
TELOS SERIES 2101

Advanced All Digital Multi-Line Multi-studio Broadcast Telephone System



USER'S MANUAL VOLUME 1

Important Notes & Information, Service and Support

PART I – Introduction to the Series 2101 and its Components

PART II – Series 2101 Planning and Design

Customer Service

We support you...

By phone/Fax in the USA.

Customer service is available from 9:30 AM to 6:00 PM USA Eastern Time, Monday through Friday at +1 216.241.7225. We're often here at times outside of these, as well – please feel free to try at any time! Fax: +1 216.241.4103.

By phone/Fax in Europe.

Service is available from Telos Europe in Germany at +49 81 61 42 467.

Fax: +49 81 61 42 402.

By E-Mail.

The address is: support@telos-systems.com.

Via World Wide Web.

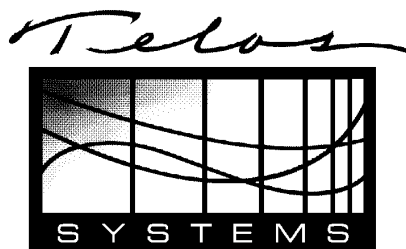
The Telos Web site has a variety of information which may be useful for product selection. The URL is: <http://www.telos-systems.com>.

Feedback

We welcome feedback on any aspect of the Series 2101 or this manual. In the past, many good ideas from users have made their way into software revisions or new products. Please contact us with your comments.

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Updates

The operation of the Telos 2101 is determined almost entirely by software. Contact us or look on our website to determine if a newer release is more suitable to your needs.

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Notice

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Warranty


This product is covered by a one year limited warranty, the full text of which is included in the Volume 3 of this manual.

Service

You must contact Telos before returning any equipment for factory service. Telos Systems will issue a Return Authorization number, **which must be written on the exterior of your shipping container**. Please do not include cables or accessories unless specifically requested by the technical support engineer at Telos. Be sure to adequately insure your shipment for its replacement value. Packages without proper authorization may be refused. US customers please contact Telos technical support at +1 (216) 241-7225. All other customers should contact your local representative to make arrangements for service.

Notices and Cautions

| | |
|---|---|
|  | <p>CAUTION:</p> <p><i>THE INSTALLATION AND SERVICING INSTRUCTIONS IN THIS MANUAL ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER ALL SERVICING TO QUALIFIED PERSONNEL.</i></p> |
|---|---|

| | |
|---|---|
|  | <p>WARNING:</p> <p><i>TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE. DO NOT SHOWER WITH THE UNIT.</i></p> |
|---|---|



This symbol, wherever it appears, alerts you to the presence of uninsulated, dangerous voltage inside the enclosure – voltage which may be sufficient to constitute a risk of shock.



This symbol, wherever it appears, alerts you to important operating and maintenance instructions. Read the manual.



TO PREVENT RISKS OF
ELECTRIC SHOCK,
DISCONNECT POWER
CORD BEFORE SERVICING



USA CLASS A COMPUTING DEVICE INFORMATION TO USER. WARNING: This equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used as directed by this manual, it may cause interference to radio communication. This equipment complies with the limits for a Class A computing device, as specified by FCC Rules, Part 15, Subpart J, which are designed to provide reasonable protection against such interference when this type of equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. If it does, the user will be required to eliminate the interference at the user's expense. **NOTE:** Objectionable interference to TV or radio reception can occur if other devices are connected to this device without the use of shielded interconnect cables. FCC rules require the use of only shielded cables.



CANADA WARNING: "This digital apparatus does not exceed the Class A limits for radio noise emissions set out in the Radio Interference Regulations of the Canadian Department of Communications." "Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de Class A)

prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.”

Warning and Cautions About the Telco Interface Cards Used in this System

FCC Part 68 Notice for T1 Interface Model PRI-PCI

This equipment complies with Part 68 of the FCC Rules. On the surface of the circuit side of the printed circuit board of this equipment is a label that contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN), if applicable, for this equipment. If requested, this information must be provided to the telephone company.

This equipment uses two (2) RJ-48 8-pin modular registered jacks. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular plug which Part 68 compliant. When ordering Primary Rate ISDN service for this product the following information should be given to your service provider:

- Extended Superframe (ESF) framing and B8ZS Line coding
- Each B-channel provisioned for alternate circuit-switched data/circuit-switched voice (CSD/CSV)
- The D-channel must be on channel 24 of the line
- No Packet handlers other than the D-channel
- 64kbps clear channel service end-to-end for every call

Refer to the appropriate section in the User Guide concerning ISDN service provisioning for additional information.

If the PRI-PCI terminal equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company shall notify the customer as soon as possible. Also you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operation or procedures that could affect the operation of your equipment. If this happens the telephone company will provide advance notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

If trouble is experienced with the PRI-PCI, please contact Telos Systems (see above) or;

Warranty and Repair Service Center

Netaccess, Inc

18 Keewaydin Dr

Salem, NH 03079

603 890-7298

for repair and (or) warranty information. If the trouble is causing harm to the telephone network, the telephone company may request that you remove the equipment from the network until the problem is resolved.

The PRI-PCI does not contain users repairable or serviceable components.

This equipment may not be used on the publish coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs.

The PRI-PCI is a DSX-1 device. Federal regulations (FC Part 68) prohibit connection of a DSX-1 device to the network without an FCC approved Channel Service Unit (CSU). Customers connecting this device to the network shall upon request of the telephone company, inform the telephone company of the particular lines to which such connections are made and the FCC registration of the protection device (CSU).

INDUSTRY CANADA (IC) NOTICE (Canada)

“NOTICE: The Industry Canada (IC) label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The department does not guarantee the equipment will operate to the user’s satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telephone communications company cause to request the user to disconnect the equipment.

Users should ensure, for their own protection, that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority, or electrician, as appropriate”

“This Class (A) digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations”

“Cet appareil numérique de classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada”

EUROPEAN UNION NOTICES

To ensure compliance with EN 60950: 1992, you must follow the requirements below when installing a PRI-PCI board:

Power

- The PC chassis must supply power to the board according to the power requirements listed elsewhere

- The total power required by the host processor, PRI-PCI board(s) and other boards in the PC chassis must not exceed the power specifications in the PC's technical manual.

Hazardous Voltage

- Typical, a PRI-PCI board is not installed in a PC chassis that contains boards which use or generate hazardous voltage (voltages that exceeds 42.4 Vac or 60 Vdc at peak condition). If you believe hazardous voltages is present in the PC chassis, contact Netaccess Customer Support for assistance when installing a PRI-PCI board.

Interface Connections

- All PRI-PCI board interfaces possess a SELV safety classification for connection to other devices.
- PRI-PCI boards must not be used in conjunction with other equipment to switch messages, producing two-way live speech calls, except where such use is explicitly permitted by the approval of the other equipment.

Clearance & Creepage Distances

- The PRI-PCI board must be installed with appropriate clearance and creepage distances between the board and any device that uses or generates voltage (other than PCI bus connections). The table below identifies the minimum distances according to the voltage used or generated by the device:

| Voltage Used/Generated | Clearance | Creepage |
|------------------------------|---|------------------|
| Up to 50 Vrms/Vdc | 2.0 mm | 2.4 mm (3.8 mm) |
| Between 50 and 125 Vrms/Vdc | 2.6 mm | 3.0 mm (4.8 mm) |
| Between 125 and 250 Vrms/Vdc | 4.0 mm | 5.0 mm (8.0 mm) |
| Between 250 and 300 Vrms/Vdc | 4.0 mm | 6.4 mm (10.0 mm) |
| Greater than 300 Vrms/Vdc | Obtain advice from a competent telecommunications safety engineer before installing the board | |

NOTE: if the PC chassis is subject to conductive pollution or dry nonconductive pollution which may become conductive due to condensation, use the creepage distances specified in brackets.

GERMAN NOTICE

The edge connector that is intended for connection to the host PC is a Safety Extra Low Voltage (SELV) circuit. Rechnerschnittstelle: Der Kontakteiste der die Verbindung Zum PC herstellt entspricht den Safety Extra Low Voltage (SELV) Bestimmungen.

AUSTRALIAN NOTICE

WARNING- This equipment will be inoperable when mains power fails!

“Connection of this equipment must be made via an AUSTEL certified or permitted Line Isolation Unit”.

This customer equipment is to be installed and maintained by service personnel as defined by AS/NZS 3260 Clause 1.2.14.3 (Service Personnel). Incorrect connection of connected equipment to the General Purpose Outlet could result in a hazardous situation.

Safety requirements are not fulfilled unless equipment is connected to a wall socket outlet with protective earth contact.

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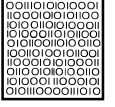
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A word about this manual

This manual is written in seven parts, as shown on the previous page. The parts are identified with the Roman numerals I through VII. It is bound as three volumes. The first volume, the volume you are reading, contains important safety information and compliance information as well as how to contact Telos (see pages III-IX, preceding).

The following symbols are used throughout this manual to highlight various type of information contained within.

| | |
|---|---|
|  | <p>DANGER!</p> <p><i>This information is important to safe operation of the equipment and warns of possible hazards. For you safety you should read these.</i></p> |
|  | <p>IMPORTANT!</p> <p><i>This information is essential to getting the Series 2101 to work, or prevent damage to it. To avoid headaches read these.</i></p> |
|  | <p>HOT TIP!</p> <p><i>This information will probably come in handy at some point. You will probably wish to read these.</i></p> |
|  | <p>ISDN TIP!</p> <p><i>Important information about ISDN. This is recommended reading for all ISDN users.</i></p> |

| | |
|--|--|
|  | <p>MIX- MINUS TIP!</p> <p><i>Information useful when configuring your send- to- caller Mix- Minus feeds.</i></p> |
|  | <p>DEEP TECH NOTE!</p> <p><i>Amaze your technical friends with your voluminous knowledge of the 2101, ISDN, and hybrid technology! Not necessary for the ability to install and use the 2101, but this information might come in handy if you ever need to troubleshoot the system.</i></p> |
|  | <p>CURIOSITY NOTE!</p> <p><i>Amaze your friends with your grasp of ISDN and Hybrid trivia. Not necessary for the ability to install and operate the 2101.</i></p> |

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TELOS SERIES 2101

**Advanced All Digital Multi-line Multi-studio Broadcast Telephone
System**

USER'S MANUAL

PART I

Introduction to the Series 2101 and its Components

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1 Why the Series 2101?

