



farsouth
networks

Com.X10

Installation Guide

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Document History

Version	Date	Description of Changes
1.0	2013/07/26	Release update

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1 Introduction

1.1 Overview

This document describes the means of physical interconnection between the Com.X10 and the various telecom networks at the wiring level.

The document provides recommended line protection mechanisms and specified classes of device that should be used to provide adequate surge protection.

Refer to the “Com.X-Administrators Guide” for detailed information on platform configuration, management and monitoring.

Refer to the “Com.X-End-User-Guide” for a detailed operations manual of the Com.X10.

The above documents are available at: <http://www.farsouthnet.com/support/manuals/>

1.2 Terminology



2 Hardware Description

This chapter tells you what is contained in your hardware package. A description of each component is also included.

Specifically, the following topics are covered:

- Package contents
- Description of the unit's front and rear panel

2.1 Package Contents

The table below describes all components you should receive within your Com.X10 package.

Item	Description	Comments
Com.X10	SIP Gateway or IP PBX platform	Com.X10(W), 19" rack mount format: (445mm x 220mm x 44mm)
Rack mount kit	Rubber feet (x4) 1U rack mount ears (x2) Screw M3x8mm (x9)	Round self adhesive Recessed Pan Head Stainless Steel
Com.X10 Power Supply	AC/DC Power Supply	Input:110Vac/220Vac Output:+12Vdc @ 5A
Com.X10 quick start guide	"Quick start guide"	Pamphlet

2.2 Enclosure Description

Com.X10 is supplied two physical formats:

- Com.X10, "Traditional PBX", ISDN and Analogue support
- Com.X10, "SIP Gateway", ISDN support only

2.2.1 Com.X10, "traditional PBX" format

The Com.X10 is a desk mount stackable or 19" rack mountable device, which provides connections to four different sites: PBX, PSTN, Ethernet LAN and a PC Consol.

The Com.X10 rear panel includes connection jacks, LEDs and reset button. The Com.X10 front panel (kept purposely simple) includes a single status LED and product / manufacturer labels only.

2.2.1.1 Com.X10 Rear Panel Description

Refer to Figure-1 and Figure-2 below for a pictures and a graphic of the Com.X10 rear panel:

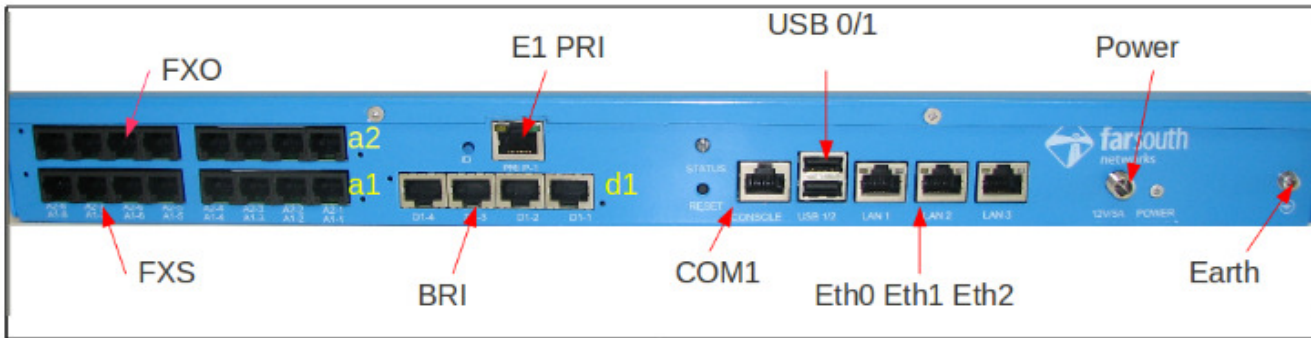


Figure-1: Com.X10, "traditional PBX" Rear Panel picture

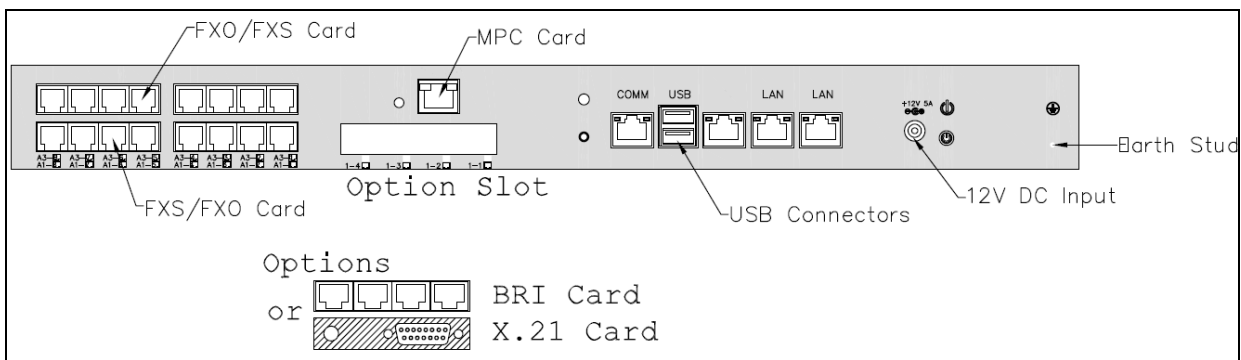


Figure-2: Com.X10, "traditional PBX" Rear Panel Diagram

Refer to the table below for a description of each rear panel connector type.

