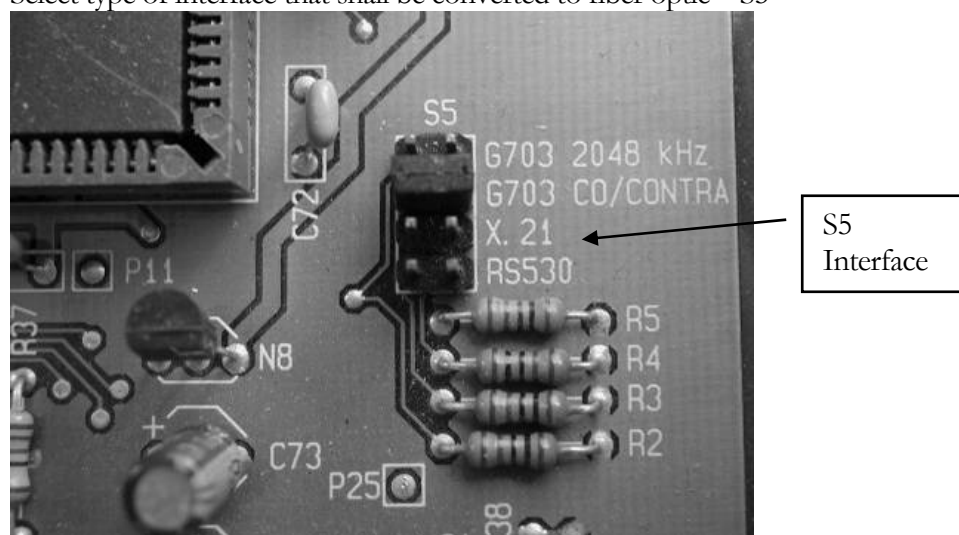
Signal ground to Protective ground reference – S1

NOTE! Jumper S6 must always be set to either CO or CONTRA. It may not be left open!



Type of interface

Select type of interface that shall be converted to fiber optic – S5



Four alternative interfaces selectable:

1. G.703, 2048kbps, (E1) – BNC connectors.
2. G.703 64kbps Codir / Contra - RJ45 or 9 pin D-sub connector.
3. X.21 – 15 pin D-sub connector.
4. RS530 – 25 pin D-sub connector. D-sub connector not mounted on units produced after October 2006.

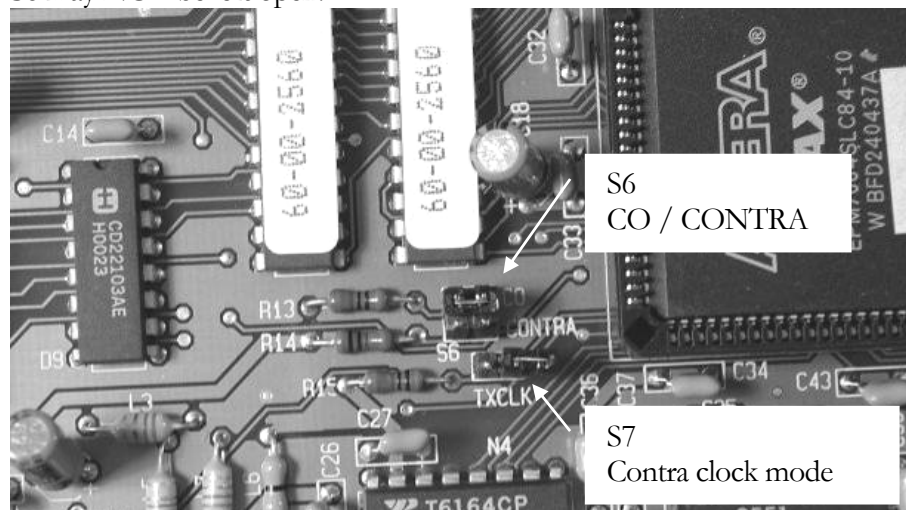
G.703 E1 2048kbps.

Data rate selector S11 shall be set to position 0, 2048kbps.

Codir – Contra, CO/CON

If S5 G.703 64kbps Codir/Contra is selected, select with S6 Codir or Contra.

S6 may NOT be left open!