If you have already purchased the Series 2101 Telephone System, you may not need further discussion of why it was a good idea. However, you may be reading this manual prior to deciding if the Series 2101 is right for you. This section can also help you get the best performance out of your system, since it highlights the system's capabilities.

1.1 First of all, just what is the Series 2101?

The Telos Series 2101 is designed for broadcast facilities where dozens of incoming talk lines are required and those lines are required to be shared among multiple studios. Depending on the version ordered, the 2101 Hub can interface to as many as four T1 circuits (24 channel digital circuits as used in North America and Japan), E1 circuits (30 channel digital circuits as used in most other areas of the world), or ISDN PRI (Primary Rate Interface) circuits based on E1 or T1.

The 2101 supports up to 32 multiple studios. Each Studio typically has a single Telos 2101 Studio Interface that contains two all-digital telephone hybrids. Four-hybrid studio configurations are also possible, consisting of a Telos 2101 Studio Interface plus a Telos TWO all digital dual hybrid.

At the heart of any broadcast telephone system are the hybrids used. Based on the Telos TWO dual hybrid, the 2101 Studio Interface includes simply the best broadcast hybrids made. With a trans-hybrid loss of well over 70dB, it allows for the best possible announcer audio over the air. Performance when used with open speakers and in teleconferencing applications is also superb.

The 2101 combines this hybrid design with a multi-line system controller (the Series 2101 hub) and multiple studio interfaces. Each 2101 Studio Interface offers support for up to two (expandable to eight) Telos Desktop Director control surfaces - typically one for a phone screener and one for talent. Each Desktop Director can be easily reconfigured between the talent and producer (screener) modes of operation and to select the a "show configuration" for that studio. The Desktop Director has an intuitive user interface and we are confident your staff will take to the system in no time.

If it sounds like we are proud of this system, you are right! We appreciate the opportunity to take your facility into the 21st Century.

1.2 Features and benefits of the Series 2101

Telos products have earned a reputation for ease of use and outstanding performance, and the Telos Series 2101 lives up to that reputation. Our advanced ISDN hybrid technology comprises an integrated suite of audio processing functions to achieve unsurpassed audio quality.

- Up to 120 incoming Telco Channels (depending on the type of Telco connections used)
- Systems available with support for up to 32 studios

- Dual-redundant Hubs can be used to protect against the loss of a hub or any Telco Trunk (Please consult your Telos Sales Engineer for additional information on this option).
- Multiple “show configurations” each of which determines the number of active lines. Studio configurations can be changed easily – No more “programming” with a punch tool.
- Any phone number can ring in any studio. Using PRI trunks hunt groups can be created. Number/Line assignments can be dynamically changed.
- Studio-grade 20-bit A-to-D conversion, combined with noise gating and shaping, guarantees crystalline audio to the caller and significantly improved send levels.
- Simultaneous analog and AES/EBU outputs.
- Automatic high-precision sample rate conversion for incoming AES/EBU.
- Unmatched Send/Receive separation using Telos’ time-tested Adaptive Cancellation technology. Each hybrid automatically & continuously adjusts to phone line conditions, virtually eliminating the hollowness, feedback and distortion that occurs when send audio “leaks” into the caller output signal.
- Sophisticated AGC/limiting functions and three-band Digital Dynamic Equalization (DDEQ) ensure consistent caller audio levels and spectral consistency.
- Easy to use menus. Full metering for proper setup and operation.
- Caller ID* support and fully adjustable Caller Ducking (override) helps hosts stay in control (PRI only).
*Caller ID service required from your Telco service provider.
- Conference linking ability lets you set up high-quality conferencing between callers with no external equipment needed. (Only a single mix-minus is required.)

1.3 Why Digital Trunks Make Sense for Broadcast Talk Show Systems

We’d like to highlight the advantages of using digital telephone trunks such as E1, T1, and PRI for interfacing your studio to the outside world. Our website at <http://www.telos-systems.com> has several papers dedicated to this subject as well.

Digital Trunks including ISDN are widely available, cost-effective, and offer many advantages for studio systems. It is yet another example of digital technology enhancing broadcast operations.

Integrated Services Digital Network (ISDN) is a set of international standards for digital transmission over ordinary telephone copper wire (as well as over other media). Presently, the dial-up telephone network is nearly entirely digital, except for the “last mile” copper connections from the Central Office (Exchange) to the customer’s site. The Series 2101 takes advantage of this technology to deliver crystal clear caller audio to the radio studio.

The telephone network routes calls over 64 kbps channels. A sampling rate of 8 kHz is used, with a word length of 8 bits. The 8 kHz sampling rate supports a Nyquist (audio cut-off) frequency of 4 kHz. In practice, telephone systems are designed to

have audio frequency response extending to 3.4 kHz in order to allow relatively simple roll-off filters to be used.



CURIOSITY NOTE!

The word length is what determines dynamic range—and 8 bits would only permit 48 dB were it used in standard PCM linear fashion. A primitive kind of compression is used to stretch the dynamic range: μ Law in North America and much of Asia, and A-law in Europe. This is a scheme that equalizes the step-size in dB terms across the dynamic range—a smaller step-size on low-level signals reduces quantization noise and improves effective dynamic range to the equivalent of about 13 bits. The correct setting is covered in Part IV (Studio Interface & Additional Hybrids).

While the application of digital signal processing to the problem of separating host and caller audio – pioneered by Telos and used in all of our telephone interfaces – has made a dramatic improvement over pure analog systems, using digital phone lines for incoming calls further improves performance for several reasons:

ISDN Lines are Inherently “4-wire”

Analog lines use a single pair of wires for both signal directions, mixing the send and caller audio. This causes the “leakage” problem—where the announcer’s audio is present on the hybrid output, where we desire that there only be caller audio. A “4-wire” circuit has two wire pairs, and therefore two independent audio paths. Digital circuits inherently offer independent and separated signal paths because it is not possible to have bits moving in both directions without separating them somehow. (Though a digital circuit may today not use wires at all, but rather fiber, microwave radio, or satellite, telephone engineers, bowing to tradition, continue to refer to all separated speech paths as being “4-wire.”)

While the application of DSP to the problem of separating the signals—used in digital hybrid interfaces—has made a dramatic improvement over analog systems, ISDN enables yet further improved performance.

Better Digital-Analog Conversion Quality

The analog-digital conversion chips used in telephone central offices are poor compared to the converters used in professional audio equipment. Fidelity is not an important consideration when most Telco equipment designers choose parts for this function. In a professional interface for studio applications such as the Series 2101 Studio Interface, we can afford to design-in much better converters than available in the Telephone Company’s equipment. Noise-shaping functions permit a larger word-length converter to provide significantly better distortion and signal-to-noise performance.

Since we are handling the conversion, we can encode at higher levels without concern about regulations designed to prevent crosstalk on analog lines, resulting in improved send-to-caller levels.

In all-digital installations, the telephone interface can maintain a digital path all the way. AES/EBU is included in the 2101 Studio Interface to accomplish the connection to digital studio gear.

Lower Noise

Because they are digital circuits, digital lines are not susceptible to induced noise. Analog lines are exposed to a variety of noise and impulse trouble-causers as they move across town on poles and through your building. Hum is the main one, given most line's proximity to pole transformers and power lines, but there are also sources of impulse noise from motors, switches, and other sources. Digital lines convey the bits precisely and accurately from the network to your studio equipment without any perturbation—so the audio remains clean. Even when the caller is using an analog phone line to call in, the noticeably quieter digital connection between the hybrid and the telephone network helps the hybrid achieve better rejection of outgoing audio leakage.

Call Setup and Supervision are Better

Analog lines use a strange mix of signaling to convey call status. Loop current drop and returned dial-tone signal that a far-end caller has disconnected; blasts of 100 volts at 20 Hz mean someone wants you to answer. Why should we be using a mechanism designed to bang a hammer against a metal bell to transmit network status information into the 21st Century? ISDN uses a modern digital approach to controlling calls and conveying status information about them. The sophisticated transactions on the D channel are able to keep both ends of a call accurately informed about what is happening.

For starters, ISDN call set-up times are often only a few 10's of milli-seconds, enhancing production of a fast-paced show. Perhaps more importantly, when a caller disconnects while waiting on hold, the ISDN channel communicates this status change instantly. This contrasts with the usual 11-second delay on most analog lines. One of the most common complaints of talk hosts is that they go to a line where they expect a caller to be waiting, only to be met with a blaring, annoying dial tone. The chance of this happening with an ISDN line is nearly zero.

Another common error is the condition where a talent punches-up a line that looks free, but which actually is just about to begin ringing and connects to a surprised caller. This condition, called glare, results from the delay in the ring signaling, which comes from the nature of the analog line's ringing cadence. This is much less likely with ISDN because it eliminates the ambiguous status period.



CURIOSITY NOTE!

We don't know why the condition of picking up a line which was about to ring and getting an incoming call instead of dial tone is called "Glare". Perhaps its because the looks air staff give engineers when this happens too often!

If you find out, be sure to let us know!

Higher Gain and Reduced Feedback During Multi-line Conferencing

Higher Gain and Reduced Feedback During Multi-line Conferencing. When conferencing is required on 2-wire circuits, very good hybrids are needed to separate the two audio paths in order to add gain in each direction. When the gain around the loop exceeds unity, the unpleasant result is feedback. Since the conference path usually includes four AGC functions, the hybrid must be sufficiently good to cover the additional gain that may be dynamically inserted by these AGC's.

Because of the 4-wire nature of digital telephone lines, the hybrid function is more effective—and more reliably so across a variety of calls. That means more gain can be inserted between calls before feedback becomes a problem.

Better Line Monitoring.

Since there is a full-time connection between the central office and the terminal on the D channel, it is possible to detect when a line is not working. On an analog line, one discovers a problem only from a failed attempt to use the line. Many digital phone lines maintain a full-time connection between the Central Office and your studio on the “D” channel, so you can quickly detect when a line is not working.

Furthermore, the sophisticated transactions on the “D” channel keep both ends of a call accurately informed about line status.

Elimination of A-to-D & D-to-A conversions.

- The analog-digital conversion equipment used in telephone central offices is of poor quality compared to the converters used in professional audio equipment. Using a digital phone line enables you to maintain a digital path all the way from the caller's central office to your studio equipment — requiring only the initial conversion to digital, and doing away with the need to reconvert from digital to analog audio. AES/EBU outputs are provided on Series 2101 Studio Interface to help accomplish this direct connection to digital studio gear.

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2 So what is Series 2101? (System Components)

But just what does the Telos Series 2101 consists of? A Series 2101 consists of the following components:

- Series 2101 Hub and associated Quad T-Link and Telco Trunk Interface cards.