Port #	Port type	Connector description	Comments
a1-1 to a1-8	8FXS	RJ-11	FXS supports POTS handsets only
	8FXO	RJ-11	FXO supports analogue PSTN connections
a2-1 to a2-8	8FXS	RJ-11	FXS supports POTS handsets only
	8FXO	RJ-11	FXO supports analogue PSTN connections
1-1 to 1-4	Basic Rate ISDN	RJ-45	TE1 or NT1 mode supported
	X.21	DB-15	DTE to network service provider
E1-1	Primary Rate ISDN	RJ-45	E1/T1 rates, TE1 or NT1 mode
USB0/1	USB2.0-A	Std USB Device receptacle	
LAN1-3	10/100/1000Base-Tx Ethernet	RJ-45	Standard GbE LAN connector standard
COM	RS232	RJ-45	For connection to a consol
Power	DC Power Jack	6.5mm diameter,	Use only the power supply provided



		2.5mm pin	with your unit
Earth Strap	Chassis GROUND	M3 "ring tongue" crimp terminal	Essential to ensure adequate surge protection mechanism for the unit

2.2.1.2 Visual Indications

Three rear panel LED display the following system diagnostic information as follows:

LED label	Code	Description
Status	See front panel	As per above
WAN	Flashing	Indicates DSL activity (where fitted)
HDD	Flashing	Indicates SATAII drive access (where fitted)

The table below provides a description the LAN port diagnostics available on the rear panel.

Port #	Diagnostics
LAN1-3	<p>LED Green: LAN Speed indication</p> <ul style="list-style-type: none">○ ? – 1000mbps○ On – 100Mbps○ Off – 10Mbps <p>LED Yellow: Link active status</p> <ul style="list-style-type: none">○ On – LAN connecting○ Flashing – Data is accessing○ Off – LAN disconnect

2.2.1.3 Front Panel Description

The Com.X10 front panel includes a "status" LED and product vendor and model labels only.

2.2.1.3.1 Visual Indications

The front panel LED (not shown) displays unit "status" information as follows:

Code	Description
Red	Unit fault
Solid yellow	Boot state
Flashing yellow	Waiting for PSTN connectivity
Solid green	OK (unit operational)



2.2.2 Com.X10, “SIP Gateway” format

The Com.X10 is a desk mount stackable or half 19” rack mountable device, which provides connections to four different sites: PBX, PSTN, Ethernet LAN and a PC Consol.

The Com.X10 rear panel includes connection jacks, LEDs and reset button. The Com.X10 front panel (kept purposely simple) includes a single status LED and product / manufacturer labels only.

2.2.2.1 Rear Panel Description

Refer to Figure-1 and Figure-4 below for a picture and graphic of the Com.X10, SIP Gateway format, rear panel:

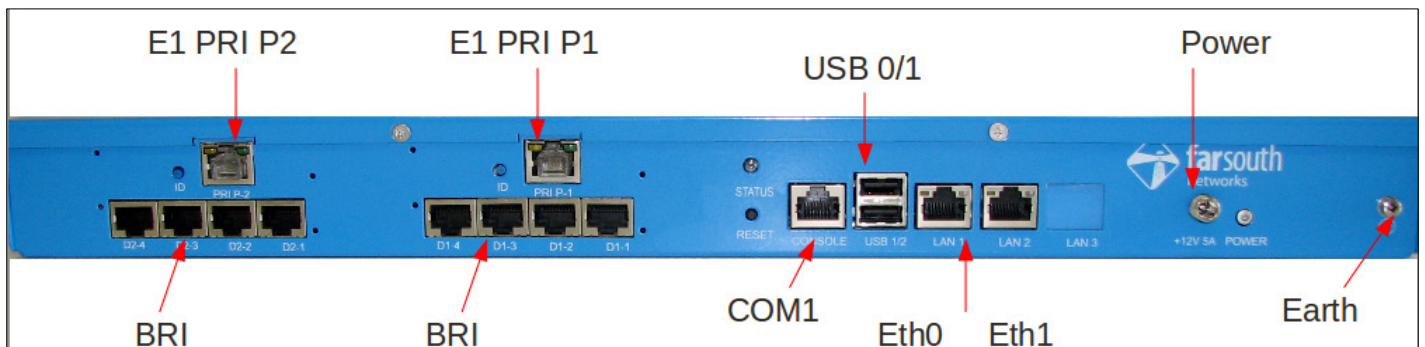


Figure-3: Com.X10, “SIP Gateway” Rear Panel picture

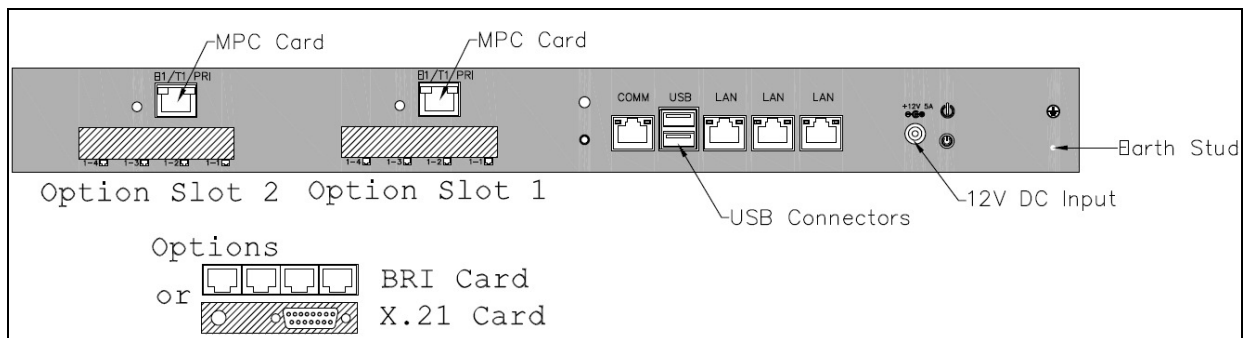


Figure-4: Com.X10, “SIP Gateway” Rear Panel Diagram

Refer to the table below for a description of each rear panel connector type.

Port #	Port type	Connector description	Comments
d1-1 to d1-4	Basic Rate ISDN	RJ-45	TE1 or NT1 mode supported
d2-1 to d2-4	X.21	DB15	DTE to network service provider
E1-1	Primary Rate ISDN	RJ-45	E1/T1 rates, TE1 or NT1 mode
E1-2	Primary Rate ISDN	RJ-45	E1/T1 rates, TE1 or NT1 mode
USB0/1	USB2.0-A	Std USB Device receptacle	
LAN1-2	10/100/1000Base-Tx Ethernet	RJ-45	Standard GbE LAN connector standard
COM	RS232	RJ-45	For connection to a consol



Power	DC Power Jack	6.5mm diameter, 2.5mm pin	Use only the power supply provided with your unit
Earth Strap	Chassis GROUND	M3 "ring tongue" crimp terminal	Essential for adequate surge protection mechanism for the unit

2.2.2.2 Visual Indications

Three rear panel LED display the following system diagnostic information as follows:

LED label	Code	Description
Status	See front panel	As per above
WAN	Flashing	Indicates DSL activity (where fitted)
HDD	Flashing	Indicates SATAII drive access (where fitted)

The table below provides a description the LAN port diagnostics available on the rear panel.

Port #	Diagnostics
LAN1-2	<p>LED Green: LAN Speed indication</p> <ul style="list-style-type: none">○ On – 1000mbps○ Off – 10/100Mbps○ Off – 10Mbps <p>LED Yellow: Link active status</p> <ul style="list-style-type: none">○ On – LAN connecting○ Flashing – Data is accessing○ Off – LAN disconnect

2.2.2.3 Front Panel Description

The Com.X10 front panel includes a "status" LED and product vendor and model labels only.

2.2.2.3.1 Visual Indications

The front panel LED (not shown) displays unit "status" information as follows:

Code	Description
Red	Unit fault
Solid yellow	Boot state
Flashing yellow	Waiting for PSTN connectivity
Solid green	OK (unit operational)



3 Hardware Installation

Before you begin the actual installation, review the safety instructions and pre-installation guidelines that follow.

3.1 Important Safety Instructions

When using your Com.X unit, basic safety precautions should always be followed to reduce the risk of fire, electric shock, and injury to persons, including the following:

- Read and understand all instructions.
- Follow all warnings and instructions marked on the product.
- Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- Do not use this product near water (for example, in a wet basement).
- Do not place this product on an unstable cart, stand, or table. The product can fall, causing serious damage to the product.
- Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating; these openings must not be blocked or covered.
- This product should never be placed near or over a radiator or heat register.
- This product should not be placed in a built-in installation unless proper ventilation is provided.
- This product should be operated only from the type of power source indicated in the manual. If you are not sure of the type of power source to your building, consult your dealer or local Power Company.
- The mains power socket outlet must be located near the product and must be easily accessible to allow plugging/unplugging.
- Do not allow anything to rest on the power cord. Do not locate this product where persons walking on it will abuse the cord.
- Never push objects of any kind into this product through cabinet slots as they can touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.
- Never spill liquid of any kind on the product.
- To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified serviceman when some service or repair work is required.
- Opening or removing covers can expose you to dangerous voltages or other risks. Incorrect re-assembly can cause electric shock when the product is subsequently used.
- Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - When the power supply cord or plug is damaged or frayed.
 - If liquid has been spilled into the product.
 - If the product has been exposed to rain or water.
 - If the product does not operate normally by following the operating instructions.