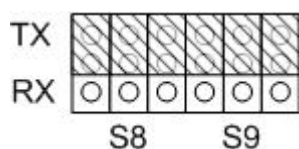
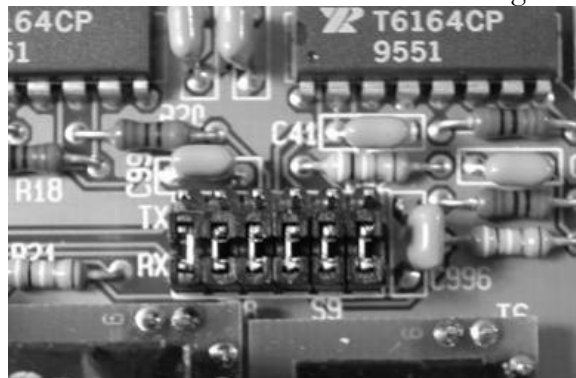
Select clock mode for Contra

First with S7 select if 21-16xx shall **transmit** the receive and transmit clock.

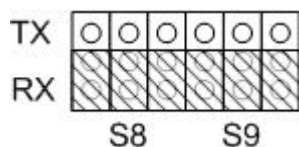
Strap at S7 selects that 21-16xx **transmit** the receive and transmit clock.

No strap at S7 selects that 21-16xx **receives** the receive and transmit clock.

In addition S8 and S9 must be set according to S7 selection.

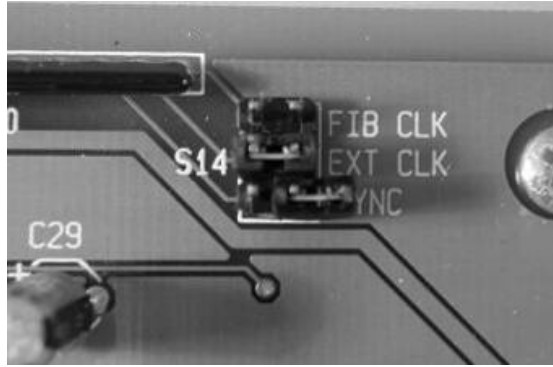


The 21-16xx **transmit** the receive and transmit clock.

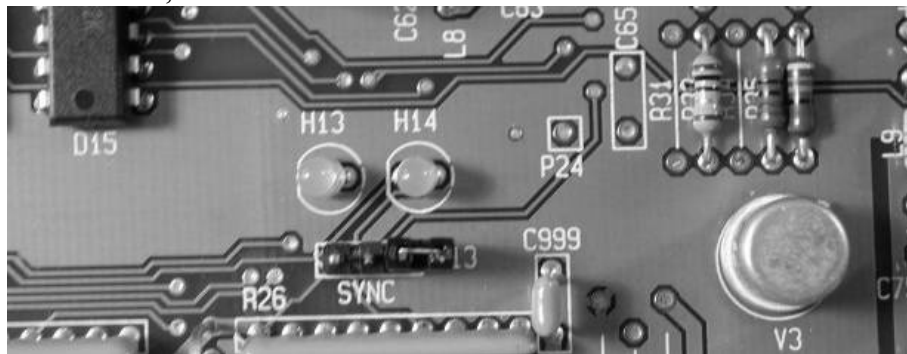


21-16xx **receives** the receive and transmit clock.

Clock source.



1. FIB CLK – Fiber clock. With strap, clock is extracted from incoming signal on fiber.
2. EXT CLK – External clock. With strap clock is extracted from signal on electrical interface.
3. Internal clock. No strap on FIB CLK and no strap on EXT CLK. Clock is generated internally in 21.16xx.
4. SYNC - If the data received from the fiber needs to be synchronized in phase with the data from the electrical interface, position a jumper at the SYNC (lower) position of S14 and place the jumper S13 according to the brightest LED, H13 – H14.



Internal clock – “Master mode”

When internal clock is selected, no straps on EXT CLK and FIB CLK, the clock used is generated by an internal clock. This is used when two 21-16xx, (or other product with same fiber protocol), are directly connected to each other. Only one 21-16xx shall have this configuration.

If both local 21-16xx and remote 21-16xx has Internal Clock selected the link works in Asynchronous mode. Only X.21 and RS530 interfaces support Asynchronous mode. S11 shall be set to position 2048kbps. Maximum data rate is 256kbps in asynchronous mode.

Clock speed/data rate.

Select data rate with HEX-switch S11.