In some countries, such as the USA & Canada, a CSU must also be provided (CSU or NCTE is not included)

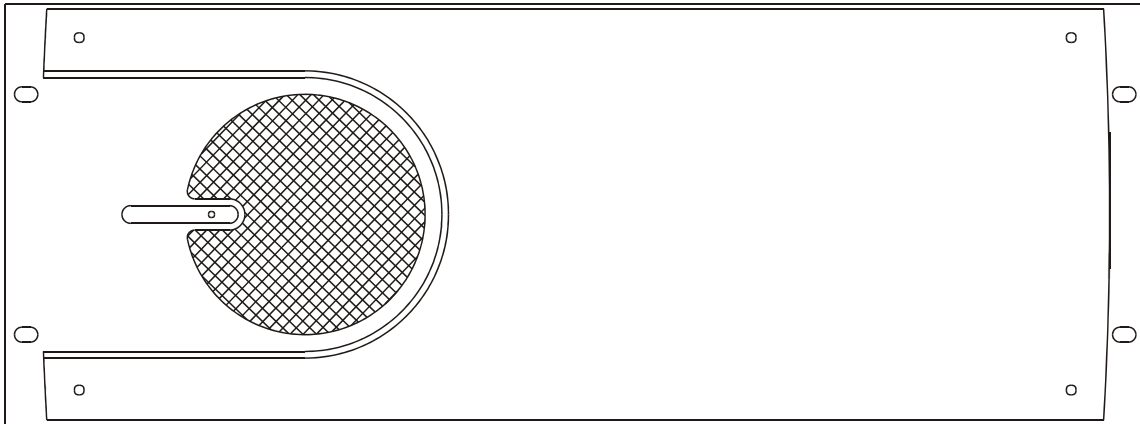
- Series 2101 Studio Interfaces (with integral dual hybrid)
- 2101 dual Extended hybrid (optional)
- Telos Desktop Directors (or Extended Desktop Directors)
- Ethernet 10/100Base-T LAN hub (not included)
- Administration Computer with web browser (not included)
- Assistant Producer 3.5 for 2101 Software Package (optional).

2.1 The 2101 Hub

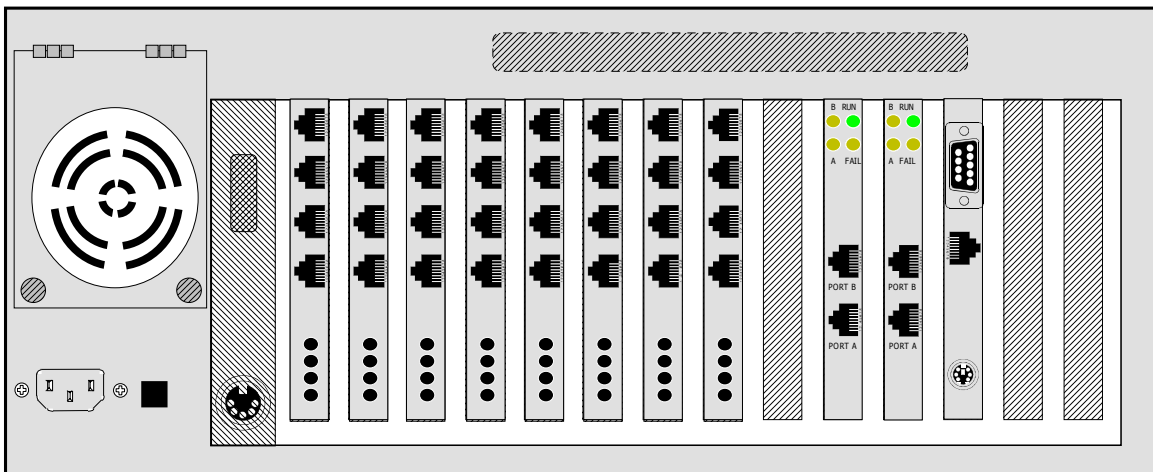
The 2101 Hub is a highly specialized microprocessor-controlled telephone switch, optimized for easy management and flexible control. It has up to two trunk interface cards to connect to the digital trunks from your telephone company. Each Telco interface supports one or two Telco circuits, for a maximum total of 4 circuits. Each PRI/T1 has 23 channels while each PRI/E1 circuits has 30 channels for a total caller capacity of up to 120 “lines”. The 2101 hub also has up to 32 T-Link interface ports that are the “Line side” interface from the System Hub to the 2101 Studio Interface(s). Each Studio Interface acts as a “Key” telephone system, with 12-24 “lines” coming from the Hub.

A significant feature of the system hub is the fact that it can be easily configured on-line with a number of *Show Configurations*. Each *Show Configuration* assigns a specific group of “line appearances” to a specific Studio Interface. Numbers may be shared among one or more *Show Configurations*, if desired.

IP (Internet Protocol) connections over 10/100 Base-T Ethernet allows communication directly between the 2101 Hub and the Studio Interfaces for coordination.



System 2101 Hub, front panel



The System 2101 Hub, rear panel. This hub is fully populated (for 32 Studio Interfaces and 4 Telco Trunks) See Part III of this manual for details.

Your T-Link cards and CPU card may look different.

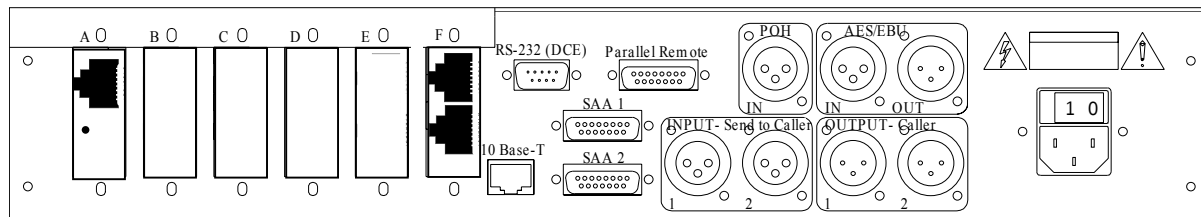
The *Telos 2101 Configuration Web Pages* are used to configure the Hub and create Show Configurations.

2.2 2101 Studio Interface

The 2101 Studio Interface is closely related to our TWOx12 telephone system. It contains two all-digital hybrids. It also contains one (expandable to two) T-Link interface as well as support for four (expandable to eight) Desktop Directors™. Each studio interface must be located within 655 feet (200 meters) of the Hub.

All audio connections are made to the Studio Interface(s). Each has two analog inputs, two analog outputs, an analog Program-on-hold input, a dual AES/EBU input, and a dual AES/EBU output.

Your talent will use a Desktop Director™ in the studio to be used for the show to “log in” to the appropriate *Show Configuration* which serves to make a group of “Lines” active in that studio. A given show configuration is inactive if there are no Desktop Directors in the *Talent Mode* logged into it.



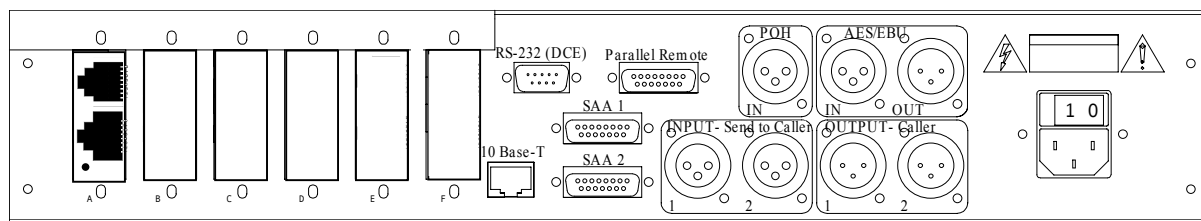
Rear panel of the Series 2101 Studio Interface.

The Desktop Director Interface in Slot F supports up to four Desktop Directors (or 2 Desktop Directors and a Telos TWO Hybrid). A second Desktop Director Interface (Telos **part # 2001-00022**) can be inserted in Slot E to allow eight Desktop Directors (or 6 Desktop Directors and a Telos TWO Hybrid)

A second T-Link card (Telos **part # 1701-00048**) can be added in slot B to create redundant systems.

2.3 Telos 2101 Extended Hybrid (Telos TWO Hybrid)

If more than 2 hybrids are required for a studio, a Telos TWO dual all-digital hybrid with special 2101 Software (Telos **part # 2001-00128**) can be linked to a Desktop Director port of the Studio Interface providing an additional pair of hybrids. This unit requires special 2101 software, so be sure to specify that the unit will be used as a 2101 Extended Hybrid when ordering. Adding this unit permits access to 4 hybrids using the extended model of the Desktop Director (Telos **part # 2001-00072**). Note that when the Telos TWO hybrid is added the number of Desktop Directors attached to the associated Studio Interface drops to a maximum of 6.



Telos TWO Dual Hybrid. NOTE: The upper (RJ-11 style) modular jack may not be present. The RJ-45 style jack (“S” Interface) is used to connect to a Desktop Director port on the Studio Interface when a four hybrid studio configuration is required.

2.4 Desktop Director™

The TWOx12 has 2 Desktop Director™ ports located in slot F. The system can be expanded by adding a second interface card (Telos **part # 1701-00022**) to slot E, allowing for a maximum of 8 Desktop Directors. Power for the first two Desktop Directors is supplied by the Studio Interface.

A second Desktop Director can be added to each port (for a total of 8 per Studio Interface) using a Desktop Director Power Supply Kit (**part number 2091-00001**) available from your Telos Dealer. Each power supply kit allows one additional Desktop Director.

A power supply is also required for any Desktop Director located more than 250 feet (75 meters) from the TWOx12.

The Desktop Director™ is available in two configurations. The basic Desktop Director (Telos **part # 2001-00071**) has two rows of twelve buttons allowing for control of two hybrids and access of up to 12 lines. The extended Desktop Director (Telos **part # 2001-00072**) has four rows of button which can be used either for control of two hybrids and access to 24 lines **or** to allow control of four hybrids with access to 12 lines.



*Standard (12 Line/2 Hybrid) Desktop Director (Telos **part # 2001-00071**)*

Both versions of the Desktop Director also provide function buttons and an LCD screen. A telephone handset and built in speakerphone are also provided.

From a Desktop Director your staff can choose a specific *Show Configuration* and can determine the mode of operation of that Director. A given Director can be in either *Producer mode* or *Talent mode*. *Producer mode* allows for call screening while *Talent mode* controls placing calls on the hybrids. More on this in Part V.