- Adjust only those controls that are covered by the operating instructions because improper adjustment of other controls can result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
 - If the product has been dropped or the cabinet has been damaged.
 - If the product exhibits a distinct change in performance.
- Avoid using a telephone (other than a cordless type) during an electrical storm. There can be a remote risk of electric shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.
- **WARNING:** It is recommended that an ICASA approved lightning protection device be used on the Power as well as the PSTN lines. If lightning protection is not used it will invalidate the warranty.

3.2 Pre-Installation Guidelines

Only trained service technicians should remove the unit cover. Inside parts have hazardous voltages.

Do not connect equipment in wet conditions or during a lightning storm.

3.3 Installation Options

3.3.1 Rack mount

The unit may be front or back mounted in a standard 19" rack.

Pre-installation Guidelines

- The maximum recommended ambient temperature is 30°C. Internal rack temperature should be considered for safe operation.
- Do not restrict airflow vents when installing the unit in the rack.
- Mechanical loading of rack should be considered so that the rack remains stable and unlikely to tip over.
- Ensure that a reliable chassis earth-strap or bar is maintained in a rack system. This unit is intended to be connected to earth ground, refer to section 4.8 below for the recommended surge protection wiring configuration.

Install the unit in a rack as follows:

- Position and attach the left and right mounting brackets to the unit using the pan head rack mount screws supplied within the rack mount kit.
- Place the unit in a 19" rack.
- Align the unit's mounting brackets with the rack's mounting holes and install screws with star washers. See vendor specific instructions for rack installation.
- Ensure the unit is placed firmly in the rack.

3.3.2 Desk mount

The Com.X unit can be located on any sturdy, flat surface. Before locating the unit on a tabletop, read the location guidelines below:

WARNING: If installing on a tabletop or any other flat surface, we recommend that you stack no more than four units together.



Pre-installation Guidelines

- The surface must be sturdy.
- Avoid exposing the unit to excessive vibrations.
- Keep the unit away from wet or dusty areas.
- The area must not exceed the temperature and humidity guidelines outlined in the product datasheets.
- Leave at least 3" clearance surrounding the unit.
- Do not cover vent holes on top of unit.

Locate the unit on a tabletop as follows:

- Place the unit on a desk, tabletop, or any flat, solid surface.
- Ensure the unit will not slip or fall from the surface.
- Ensure the power cord is in reach of the power outlet.

3.4 Wiring Connections

3.4.1 Unit connection overview

Refer to Figure-25 below for a diagram describing the recommended methods of interconnecting the Com.X10, "traditional PBX" format, unit to suitable external devices and network interfaces.

Note, where the same interconnect methods are to be used for the Com.X10, "SIP Gateway" format, where the same port types apply.