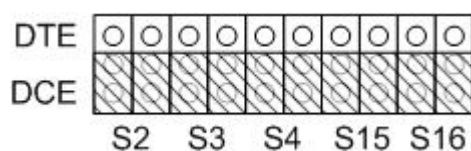
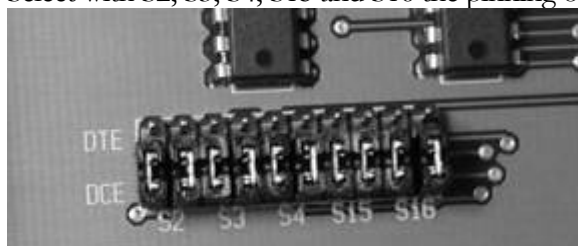
The different interfaces have individual possible selections:

| Data rate (kbps) | S11 position | G.703, 2Mbps | G.703 codir | G.703 contra | X.21 | RS-530 |
|-----------------------------|-------------------------|-------------------------|------------------------|-------------------------|-------------|---------------|
| 2048 | 0, E, F | OK | - | - | OK | OK |
| 1536 | 1 | - | - | - | OK | OK |
| 1024 | 2 | - | - | - | OK | OK |
| 768 | 3 | - | - | - | OK | OK |
| 512 | 4 | - | - | - | OK | OK |
| 384 | 5 | - | - | OK | OK | OK |
| 256 | 6 | - | OK | OK | OK | OK |
| 192 | 7 | - | OK | OK | OK | OK |
| 128 | 8 | - | OK | OK | OK | OK |
| 64 | 9 | - | OK | OK | OK | OK |
| 38,4 | A | - | - | - | OK | OK |
| 19,2 | B | - | - | - | OK | OK |
| 9,6 | C | - | - | - | OK | OK |
| 4,8 | D | - | - | - | OK | OK |

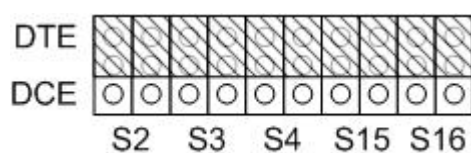
NOTE! Regardless of the clock method, the data rate must be set accordingly to the data rate used!

X.21 mode.

Select with S2, S3, S4, S15 and S16 the pinning of the 15 pin D-sub.



All straps in lower position → DCE pinning.



All straps in upper position → DTE pinning.

D-sub pinning

| Pin | Signal | Function | DTE | DCE |
|-----|--------|--------------------------|-----|-----|
| 1 | Shield | Shield – Chassies ground | - | - |
| 2 | TxD A | Transmit (A) | Out | In |
| 3 | | Control (A) | Out | In |
| 4 | RxD A | Receive (A) | In | Out |
| 5 | | Indication (A) | In | Out |
| 6 | | Signal Timing (A) | In | Out |
| 7 | - | Unassigned | - | - |
| 8 | SGND | Signal Ground | - | - |
| 9 | TxD B | Transmit (B) | Out | In |
| 10 | | Control (B) | Out | In |
| 11 | RxD B | Receive (B) | In | Out |
| 12 | | Indication (B) | In | Out |
| 13 | | Signal Timing (B) | In | Out |
| 14 | - | Unassigned | - | - |
| 15 | - | Unassigned | - | - |

If both local 21-16xx and remote 21-16xx has Internal Clock selected the link works in Asynchronous mode. S11 shall be set to position 2048kbps. Maximum data rate is 256kbps in asynchronous mode.

RS530 mode.

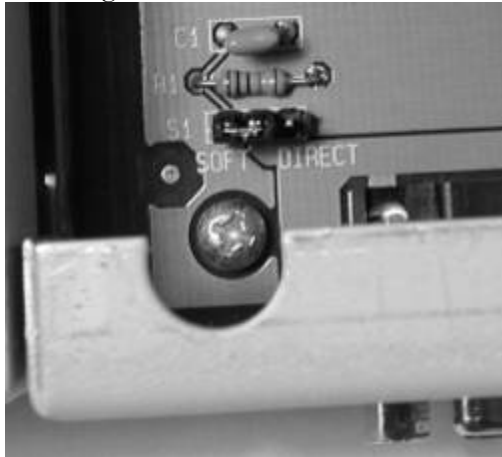
Not available on units produced later than October 2006.