Each Desktop Director must be located within 250 feet (76 meters) of the 2101 Studio Interface or a Desktop Director Power Supply (Telos **part # 2001-00024**) will be required. With this Power Supply the Desktop Director can be located as far as 2300 feet (700 meters) from the Studio Interface. A Power Supply must also be used for each additional Director, over two, connected to a given 2101 Studio Interface. Two Desktop Directors can be powered by a single expander kit if located in close proximity. A second Desktop Director Port card (Telos **Part # 2001-00022**) must be installed in the Studio Interface if more than 4 Directors are required.

**IMPORTANT!**

*The Extended Desktop Director (Telos **part # 2001- 00072**) requires the Desktop Director Power Supply (Telos **part # 2001- 00024**).*

2.5 Ethernet 10/100 Base-T LAN Hub

The various components of the Series 2101 communicate with each other over an Ethernet 10/100Base-T Local Area Network (LAN). The Series 2101 Hub uses 100Base-T while the Studio Interfaces use 10Base-T, so a Ethernet Hub capable of both types of connections must be used. A few sources for purchasing such equipment in North America are Data Comm Warehouse (800 990-0748 or www.warehouse.com) or Contact East Networking (800 282-1800 or www.contacteast.com). Many other sources exist.

**HOT TIP!**

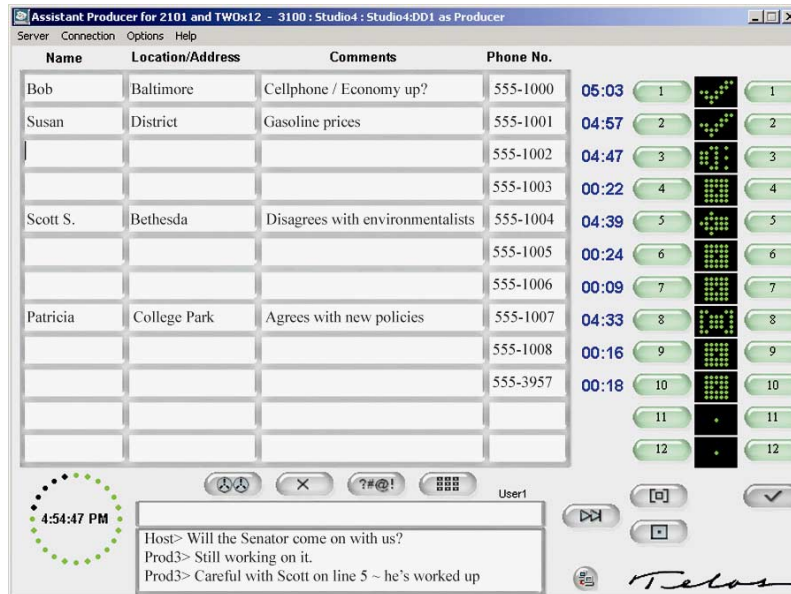
Not all 100Base- T hubs support 10Base- T as well. It is important that you use a hub capable of both types of connections.

It is highly preferable that this LAN be isolated from your office LAN. If you wish to interconnect the two LANs a Router (preferably) or Ethernet "switching hub" should be used to provide isolation between the 2101 LAN and the Office LAN. Such routers and switching hubs are widely available from sources such as those mentioned above.

2.6 Administration Computer

This computer is required to access the Series 2101 Hub's *Web Configuration Web Pages* over the network. You will use a Web Browser on this machine and an Ethernet connection to configure the 2101 Hub for use with your Telco Circuits, create Show Configurations and allow access to those shows from your studios. Microsoft Explorer version 6.0 has been tested with the 2101's built in web server. Other browsers or versions may or may not be compatible.

2.7 Assistant Producer 3.5 for TWOx12 and 2101 Call Screening Software

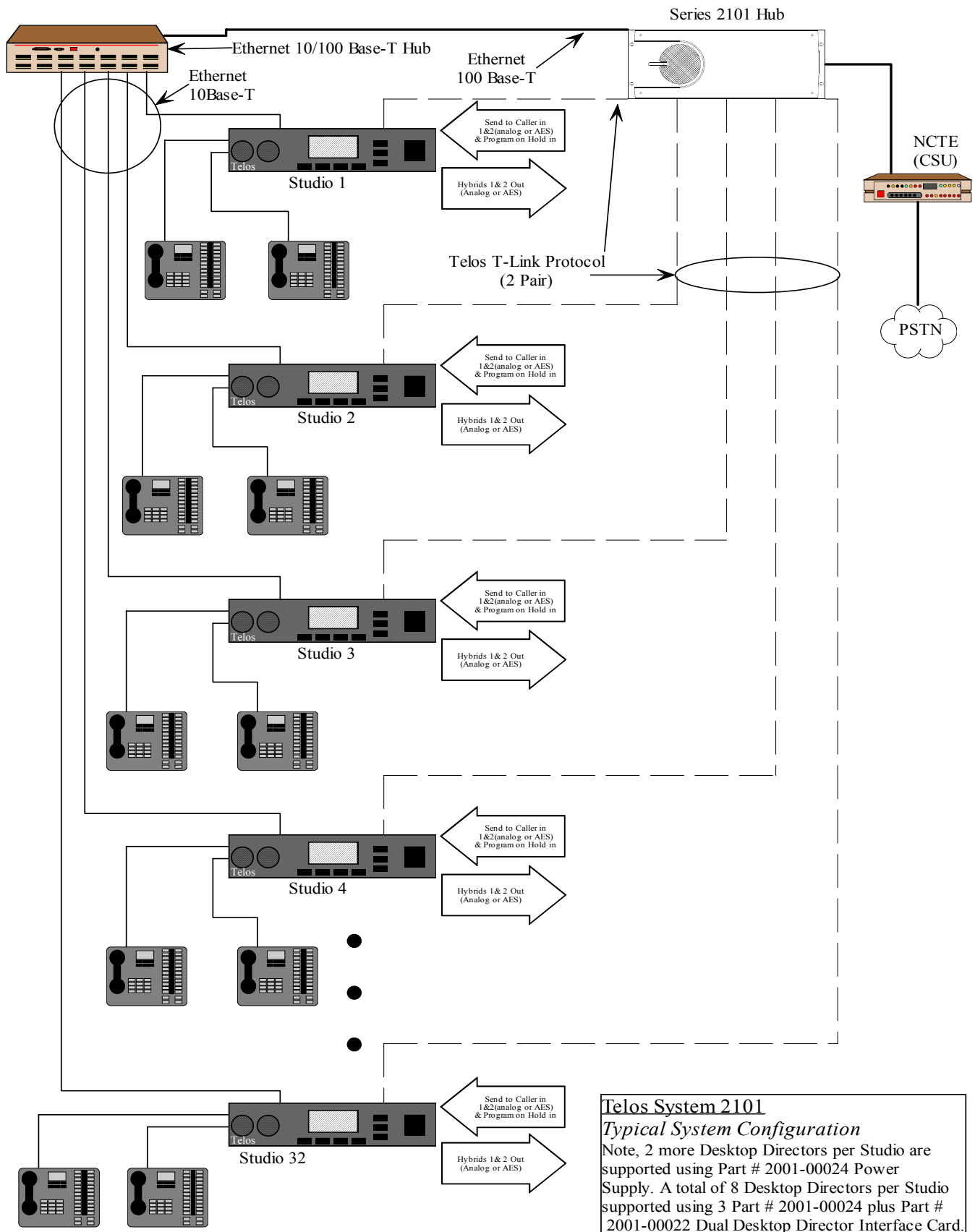


Our *Assistant Producer 3.5* software package is used to allow call screeners to enter data about callers for use by the on-air talent. This optional software is documented separately from the Series 2101.

2.8 Putting it all together. (A sample configuration)

By now the reader has probably deduced that the typical Telos Series 2101 installation consists of a 2101 Hub with multiple Studio Interfaces. Each 2101 Studio Interface connects with a “home run” cable back to the 2101 Hub as well a common IP 10 Base-T Ethernet connection. Each Desktop Director connects to a 2101 Studio Interface.

A typical installation is shown on the next page.



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TELOS SERIES 2101

**Advanced All Digital Multi-line Multi-studio Broadcast
Telephone System**

USER'S MANUAL

PART II

Series 2101 Planning, Design, & Commissioning

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2101 Planning and System Design

Here, in Part II, we will cover what you'll need to know in order to plan your Series 2101 system. We'll cover everything from maximum allowable cable distances to the basic design of your Studios and Telco trunks, which will determine how you will use *Show Configurations*.

We will assume some familiarity with Telco concepts and terminology in this Part of the manual. You may wish to read our Telephone Technology Tutorial (Appendix 1). Please also consult the Glossary (Appendix 2) if we use a term unfamiliar to you.