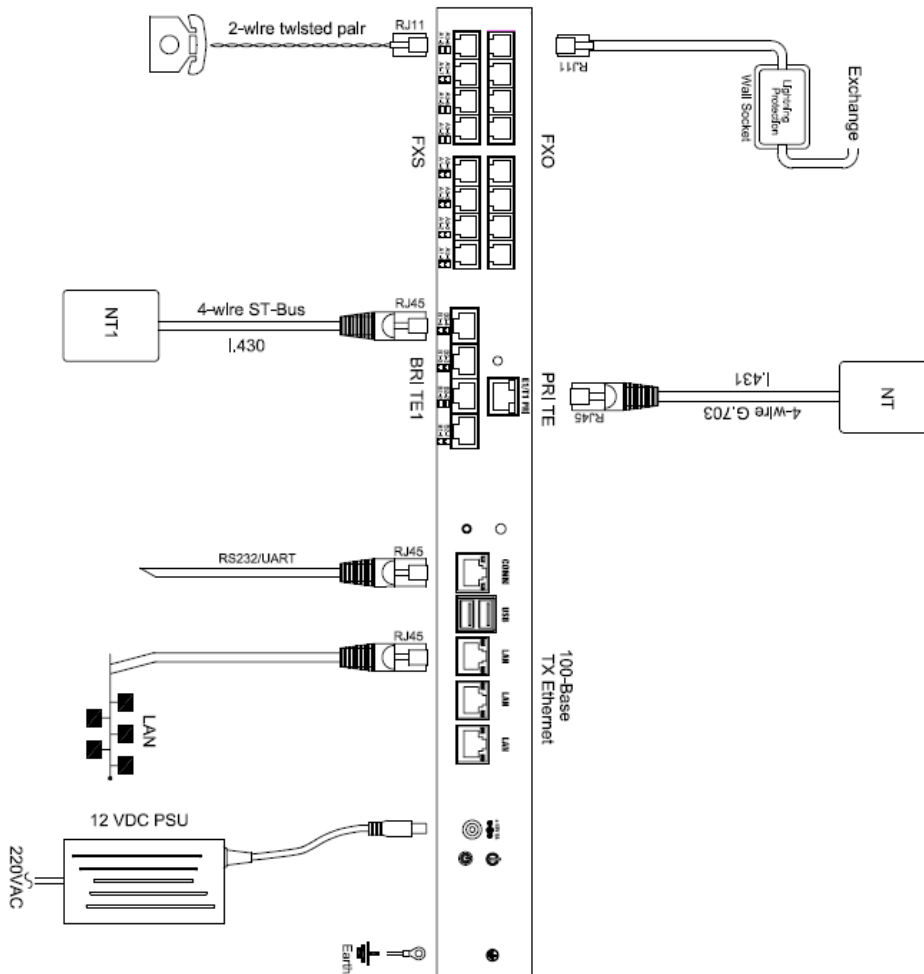


Figure-2: Com.X10 Interconnection methods

3.4.2 Power

The Com.X10 unit is powered by connecting the AC/DC power adapter to the “Power” input of the unit.

Use only the Com.X10 power adapter unit supplied with your product.

Note: Using any other power adapter may cause erratic operation and/or damage the Com.X10 unit.

3.4.3 Telephony interface connections

The Com.X10 unit supports the following range of telephony ports:

- Analogue PSTN: Foreign Exchange Office (FXO)
- Analogue Extension: Foreign Exchange Station (FXS)
- Basic Rate ISDN (BRI)
- Primary Rate ISDN (PRI)

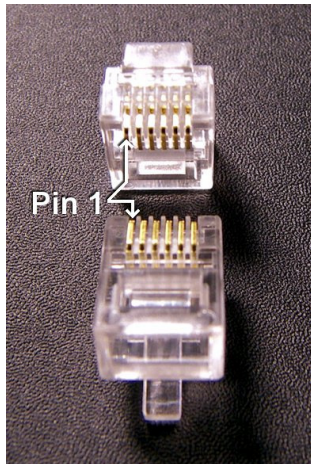
Refer to the unit datasheet for technical specification of each of these ports.



3.4.3.1 Analogue PSTN (FXO)

The FXO port connector and cabling is described below.

Connector type: RJ11, 6P4C type



Cable: 2-wire twisted pair

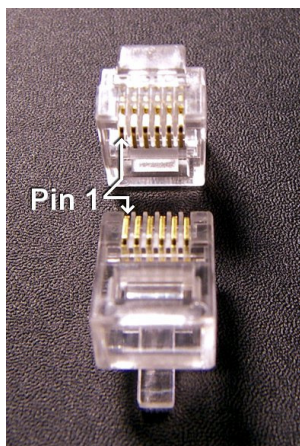
Connector pin-outs:

Position	Pin#	Definition
1	1	-
2	2	-
3	3	Tip
4	4	Ring
5	5	-
6	6	-

3.4.3.2 Analogue Extension (FXS)

The FXS port connector and cabling is described below.

Connector type: RJ11, 6P4C type



Cable: 2-wire twisted pair

Connector pin-outs:

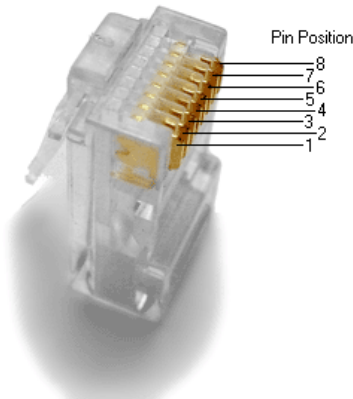


Position	Pin#	Definition
1	1	-
2	2	-
3	3	Tip
4	4	Ring
5	5	-
6	6	-

3.4.3.3 Basic Rate ISDN (BRI)

The BRI port connector and cabling is described below.

Connector type: RJ45, 8P8C type



Cable: Cat5e cable as defined by TIA/EIA-568-B. Refer to I.430E for cable specification and length recommendations for Point-to-Point, Short Passive and Extended Passive network configurations.