DTE or DCE function must be selected with pinning of cable connectors.

If both local 21-16xx and remote 21-16xx has Internal Clock selected the link works in Asynchronous mode. S11 shall be set to position 2048kbps. Maximum data rate is 256kbps in asynchronous mode.

Ground selection.

Select Signal Ground – Chassie Ground relation.

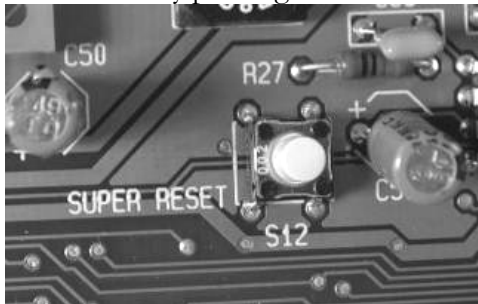


| | |
|-----------------|--|
| SOFT | Signal ground is referenced to Chassie ground with a resistor in parallel with a condensator, (100kOhm and 100nF). |
| DIRECT | Signal ground is connected direct to Chassie ground. |
| Strap left open | No reference between Signal ground and Chassie Ground. |

Super Reset.

If any selection is done with power on, the selection must be updated.

This is done by pressing SUPER RESET.



Start and usage.

Power on.

Connect the power cord to the 21-1601 / 21-1651 and then connect to AC-mains or DC-supply.

The “LO”-LED shall be lit green. If not, try to cross-connect the fibers at one end of the link.

LED-status.

There are 12 LED-indicators at the front panel.

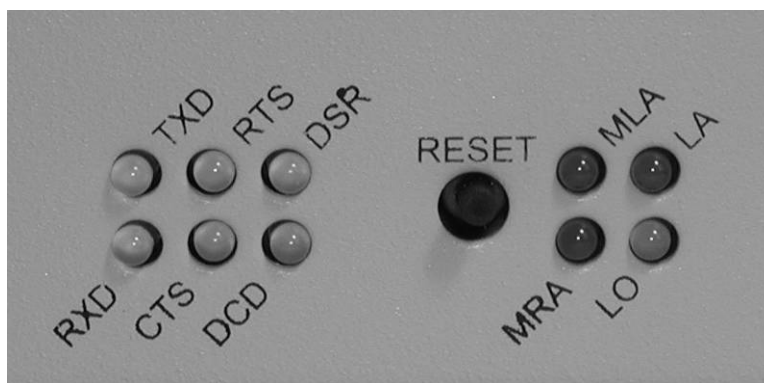


CON

A green LED is lit when Contra is selected.

CO

A green LED is lit when Codir is selected.



TXD

A yellow LED indicates data sent at selected electrical interface.

RXD

A yellow LED indicates data received at selected electrical interface.

RTS

A yellow LED indicate the status of RTS, (Ready To Send) on interface RS530 .

CTS

A yellow LED indicate the status of CTS, (Clear To Send) on interface RS530 .

DSR

A yellow LED indicate the status of DSR, (Data Set Ready) on interface RS530 .

DCD

A yellow LED indicate the status of DCD, (Data Carrier Detect) on interface RS530.

LA

Local Alarm. Normally off. Is lit red if the fiber optic link monitoring has detected a communication error on the incoming fiber.

MLA

Memory Local Alarm. Normally off/dark. This indication has the same function as “LA” with an additional memory function. Is lit red if the unit has detected an “LA”-error, and stays lit until the “**Reset**”-button is pressed.

MRA

Memory Remote Alarm. Normally off/dark. Is red if when the remote unit of the fiber optic link has detected an error. This indication has a memory function. Any remote error will be indicated until “**Reset**”-button is pressed.

LO

Link OK. Green when the fiber optic link is operating correctly.

Technical support

Before contacting technical support, we beg you to first read the manual once again..
If you still have problems or questions, don't hesitate to contact help desk. Please gather all relevant information, including serial number, about your installation before contacting help desk.

Our technical support can be reached at:

Fibersystem AB

Gardsfogdevagen 18B

S-16866 Bromma

Sweden

Telephone: +46-8-564 828 80 • telefax: +46-8-28 33 50

Web:

E-mail addresses can be found on our web-site.

CE - mark

The product described in this manual, is designed to apply to the specifications of the EMC directive 89/336/EEC and to low voltage directive 73/23/EEC

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