1 System Design Criteria and Basic Design Principles

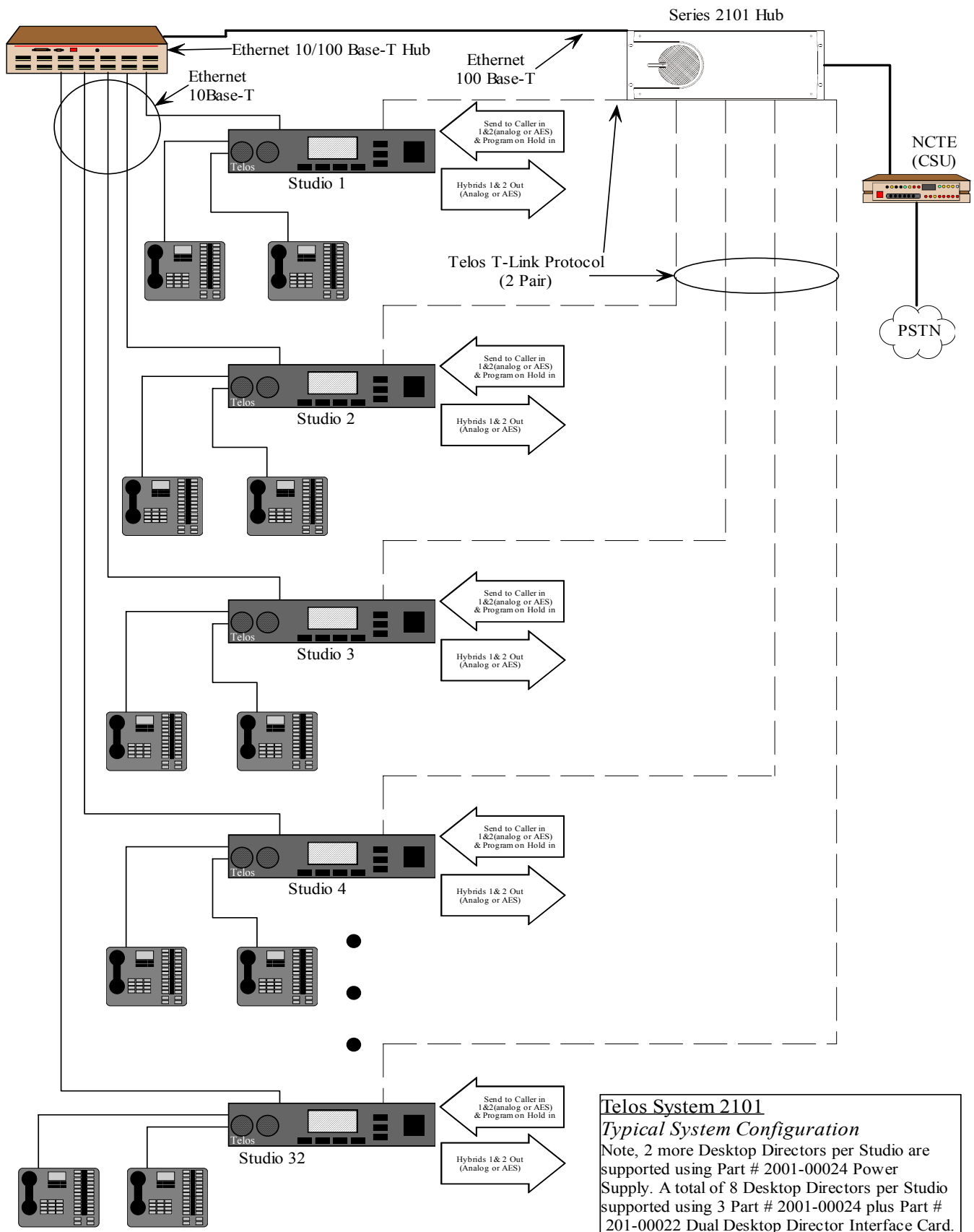
1.1 System Architecture

As we discussed in Part I, a Series 2101 system consists of a Hub connected to multiple studio interfaces. Each Studio Interface connects to your audio console as well as supporting up to eight* Desktop Directors™.

*Desktop Director Power Supply (Telos **part # 2001-00024**) are required for each Director greater than two.

*An Additional Interface card (Telos **part # 2001-00022**) is required if more than 4 Desktop Directors are required.

A typical Series 2101 is shown on the next page.



1.2 System Interconnecting Cables - types and specifications

You can use the following table as a resource when designing your physical plant. You will note that the maximum cable lengths are long enough to offer quite a bit of flexibility. However, you should check your studio design to ensure these criteria are met. Each type of cable is documented in more detail in other sections, as indicated. See Appendix 3 for more information on the various cables used.

| Application | Signal Type | Maximum Distance | Required Cable | Connector & Wiring |
|--|--|--|---|---|
| <u>Desktop Director</u> (Single Director per port) See Part V, Section 1.1 | ISDN "S" bus (AMI) compatible. "Point to Point" configuration. | 2300 feet (700 meters). Requires External Desktop Director Power Supply Kit if over 250 feet (76 meters). | Three pair, Category 3 or better. Category 5 recommended. | 8-Position/8-Pin miniature modular (RJ-45 style). 3 or 4 pairs (pins 3-8) wired according to TIA/EIA-568-A T568A or T568B. |
| <u>Desktop Director</u> (Two Directors per port) See Part IV Section 1.3.2 & Part V Section 1.1 | ISDN "S" bus (AMI) compatible. "Extended Passive Bus" configuration. | 1220 feet (375 meters). Requires External Desktop Director Power Supply Kit. Director A must be within 120 feet (37 meters) of the power supply. Director B must be within 33 feet (10 meters) of the power supply) | Three pair, Category 3 or better. Category 5 recommended. | 8-Position/8-Pin miniature modular (RJ-45 style). 3 - 4 pairs (pins 3-8) wired according to TIA/EIA-568-A T568A or T568B. |
| <u>T-Link</u> See Part III Section 3.1.2 & Part IV Section 1.3.1 | DSX-1 | 655 feet (200 meters) | Two pair, Category 3 or better. | 8-Position/8-Pin miniature modular (RJ-45 style). 2-4 pairs (pins 1&2, 4&5) wired according to TIA/EIA-568-A T568A or T568B |
| <u>Incoming T1/PRI</u> Note: An approved CSU (NCTE) must be used to terminate the line per local conventions. See Part III Section 3.1.1 | DSX-1 | 655 feet (200 meters) | Two pair, Category 3 or better. | 8-Position/ 8-Pin miniature modular (RJ- 45 style). 2- pairs wired according to TIA/EIA-568-A T568A or T568B |

| Application | Signal Type | Maximum Distance | Required Cable | Connector & Wiring |
|--|------------------------|------------------------|-------------------------------------|--|
| <u>Incoming E1/PRI</u> Note: An approved NCTE must be used to terminate the line per local conventions. See Part III Section 3.1.1 | E1 (ITU-T G.703, CSEP) | 1000 feet (305 meters) | Two pair, ABAM 110 ohm Twisted pair | 8-Position/ 8-Pin miniature modular (RJ- 45 style). 2- pairs wired according to TIA/EIA-568-A T568A or T568B. |
| <u>Ethernet 10 Base-T</u> See Part IV section 1.6.4 | Ethernet 10 Base-T | 330 feet (100 meters) | Two pair, Category 3 or better. | 8-Position/8-Pin miniature modular (RJ-45 style). 2 – 4 pairs (pins 1&2, and 3&6) wired according to TIA/EIA-568-A T568A or T568B. |
| <u>Ethernet 100 Base-T</u> See Part III section 3.1.3 | Ethernet 100 Base-T | 330 feet (100 meters) | Two pair, Category 5 or better. | 8-Position/8-Pin miniature modular (RJ-45 style). 2 – 4 pairs (pins 1&2, and 3&6) wired according to TIA/EIA-568-A T568A or T568B. |
| Also see Appendix 3 in Part VII for a summary of the pin outs on each of the above cables. | | | | |

1.3 Power & Environmental Considerations

1.3.1 Heating, Ventilating, & Cooling Requirements

For optimal reliability, it is necessary to avoid exceeding the maximum allowable ambient air temperatures surrounding the components of the Series 2101. Ambient air temperature should be between 0 to 40 degrees Celsius (32 to 104 degrees Fahrenheit). Relative Humidity can be 0 to 98% (non-condensing).

1.3.2 AC (mains) requirements

The Telos 2101 Studio Interface can be powered from an AC source from 100 to 240 volts. The 2101 Hub can be used on either 120 or 240 volts; however, it must be manually configured to the appropriate voltage using switches located on the power supplies. See Volume 2 Part III of this manual.

As with any microprocessor-based equipment, it is highly desirable that the Series 2101 components be fed from a reliable source of clean power. We recommend that a UPS (Uninterruptible Power Supply) and quality noise suppressor be employed. Surge protection is also desirable. Our first choice would be a top-of-the-line unit containing a ferroresonant transformer as well as a UPS. You will want to avoid "bargain basement" brands that can cause more problems than they solve.

One possible source is Best Power Technology with its ferroresonant transformer/UPS combination for extremely clean UPS power. See: http://www.bestpower.com/products/ferrups/price/ferrupsfe60hz_price_usd.htm

Another source is American Power Conversion. Their Back-Ups Pro series is well suited for microprocessor-based equipment such as the Series 2101 Hub and Studio Interface. See: http://www.apc.com/products/back-ups_pro/index.cfm

Be sure that UPS battery replacement goes on your preventative maintenance schedule.

It is essential that the third “grounding” pin not be defeated on the power cord and that the power cord be connected to a properly grounded receptacle.



IMPORTANT!

As with any piece of modern electronic gear, it is advisable that precautions be taken to prevent damage caused by power surges. Standard line surge protectors can be used to offer some degree of protection. It is the user's responsibility to ensure protection adequate for their conditions is provided.



WARNING!

This equipment is designed to be operated from an AC power source that includes a third “grounding” connection in addition to the power leads.

Do not defeat this safety feature. In addition to creating a potentially hazardous situation, defeating this safety ground will prevent the internal line noise filter from functioning.



IMPORTANT SAFETY INFORMATION!

*If fuse replacement is required, please note: **For continued protection against fire, replace fuse only with same type and value.** See the DETAILED TECHNICAL INFORMATION section for information and cautions.*



1.3.3 Lightning Protection for the Telephone Circuits

The single biggest source of failures of Telecom equipment is due to damage related to lightning. Some failures are catastrophic failures, while some are due to the cumulative damage that can occur over the course of several years. See section 1.3.2 for information on protecting the AC (mains) power connection.

We also recommend that a quality telephone line protector designed for the digital lines you are using be employed at the back panel of the Series 2101 Hub. The ground terminal should be connected directly to the 2101 Hub chassis and connected

to the Telco Interface jack with as short a cable as possible (under 8 inches). This approach is particularly well suited to situations where you expect nearby strikes, such as when you are located near a tower.

One source for an appropriate unit is Polyphaser. See <http://www.polyphaser.com/>. Users have reported good results with their multi-conductor twisted pair models.

Another source for telephone line protectors is Telebyte corp. See <http://www.telebyteusa.com> . Many other sources are available.

**IMPORTANT TIP!**

In many countries, including the USA & Canada, a NCTE (Network Channel Termination Equipment) or CSU (Channel Service Unit) is required to be provided by the end- user at the network interface to terminate the line. This device provides a first line defense against lightning, among other things, and must be installed according to the manufacturer's instructions.

2 Planning your Telco & LAN Installation

2.1 PRI, T1, E1 compared

T1 and E1

T1 and E1 are similar protocols, and pre-date the PRI protocols we will discuss next. We strongly recommend PRI because it allows you to take advantage of the flexibility inherent in the Series 2101 (see below). In addition, while in some cases T1 channels are merely analog trunks converted to T1 using a channel bank, PRI requires a true digital path from the local central office switch.

T1 is used in the USA, Canada, a few Asian countries, and a few other countries. E1 is used throughout much of the rest of the world. These are older 4 wire standards which require Telco repeaters every few thousand feet.

T1 has 24 channels at 64 kbps each while E1 has 32 channels at 64 kbps each, two of which are used for signaling purposes and synchronisation (leaving 30 channels left for user purposes). Signaling over T1 uses some form of “Robbed Bit Signaling” on each channel. Since this “borrows” the lowest Bit from every 6th byte, this bit cannot be used for data transmission and the remaining “clear channel” capacity is 56 kbps.