Connector pin-outs as defined by ISO standard I.430E:

Position	Pin#	TE function	NT function	Comments
1	1	Power source/sink3	Power sink 3	N/A
2	2	Power source/sink3	Power sink 3	N/A
3	3	Tx+	Rx+	
4	4	Rx+	Tx+	
5	5	Rx-	Tx-	
6	6	Tx-	Rx-	
7	7	Power sink 2	Power source 2	N/A
8	8	Power sink 2	Power source 2	N/A

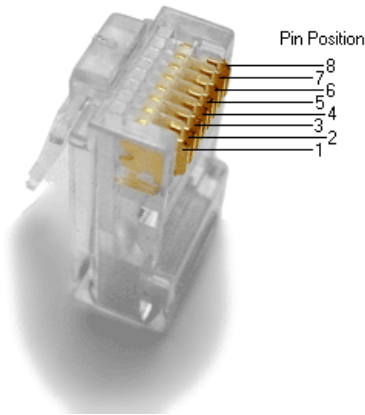
Note: Power feed functionality is NOT supported

3.4.3.4 Primary Rate ISDN (PRI)

The PRI port connector and cabling is described below.



Connector type: RJ45, 8P8C type



Cable: Cat5e cable as defined by TIA/EIA-568-B. Refer to I.431 for cable specification and length recommendations for Point-to-Point, Short Passive and Extended Passive network configurations.

Connector pin-outs as defined by ISO standard I.431:

Position	Pin#	TE function	NT function	Comments
1	1	Tx+	Rx+	
2	2	Tx-	Rx-	
3	3	-	-	
4	4	Rx+	Tx+	
5	5	Rx-	Tx-	
6	6	-	-	
7	7	-	-	
8	8	-	-	

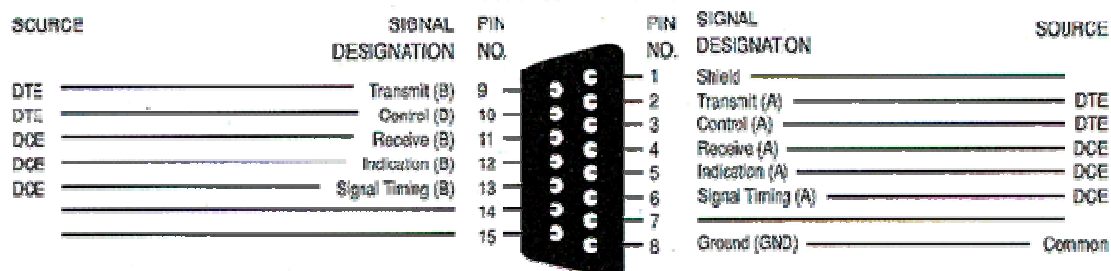
3.4.4 WAN

3.4.4.1 X.21

The X.21 port connectors and cabling is described below.

A D-sub 15 pin male connector is the connector interface accessible in the slot. This is the DTE interface of the X.21 standard. The Telkom Diginet WAN interface provides a DB15 female connector and thus the unit is shipped with a straight through cable.

X.21 Interface





The signals of the X21 interface are presented on a 15-pin connector defined by ISO Document 4903. The electrical characteristics are defined in ITU Recommendations X.26 and X.27, which refer to ITU Recommendations V.10 and V.11.

Pin Number	Signal Name	Pair Number	Cross-over Connection
1	Shield		1
2	Transmit (Tx) A	1	4
3	Control (Ctl) A	2	5
4	Receive (Rx) A	3	2
5	Indication (Ind) A	4	3
6	Signal Timing (Ck) A	5	6
7	N/C		
8	Ground		8
9	Transmit (Tx) B	1	11
10	Control (Ctl) B	2	12
11	Receive (Rx) B	3	9
12	Indication (Ind) B	4	10
13	Signal Timing (Ck) B	5	13
14	N/C		
15	N/C		

12-core shielded twisted pair cable, supplied with a 3m cable with Male to Female connectors.

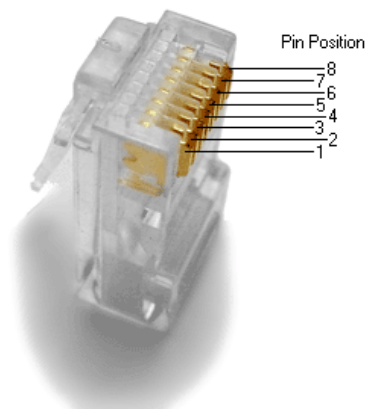
The A/B pairs of the signals as described in table above are connected to 5 twisted pairs of the cable and one of the remaining two wires in the cable carries the signal ground.

The shield is connected to chassis earth.

3.4.5 LAN

The Ethernet LAN port connectors and cabling is described below.

Connector type: RJ45, 8P8C type



Cable: Cat5 or 5e cable as defined by TIA/EIA-568-B.

Connector pin-outs:

Position	Pin#	Function	Comments
1	1	Tx+	



2	2	Tx-	
3	3	Rx+	
4	4	-	Balance "Bob-T" termination
5	5	-	Balance "Bob-T" termination
6	6	Rx-	
7	7	-	Balance "Bob-T" termination
8	8	-	Balance "Bob-T" termination

3.4.6 USB2.0

The USB2.0 port connectors and cabling is described below.

Connector type: Standard USB, Type A



Cable: USB series "A" plug, with moulded cable, as defined by the USB-IF.

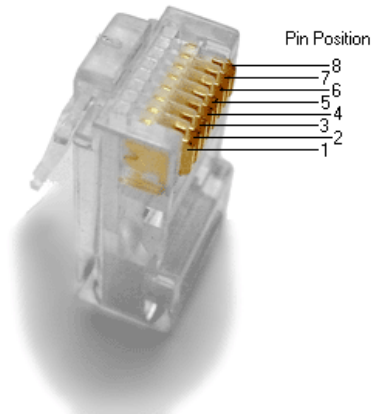
Connector pin-outs:

Pin	Name	Colour	Description
1	Vcc	Red	+5V
2	D-	White	Data -
3	D+	Green	Data +
4	GND	Black	Ground

3.4.7 COM

You will need to connect the unit to your workstation's serial port via RJ45 connector and Cat5e cable.

Connector type: RJ45, 8P8C type



Cable: Cat5 or 5e cable as defined by TIA/EIA-568-B.

Connector pin-outs: As per CISCO "rolled" console cable

Pin description	DTE	Pin description
NC	1	No connect
NC	2	No connect
Tx	3	Transmit Data
GND	4	System Ground
GND	5	System Ground
Rx	6	Receive Data
NC	7	No connect
NC	8	No connect

UART serial port settings:

- 115200bps N 8 1(No stop bit, 8 data bits, 1 bit parity)



4 Surge protection mechanisms & recommendations

4.1 Com.X10 surge protection specifications

The Com.X10 provides the following surge protection levels on the available telecom interfaces:

- Analogue (FXS & FXO) – secondary (intra-building protection)
- BRI – 1500V isolation (standard BRI S/T cables)
- PRI – 1500V isolation
- Ethernet – 1500V isolation (CAT5 or better)
- X.21 – for connection to local, co-located equipment only

The Com.X10 is designed to support secondary (intra-building) surge protection standards ONLY. Where cables connected to Com.X10 FXS and FXO ports may be exposed to extra-building environments, suitable primary surge protection mechanisms MUST be utilised. Refer to section 4.7 below for further details.

X.21 is used for “com port” connect to a local, co-located X.21 NTU device (typically supplied by the telecom service provider. As such no additional protection strategies for the X.21 port are deemed necessary.

Far South Networks DOES NOT recommend installation of PRI, BRI, X.21 or Ethernet ports with cabling exposed to extra-building conditions.

4.2 Surge protection for Com.X10 analogue interface

4.3 Over-current protection

A telefuse device is used to guarantee fire safety in the event of power cross events. These devices do not recover after activation, i.e. the circuit goes open in response to an overcurrent.

Unit replacement or repair will be required after such an occurrence.

4.4 Over-voltage protection

Electronic components have been designed to function properly when used within their specified current and voltage ratings. When these ratings are exceeded during operation, the component may sustain permanent damage and the equipment may cease to operate.

Solid-state thyristor overvoltage protection devices are provided to afford standards-compliant secondary protection. These devices are designed to switch rapidly from a high to a low impedance state in response to an overvoltage surge, conducting the surge to chassis ground and away from the vulnerable components.

In telecommunication applications, the major sources of overvoltage conditions are lightning, AC power lines, and ground shifts. Thyristor surge suppressors are used as shunt devices, conducting large currents away from sensitive electronic devices, when their threshold voltage is exceeded.

Good earthing practice is vital to ensure the effectiveness of these protection devices.

4.5 FXO interface protection circuit

The FXO port line interface circuit is shown below.

Both over-current and overvoltage devices are provisioned on each line interface.



The overvoltage protection device, Littlefuse P3100, will clamp at $V(\text{drm}) = 275\text{V}$

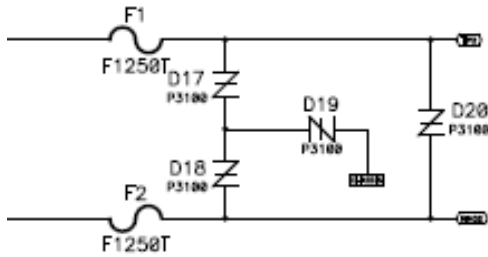


Figure-3: FXO port circuit example

Primary protection must be provided externally to the Com.X10 unit.

4.6 FXS interface protection circuit

The FXS port line interface circuit is shown in Figure-6 below.

Both over-current and overvoltage devices are provisioned on each line interface.

The overvoltage protection device, Littlefuse P1301, will clamp at $V(\text{drm}) = 120\text{V}$

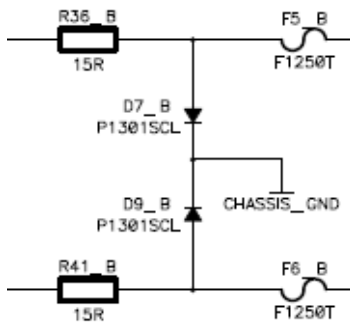


Figure-4: FXS port circuit example

Primary protection must be provided externally to the Com.X10 unit if the wiring leaves the premises.