These circuits are typically terminated in the phone room with a piece of equipment generically called a NCTE (Network Channel Terminating Equipment). The NCTE is not included as part of the Series 2101, and must be purchased separately in the country of destination. The exact name for the NCTE varies around the world; In the USA & Canada the NCTE is called a CSU (Channel Service Unit). In Australia, it is called a LIU (Line Isolation Unit). The NCTE is typically provided by the Telco, however in the USA & Canada it is the responsibility of the customer to provide it.

One source for a CSU appropriate for T1/PRI in the USA is Adtran. Many Telos Dealers in the USA & Canada carry Adtran equipment. Model T1 CSU Ace 2nd G (Adtran part # 1203022L1) or Model T1 ESF CSU Ace (part # 1203025L1) are both suitable for use in the USA. See <http://www.adtran.com>

Framing and line coding are both parameters that vary depending on the T1 or E1 line. We recommend and support the following formats for use with the Series 2101 hub.

| TRUNK TYPE | FRAMING | LINE CODING |
|----------------------------|---|---|
| T1/PRI | ESF (Extended Super Frame) | B8ZS (Bipolar 8 Zero Substitution) |
| T1 | *ESF (Extended Super Frame) OR SF (D4) (Superframe) | *B8ZS (Bipolar 8 Zero Substitution) OR AMI (Alternate Mark Inversion) |
| E1 E1/PRI | CRC-4 Multiframe with Si=FEBE | HDB3 (High Density Bipolar 3) |
| * This option is preferred | | |

T1 is generally configured as a channel-based trunk group (“Channelized T-1” or “Digital Trunking”. In this case, each channel of the T1 circuit has its own phone number and identity. Therefore, hunt groups (Rollover groups or ISGs) would be created by the Telco Provider. This reduces system flexibility, which is why we recommend PRI trunks (see below).

In some cases, a “Two way DID” form of T1 can be obtained. This uses “E&M Wink start” signaling and is the preferred T1 option in rare cases where PRI cannot be obtained.

PRI

PRI (also sometimes referred to as S2M or ISDN 30 in some areas outside the USA and Canada) stands for “Primary Rate Interface”. PRI is closely related to the more common ISDN BRI (S0 or ISDN 2), however PRI is optimized for connections from the Telco to a private telephone switch or PBX such as the Series 2101. PRI can be considered a “smart T1” or “smart E1” as the actual transmission medium uses the same technology as those circuits. This type of trunk is the preferred method of interfacing with the Series 2101 since it is the most flexible.

PRI in the USA and Canada consists of 23 B (Bearer) channels and a single D (Data or Delta) channel. Each channel is 64kbps. Unlike T1, the full 64kbps channel capacity is available for use since the signaling is conducted on the D channel.

Four ISDN protocols are offered by the various Telcos in North America and are supported by the Series 2101 Hub: National ISDN-1; National ISDN-2; Nortel DMS Custom; AT&T/Lucent Custom 5ESS. We recommend that you use the National ISDN-2 protocol if available.

In countries using the ETS 300 (Euro-ISDN) standard for ISDN, PRI has 30 B (Bearer channels) and a single D (Data or Delta) Channel as well as a synchronisation channel.

**ISDN TIP!**

PRI does not have a correspondence between actual channels and phone numbers. There can be any number of phone numbers associated with a PRI. Incoming calls include the number that was dialed in the D channel call setup message. If the 2101 Hub refuses a call then a “busy tone” is returned by the Telco switch at the caller’s end. This arrangement is very closely related to the SS7 (Signaling System 7) used by the Telcos for quite some time for inter- switch trunk arrangements.

When you program a *show configuration* for PRI you will specify which numbers will be used. By specifying a number more than once, you can create a hunt group. By including a number (or a hunt group consisting of a number more than once) in more than one *show configuration* you can share numbers across more than one studio.

2.2 Dialing

Each studio has access to different “Lines” as configured on the 2101 Hub. When an idle line is selected, standard US Dial tone will be heard and dialing can commence. Dialing can be performed via the Desktop Director, Console Director, or via Assistant Producer 3.5 software.

Since PRI channels are shared among all 2101 “Studios”, it is possible to configure the system for a degree of “concentration” of lines. In this case, there could be times when there is no channel available to place an outbound call due to activity in another studio. In this case, some or all lines may temporarily display the “x” symbol.

Outbound calls over PRI will include the “called party address” of the dialing “line”. In other words, the local DID number will be included as the originating telephone number on outbound calls.

**HOT TIP!**

If the “line” selected is a trunk to a PBX a “9” may be required.

**DEEP TECH NOTE!**

Certain specialized T1 Trunks (usually used between a PBX and the Series 2101) may offer similar benefits to PRI with regards to no channel- based configuration flexibility (i.e. dynamic channel/number assignment).

Compatibility with PBX protocols can be variable. We offer these options for the cases where connection behind a PBX is desirable. However, Telos Systems cannot guarantee that either of these protocols will work in a given situation.

Please contact both Telos and your switch vendor in advance, and plan on compatibility testing prior to any final decision to implement a PBX- to- Series 2101 connection.

2.3 Trunk Configurations using T1

Here each channel will normally have a phone number. If several channels are part of a “circular” hunt group, any of the phone numbers for the hunt group can be dialed from outside and the calls will hunt to any available channel in the group. Of course, usual practice is to just give out one number on air.



HOT TIP!

In rare cases, it is possible for channels that are part of a hunt group to not have individual phone numbers. In this case, the number pointing to the hunt group is called a Pilot Number. In this case this number would be entered once for each channel of the hunt group.

2.4 Special Considerations when the Series 2101 is used behind a PBX

Wherever possible, it is desirable for the Series 2101 to be connected directly to the Public Telco without connections to another telephone system such as a PBX. However there are some reasons why users desire to connect their Series 2101 in conjunction with a PBX system.

- To allow calls from the business system (on the PBX) to be “transferred” over to the on-air system (i.e. the Series 2101).
- To allow calls from the Series 2101 to be “transferred” over to the business telephone system (i.e. the PBX).
- To share Telco trunks in hopes of gaining economies of scale.

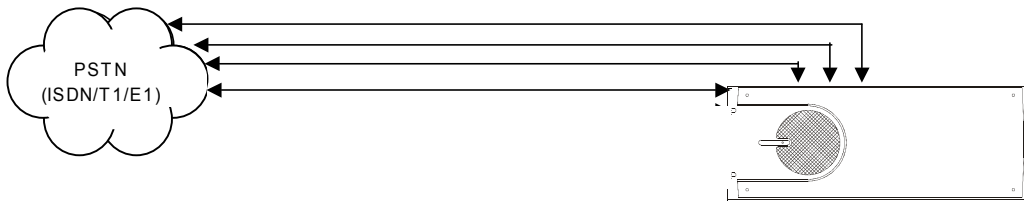
It is important to understand certain important principles when considering this sort of arrangement.

- The typical business telephone system relies on the principle of concentration – There will be a far larger number of telephones in the system as compared to the number of channels to the Telco. The Series 2101 typically will receive large numbers of calls and many calls will be on hold at a given time. Therefore, the PBX must be designed with this in mind or PBX users could be interrupted if all of the PBX’s Telco trunks are in use. It is also possible to use all available switch paths through the PBX, which would further block calls. Therefore the PBX planner should assume that all Series 2101 channels will be used simultaneously and allow for normal use of the PBX when this is the case. When discussing this with your PBX vendor it may be helpful to describe the Telos Series 2101 as “similar to an ACD (automatic call distributor)” in this regard.
- Telephone system planners often refer to the “Busy Hour”. This is the time of day when the telephone system is at its highest number of calls when observed over some time. During the busy hour, some (small) degree of “Blocking” can be expected, unless the system is over designed. The on-air telephone system may have a different busy hour than your PBX users. To the extent this is true, the better the chances are that the systems can efficiently share the PBX’s trunks to the Telco, thereby helping keep your operating costs down. If your sales and

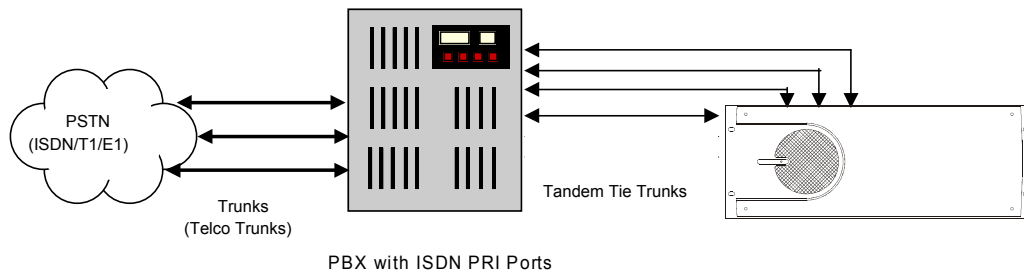
business users typically make the most calls in the afternoon and your big phone-in show is in the morning, then you may not need to have capacity for both simultaneously. We can only give so much advice here. Just remember that the safest and simplest approach is to keep the two systems separate. For more on this subject see the bibliography in the Appendix.

There are 2 different ways you might configure a 2101 system and a PBX as illustrated below:

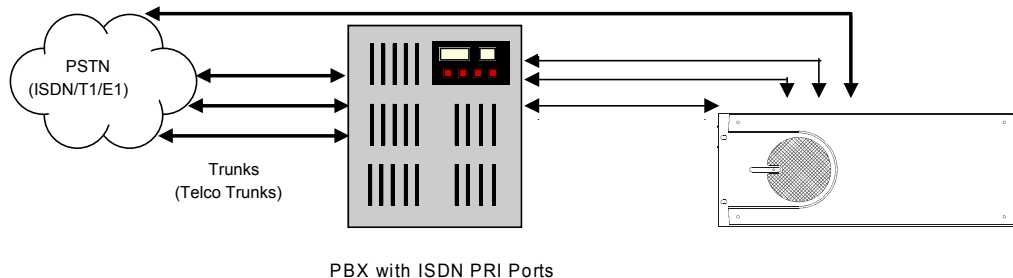
Series 2101 "Direct Connection"



Series 2101 "Behind the PBX"

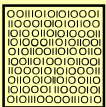


Series 2101 "Mixed Configuration"



ISDN TIP!