4.7 Primary Surge protection

Primary surge devices must be provisioned externally to the Com.X10, to provide coordinated protection for the Comma interfaces in conjunction with the secondary protection that is built into the unit.

Com.X1 does NOT support primary protection levels for interfaces exposed to outdoor environments.

Far South Networks recommend installation of primary surge protection devices (GDT – Gas Discharge Tube) installed on all analogue lines exposed to extra-building conditions.

These devices are described below.

4.7.1 FXS interface

Voltage = 130Vdc, transient = 10kA 8/20, response <25nS

Recommended part:

Clearline KP1HS (12-00663) – single line solution

Clearline KP2HS (12-00196) – 10 line solution



Surgetek: DPL 10F/TEL-ISDN – 10 line solution

Surgetek: Tel/Fax-ISDN RJ11 – single line solution

Bourns: 2036-15 – discrete 3 electrode GDT

4.7.2 FXO interface

Voltage = 230Vdc, transient = 10kA 8/20, response <25nS

Recommended part:

Clearline KP1HS (12-00621) – single line solution

Clearline KP2HS (12-00230) – 10 line solution

Surgetek: DPL 10F/TEL-ISDN – 10 line solution (230V version required)

Surgetek: Tel/Fax-ISDN RJ11 – single line solution (230V version required)

Bourns: 2036-23, – discrete 3 electrode GDT

4.8 Surge protection wiring platforms

On very large systems, the main distribution frame (MDF) is usually situated some distance away from the PABX equipment. The power surge arresters are usually located in a distribution board some distance away.

The MDF backframe is used as the protection platform typically containing “krone-style” connection blocks with primary surge arrester mounted thereon. An earth point is then created as close as possible to the surge arresters and the electrical, building and other earths are then connected to this point. Refer to figure-7 below that captures this star chassis grounding mechanism.

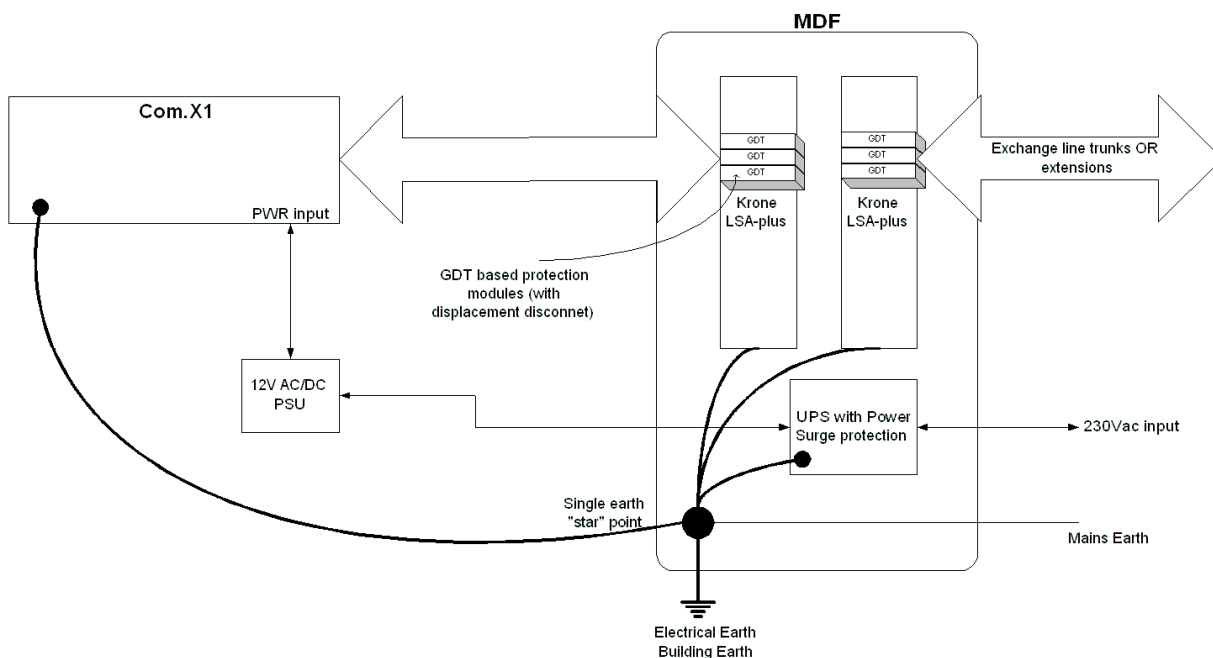


Figure-5: MDF backframe & Com.X10 earth connectivity