You should plan to use ISDN direct from the Telco, unless you have confirmed compatibility with the desired PBX. This will require working with Telos and the Switch Supplier in advance and will require that you perform compatibility tests between the two systems.



Tandem Trunking methods

A channel between two telephone switches is called a trunk. If three switches are connected sequentially, the switch that lies between the others can be referred to as a “Tandem Switch”. In the case, where a Series 2101 Hub is connected to a PBX (which is connected to the Telco) the PBX is acting in this tandem capacity. The trunks leading from the PBX to the Series 2101 Hub could therefore be referred to as Tandem trunks.

If you require that the Series 2101 be “behind a PBX”, the PBX must support one of the following Protocols (please contact Telos Customer Support for additional information).

T1

- T1 With Channel Associated Signaling (Robbed Bit Signaling)
- If you wish to use this method please contact Telos Systems customer support for a copy of the latest version of the document “Telos Series 2101 - T1 Trunk Requirements”.

PRI

The Series 2101 expects to see a PRI line that looks like a Telco central office switch. Therefore, the PBX must emulate a known ISDN protocol in the “LT” (Line Termination) mode. The PBX switch must be fully compliant with one of the PRI protocols listed in the Appendix.



IMPORTANT!

Compatibility with the above protocols can be variable. We offer these options for the cases where connection behind a PBX is desirable. However, Telos Systems cannot guarantee that these protocols will work in a given situation.

Please contact both Telos and your switch vendor in advance and plan on compatibility testing in advance of any final decision to implement a PBX- to- Series 2101 connection.

Telos Applications Engineering may be able to provide details on other cases where these techniques were successfully employed.

2.5 Show Configurations

A *Show Configuration* identifies a set of phone numbers mapped to Desktop Director button appearances (line appearances) for a specific show. Show configurations are created using the *2101 Hub Web Configuration* pages. We will go into detail on how to create *Show Configurations* in part III of this manual. However, we would like to introduce the concept here for planning purposes. In particular, it is useful to understand how the type of telephone trunks (T1 versus PRI) can affect your flexibility in this regard.

Show Configurations for PRI

If you are using PRI, you will be purchasing a “block” of telephone numbers as well as the PRI itself. You have complete flexibility in how you use those numbers. For example, if you had only two *Show Configurations* you might use only two numbers; (111)-555-1234 might be assigned to your morning show. This number would be assigned to all 12 channels of the “Morning” show configuration, thereby creating a hunt group.

| | Phone Number | Line Name | Busy All Group |
|---------|--------------|-----------|----------------|
| Line 1 | 1115551234 | AMShow | ✓ |
| Line 2 | 1115551234 | AMShow | ✓ |
| Line 3 | 1115551234 | AMShow | ✓ |
| Line 4 | 1115551234 | AMShow | ✓ |
| Line 5 | 1115551234 | AMShow | ✓ |
| Line 6 | 1115551234 | AMShow | ✓ |
| Line 7 | 1115551234 | AMShow | ✓ |
| Line 8 | 1115551234 | AMShow | ✓ |
| Line 9 | 1115551234 | AMShow | ✓ |
| Line 10 | 1115551234 | AMShow | ✓ |
| Line 11 | 1115551234 | AMShow | ✓ |
| Line 12 | 1115551234 | AMShow | ✓ |
| Cancel | | Apply | |

Show Configuration for our “Morning Show” hunt group example

A second number, (111)-555-1235 could be assigned to the “Noon Talk” show configuration. Again, we would create a *Show Configuration* assigning the number to all twelve “lines” creating a hunt group (see below).

| | Phone Number | Line Name | Busy All Group |
|---------|--------------|-----------|----------------|
| Line 1 | 1115551235 | NoonTalk | ✓ |
| Line 2 | 1115551235 | NoonTalk | ✓ |
| Line 3 | 1115551235 | NoonTalk | ✓ |
| Line 4 | 1115551235 | NoonTalk | ✓ |
| Line 5 | 1115551235 | NoonTalk | ✓ |
| Line 6 | 1115551235 | NoonTalk | ✓ |
| Line 7 | 1115551235 | NoonTalk | ✓ |
| Line 8 | 1115551235 | NoonTalk | ✓ |
| Line 9 | 1115551235 | NoonTalk | ✓ |
| Line 10 | 1115551235 | NoonTalk | ✓ |
| Line 11 | 1115551235 | NoonTalk | ✓ |
| Line 12 | 1115551235 | NoonTalk | ✓ |
| Cancel | | Apply | |

Show Configuration for our “Noon Show” hunt group example

However, let's assume that we need two more numbers. (111)-555-1230 for our "hot line" so management can always get through to the station, and (111)-555-1231 will be used for our weather service to call with forecasts. We want these two important functions to always be on lines 1 and 2, respectively. We will also define these lines so they are not part of the Busy All Group (lines that are made busy when the *busy all* button is pressed). The following examples show this:

| | Phone Number | Line Name | Busy All Group |
|---------------------------------------|--------------|--------------------------------------|-------------------------------------|
| Line 1 | 1115551230 | Hotline | <input type="checkbox"/> |
| Line 2 | 1115551231 | Weather | <input type="checkbox"/> |
| Line 3 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 4 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 5 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 6 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 7 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 8 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 9 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 10 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 11 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| Line 12 | 1115551234 | AMShow | <input checked="" type="checkbox"/> |
| <input type="button" value="Cancel"/> | | <input type="button" value="Apply"/> | |

Show Configuration for our "Morning Show" example with "Hotline" and special "Weather" line added.

| | Phone Number | Line Name | Busy All Group |
|---------|--------------|-----------|-------------------------------------|
| Line 1 | 1115551230 | Hotline | <input type="checkbox"/> |
| Line 2 | 1115551231 | Weather | <input type="checkbox"/> |
| Line 3 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 4 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 5 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 6 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 7 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 8 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 9 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 10 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 11 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Line 12 | 1115551235 | NoonTalk | <input checked="" type="checkbox"/> |
| Cancel | | Apply | |

Show Configuration for our "Noon Talk" example with "Hotline" and special "Weather" line added.



IMPORTANT TIP!

When creating Show Configurations you must use enter the correct number of digits as programmed in your PRI/TI Trunk Configuration section. In our example we have entered the full 10 digits. However, you may need to only enter 4 or 7 digits. Your Telco provider should be able to tell you how many digits are sent on calls to the 2101. See Part III section 4.4 for more details.

From these examples, you can see how simple it is to create each *Show Configuration* when PRI lines are used. Remember, with PRI you can purchase as many numbers as you wish, and can therefore customize each show if you desire.

Your talent will use the Desktop Director TM **in the studio to be used for the show** to choose the appropriate *Show Configuration*. A given *Show Configuration* is inactive if there are no Desktop Directors in the *Talent Mode* logged into it. See Part III of this manual for details on creating show configurations and Part V for specific instructions for your staff.

Show Configurations for Channelized T1

Creating show configurations for a channel oriented numbering scheme (such as most T1s) is nearly identical. However, here the individual channels have an association with the phone numbers, and the hunt groups must be created by the Telecom service provider, rather than within the Series 2101. Let's examine some sample show configurations using a T1 or other channel-oriented trunks.



IMPORTANT TIP!

When a group of channels are provisioned (by the Telco) as a hunt group you must be sure to assign all channels of that hunt group to show configurations using that group. Otherwise calls will be lost when they "hunt" to that channel.



HOT TIP!

The numbers assigned to your T1 channels may or may not be contiguous phone number assignments.

(see next page)

In our example, the T1 has been provisioned (by the Telco) for two hunt groups. The first hunt group (for the morning show) consists of a group of 10 channels having phone numbers (111)-555-1000 through (111)-555-1009. The second hunt group (for the afternoon Talk show) also has 10 channels, with telephone numbers ranging from (111)-555-1010 through (111)-555-1019. These hunt groups have already been provisioned (configured) by the Telco. (111)-555-1020 will be used for the weather and (111)-555-1023 will be the hotline. The following phone numbers (111)-555-1021, (111)-555-1022 are not used in either configuration shown. These could be used in other *Show Configurations*, possibly for a production studio.

| | Phone Number | Line Name | Busy All Group |
|---------------------------------------|--------------|--------------------------------------|-------------------------------------|
| Line 1 | 1115551023 | Hotline | <input type="checkbox"/> |
| Line 2 | 1115551020 | Weather | <input type="checkbox"/> |
| Line 3 | 1115551000 | AMHunt | <input checked="" type="checkbox"/> |
| Line 4 | 1115551001 | AMHunt | <input checked="" type="checkbox"/> |
| Line 5 | 1115551002 | AMHunt | <input checked="" type="checkbox"/> |
| Line 6 | 1115551003 | AMHunt | <input checked="" type="checkbox"/> |
| Line 7 | 1115551004 | AMHunt | <input checked="" type="checkbox"/> |
| Line 8 | 1115551005 | AMHunt | <input checked="" type="checkbox"/> |
| Line 9 | 1115551006 | AMHunt | <input checked="" type="checkbox"/> |
| Line 10 | 1115551007 | AMHunt | <input checked="" type="checkbox"/> |
| Line 11 | 1115551008 | AMHunt | <input checked="" type="checkbox"/> |
| Line 12 | 1115551009 | AMHunt | <input checked="" type="checkbox"/> |
| <input type="button" value="Cancel"/> | | <input type="button" value="Apply"/> | |

A Channel based **Show Configuration** for our "Morning Show" example with "Hotline" and special "Weather" line.

| | Phone Number | Line Name | Busy All Group |
|---------|--------------|-----------|----------------|
| Line 1 | 1115551023 | Hotline | |
| Line 2 | 1115551020 | Weather | |
| Line 3 | 1115551010 | TalkHunt | ✓ |
| Line 4 | 1115551011 | TalkHunt | ✓ |
| Line 5 | 1115551012 | TalkHunt | ✓ |
| Line 6 | 1115551013 | TalkHunt | ✓ |
| Line 7 | 1115551014 | TalkHunt | ✓ |
| Line 8 | 1115551015 | TalkHunt | ✓ |
| Line 9 | 1115551016 | TalkHunt | ✓ |
| Line 10 | 1115551017 | TalkHunt | ✓ |
| Line 11 | 1115551018 | TalkHunt | ✓ |
| Line 12 | 1115551019 | TalkHunt | ✓ |
| Cancel | | Apply | |

A Channel based **Show Configuration** for our "Morning Show" example with "Hotline" and special "Weather" line.

IMPORTANT TIP!

When creating Show Configurations you must use enter the correct number of digits as programmed in your PRI/TI Trunk Configuration section. In our example we have entered the full 10 digits. However, you may need to only enter 4 or 7 digits. Your Telco provider should be able to tell you how many digits are sent on calls to the 2101. See Part III section 4.4 for more details.



From these examples it should be clear that the PRI method is much more flexible than the channel based methods. This is because the hunt groups are fixed and therefore the channels associated with a hunt group can only be used by a *Show Configuration* that uses the entire hunt group. In a case such as this it is more likely that you would create a *Show Configuration* to be used by an entire station: So there might be a show configuration for your AM station and another for your FM station and one for each production studio.

2.6 Planning the Series 2101 Local Area Network (LAN)

The Series 2101 components use an Ethernet LAN to communicate with one another. The Studio Interface uses Ethernet 10 Base-T while the 2101 Hub uses Ethernet 100 Base-T. Therefore you will need a Ethernet network hub capable of supporting both types of connections. These are easy to find, most 100 Base-T capable hubs support 10 Base-T as well.

The series 2101 Hub requires its own physical segment with no other traffic on it. Therefore the 2101 LAN should not be connected to another LAN unless you have taken steps to isolate the 2101 LAN. You have three options on how to do this. You should have your Network Administrator review this section and decide which methods works for your facility.

- 2101 is assigned separate IP addresses from an existing LAN and the two LANs are interconnected using an IP router. This is probably the most flexible method since it allows computers outside the 2101 (for instance computers running Assistant Producer for 2101) to access the 2101 LAN will still keeping the physical segments isolated. In this cases even broadcast packets are isolated between the two LANs and therefore interaction is at a minimum.
- 2101 is assigned compatible IP addresses to an existing LAN but is isolated using a Switching Ethernet Hub. This method works well, but there will be some interaction due to broadcast packets being passed to switch ports of the 2101.
- The 2101 LAN is kept separate with no connections to any other LAN. Note that in this cases computers running Assistant Producer for 2101 software will need to be connected to this LAN. In this scenario, you can use “generic” IP addresses (in the range 192.168.0.0 to 192.168.255.255) for the 2101 equipment. As usual, each piece of equipment will need a unique IP address.

3 System Commissioning

The 2101 is a sophisticated system, with a number of different components, that must be configured carefully. For this reason, Telos offers system commissioning by approved contractors. If you choose not to purchase this service, don't panic - bringing a Series 2101 system online is not all that difficult, it's primarily a matter of ensuring that all the details have been properly attended to. The following checklists should help you stay on track.

3.1 Pre-commissioning checklist

First things first. Be sure to have the following completed before the Telos representative arrives, or before proceeding with commissioning the system.

| Series 2101 Pre-Commissioning Checklist | |
|---|---|
| <input type="checkbox"/> | Order Digital Telco Trunks. |
| <input type="checkbox"/> | Use the order form in Appendix 5 |
| <input type="checkbox"/> | Supervise Telco trunk installation. The Telco will usually install the trunks in two stages. First they'll bring up the physical T1. Later they will program the T1 or PRI signaling. |
| <input type="checkbox"/> | Once the Telco has brought up the T1 connect your CSU and verify that it sees an active line. |
| <input type="checkbox"/> | Once the Telco reports finishing the second stage of installation, confirm the following: |
| (PRI) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | For PRI verify: -CO Switch. -ISDN protocol. -List of all DID numbers, and the number of digits to be sent. Be sure to get the number you can call to have them "bring up the D channel" when you are ready to commission the system. The PRI cannot be activated until the 2101 has been connected. |
| (T1) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | For T1 verify: -Frame format (ESF preferred). -Line Format (B8ZS preferred). -Signaling type (should be E&M Wink start). -List of all DID numbers, and the number of digits to be sent. |
| <input type="checkbox"/> | Power-up-test all system components. |

| Series 2101 Pre-Commissioning Checklist | |
|--|--|
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>Install the equipment</p> <ul style="list-style-type: none"> -Rack all equipment. -Connect AC power (leave components powered off). -Make the appropriate audio connections to the Studio Interfaces. -Run T-Link connections from Studio Interfaces to 2101 Hub. -Connect Telos TWO extended hybrids (if any) to associated Studio Interfaces. -Run Desktop Directors cables from Studio Interfaces to Desktop Directors. -Install second Desktop Director interface in Studio Interface, if needed (e.g. more than 4 Directors). -Configure Desktop Director power supplies and Director termination resistors (if needed). -Install Ethernet switch and run network cabling to each Studio interface (Telos TWO does not need Ethernet connection), to Administration computer, and to 2101 Hub. -If NCTE is not Telco-provided, install NCTE (CSU) and appropriate power supply. Verify NCTE/CSU shows power. -Run cable from NCTE/CSU to 2101 Hub. -Verify 2101 Hub trunk card LOS LED and NCTE/CSU LOS LED are off. |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>Configure Studio Interfaces</p> <ul style="list-style-type: none"> -Set audio parameters (be sure to set <i>Routing</i>) -Set ISDN parameters -Assign each Studio Interface a unique IP address and short unit name -One at a time, power up each Studio Interface and configure the above. Power unit off when complete. |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>Configure Telos TWO extended hybrids (no IP address needed)</p> <ul style="list-style-type: none"> -Set audio parameters -Set ISDN parameters |
| <input type="checkbox"/> <input type="checkbox"/> | <p>Configure 2101 Hub</p> <ul style="list-style-type: none"> -Assign unique IP address |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>Compile the following information about how your 2101 will be used:</p> <ul style="list-style-type: none"> -How many studios will be part of the system? Compile a list of all studios. -Will different shows use different (inbound) telephone numbers? Compile a list of each T1/E1/PRI and the numbers associated with |

Series 2101 Pre-Commissioning Checklist

| | |
|--------------------------|---|
| <input type="checkbox"/> | each. |
| <input type="checkbox"/> | -How many stations will be part of the system? |
| <input type="checkbox"/> | -For each show or station (e.g. unique group of inbound telephone numbers) compile a list of all studios where this show may be produced. |
| <input type="checkbox"/> | -Compile a list of each computer to be used with Assistant Producer 3.5 call screening software. |
| <input type="checkbox"/> | -Compile a list of each staff member who will be using Assistant Producer 3.5 call screening software and assign an ID to each. |
| <input type="checkbox"/> | -Compile a list of all Studio Interfaces and their IP addresses and names |

3.2 Commissioning Checklist

| Series 2101 Commissioning Checklist | |
|-------------------------------------|--|
| <input type="checkbox"/> | Complete all steps in the <i>Series 2101 Pre-Commissioning Checklist</i> , above. |
| <input type="checkbox"/> | Power off all equipment but the 2101 Hub, Ethernet switch, and Administration computer. |
| <input type="checkbox"/> | Verify that you can connect to the 2101 Hub using a browser on the Administration Computer. |
| <input type="checkbox"/> | Power up each Studio Interface (and connected Telos TWO extended hybrid), verifying each as follows: <ul style="list-style-type: none"> <input type="checkbox"/> -Once unit has powered up, verify T-Link and Desktop Director status: <ul style="list-style-type: none"> <input type="checkbox"/> -Press <SELECT> then press ▼ to display status for “Slot A”. This should read “T-Link” for “Type” and “Link: Active”. <input type="checkbox"/> -Press ▼ repeatedly until “Slot E” is shown. If a Desktop Director card has been installed in Slot E, verify that one link is shown as “active” for each Desktop Director (or two links for each Telos TWO extended hybrid) connected to this card. <input type="checkbox"/> -Press ▼ to show status for “Slot E”. Verify that one link is shown as “active” for each Desktop Director (or two links for each Telos TWO extended hybrid) connected to this card. <input type="checkbox"/> -From the Administration Computer “ping” the IP address of this Studio Interface. If the “ping” fails you must determine the problem before continuing. <input type="checkbox"/> -Once operation of each Studio Interface is verified, leave that Studio Interface powered on and proceed to the next Studio Interface, testing each, until all studio interfaces have been tested. |
| <input type="checkbox"/> | Configure the 2101 Hub Systems options: Advertise Port, Host ID, Law Mode. |
| <input type="checkbox"/> | Configure the 2101 Hub Telco Trunk Interfaces Ports and Trunks: <ul style="list-style-type: none"> <input type="checkbox"/> Trunk Interface Port(s): <ul style="list-style-type: none"> <input type="checkbox"/> -Hardware: Framing, Line Code, and Line Length <input type="checkbox"/> -Circuit Type <input type="checkbox"/> -Protocol Type <input type="checkbox"/> Configure Trunks/Telephone Numbers |
| <input type="checkbox"/> | Create all required 2101 Hub <i>Show Configurations</i> . |
| <input type="checkbox"/> | Create all required 2101 Hub <i>Studio Configurations</i> . |
| <input type="checkbox"/> | If Assistant Producer 3.5 call screening software is to be used, create a User Name, and Password, for each Assistant Producer user. |

| Series 2101 Commissioning Checklist | |
|--|---|
| <input type="checkbox"/> | Install Assistant Producer 3.5 call screening software on the workstations. |
| <input type="checkbox"/> | Test System. |
| <input type="checkbox"/> | Adjust Hybrid parameters in the Studio Interfaces to suite your conditions and taste. |

This concludes our guided introduction to Series 2101. For more details on the various components, or for answers to your questions see the following guide to the rest of the Series 2101 documentation.

| | |
|--|--------------|
| INFORMATION ON THE STUDIO INTERFACE | PART IV |
| INFORMATION ON CONNECTING A TELOS TWO (TO CREATE 4-HYBRID STUDIOS) | PART IV |
| INFORMATION ON THE SERIES 2101 HUB | PART III |
| INSTALLING OPTIONAL CARDS IN THE 2101 HUB | PART III |
| INFORMATION ON USING 2101 WEB CONFIGURATION PAGES TO CREATE <i>SHOW CONFIGURATIONS</i> | PART III |
| INFORMATION ON USING 2101 CONFIGURATION UTILITY TO CONFIGURE TELCO TRUNKS | PART III |
| SUMMARY OF MAXIMUM CABLE LENGTHS AND REQUIREMENTS | PART II |
| DETAILED PIN-OUTS OF ALL CABLES | APPENDIX 3 |
| DESCRIPTION OF THE DIFFERENCES BETWEEN DIFFERENT TYPES OF TELCO TRUNKS | PART II |
| ORDERING TELCO TRUNKS | APPENDIX 4 |
| INFORMATION ON INSTALLING THE DESKTOP DIRECTORS | PARTS IV & V |
| INFORMATION ON USING THE DESKTOP DIRECTORS | PART V |