



BHARAT SANCHAR NIGAM LIMITED
(A Government of India Enterprise)

Engineering instructions

on

Installation of ADSL-CPE

[EI/ACCESS NETWORK/ADSL-001
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INSTALLATION OF ADSL-CPE

1.0 Scope:

This Engineering Instructions describe the requirements and procedures for installing ADSL-CPE at customer premises for enabling Broad Band Services.

2.0 About ADSL:

Asymmetric Digital Subscriber Line (ADSL) offers a form of DSL, a data communications technology that enables faster data transmission over analog telephone lines than a conventional modem can provide. As compared to other forms of DSL, ADSL has the distinguishing characteristic that the data can flow faster in one direction than the other, i.e., asymmetrically. Providers usually market ADSL as a service for people to connect to the Internet in a relatively passive mode. ADSL allows them to use the higher speed direction for the "download" from the Internet but not needing to run servers that would require bandwidth in the other direction.

Downstream rates start at 64 kbps and typically reach 8 mbps but can go as high as 26 mbps over short ranges (ADSL2+). Upstream rates start at 64 kbps and typically max reach 800 kbps.

The typical home ADSL connection has 512 kbps downstream and 256 kbps upstream, with a 50:1 contention ratio. Packages designed for offices or businesses have a 20:1 contention ratio and range from 512 kbps to 26 Mbps in downstream speed.

An ADSL MODEM is a broadband Internet access device, which utilizes the existing copper wire (phone line) to transmit high-speed data without interfering with the voice transmission. i.e. Voice and ADSL signal can co-exist in one line. This is achieved by a splitter, which insulates each from the other.

ADSL permits, simultaneously access to web and telephone removing the need for a second telephone line for dialup. Standard telephony devices that normally work over telephone line can be used with ADSL simultaneously (i.e. Fax). On power failure, the line is still available like with a standard telephone line.

Because of the Multimedia benefits of ADSL all of the following applications are available:

- Internet Access (SOHO)
- LAN Access (Telecommuting)
- Distance Learning
- Tele-medicine
- Broadcast TV
- Home Shopping
- Interactive Games
- Movies

ADSL uses a Frequency Division Multiplex (FDM) system with bandwidth divided in three parts. $0 < f < 4$ KHz POTS or ISDN, $30 < f < 138$ KHz Upstream and $138 < f < 1104$ KHz Downstream. A POTS splitter separates the POTS Channel. The system has up to 4 sub-

channels on the downstream separated by either FDM using Low Pass Filter (LPF) / High Pass Filter (HPF) or a combination of FDM and echo cancellation and up to 3 bi-direction sub-channels.

ADSL offers unique flexibility utilizing the available transmission spectrum of the local loop. ADSL uses a pass band scheme, which allows the data traffic to be placed strategically in the available frequency spectrum so as not to interfere with the standard analog voice service. In addition it allows the provider to power the telephone service centrally thereby maintaining critical voice traffic even in the event of a power failure.

ADSL Capabilities:

Data Rate	Wire Gauge	Wire Size	Distance
1.5 to 2 Mbps	24 AWG	0.5 mm	5.5 Km
1.5 to 2 Mbps	26 AWG	0.4 mm	4.6 Km
6.1 Mbps	24 AWG	0.5 mm	3.7 Km
6.1 Mbps	26 AWG	0.4 mm	2.7 Km

ADSL offers following three information channels:

- I. A high speed downstream channel (1.5 to 26 Mbps).
- II. A medium speed duplex channel (16 Kbps to 3 Mbps).
- III. A POTS or an ISDN channel.

The Data Rate is proportional to $1 / \text{Distance}$. Other factors which the data rate depend on are as given below:

- Length of copper line.
- Wire gauge.
- Presence of bridged taps.
- Cross-Couple interference.

3.0 Customer Premises Equipment:

The CPE (**Customer Premises Equipment**) basically contains the following:

- I. Splitter
- II. ADSL Modem
- III. Cable RJ 45
- IV. Power Adapter
- V. Telephone Cable RJ 11
- VI. User Manual.

3.1 Installation Requirements at the Customer Premises:

- I. Should have a PC with Windows 98 or Windows XP installed and Netscape Navigator or Internet Explorer to interface with the system
- II. Subscriber Telephone with ISDN standards.

- III. Subscriber should be within 3.5 kms from the point where the Equipment supporting Broad Band services (DSLAM) is installed.
- IV. Internal wiring for the Telephone Line should be within PVC pipes or wooden batten with angle and bridged type
- V. Crossing with Electrical wiring should be better to be avoided or should be at right angles
- VI. No joints should be in between the rosette and window terminals if any.
- VII. Proper grounding.

3.2 Splitter:

(Figure 1 is the Splitter being supplied by M/S UTStarcom)

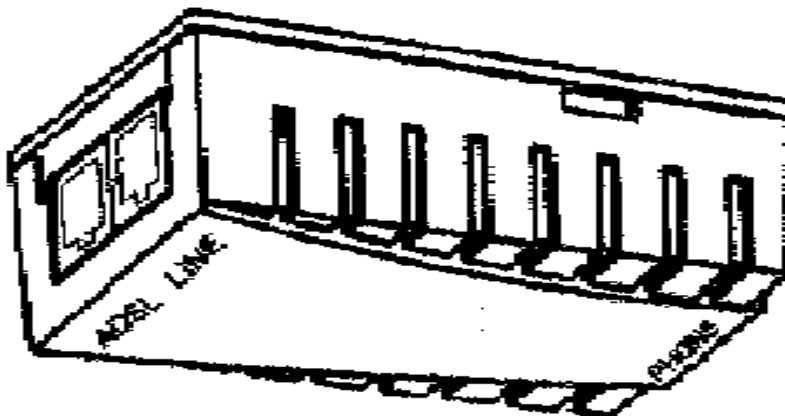
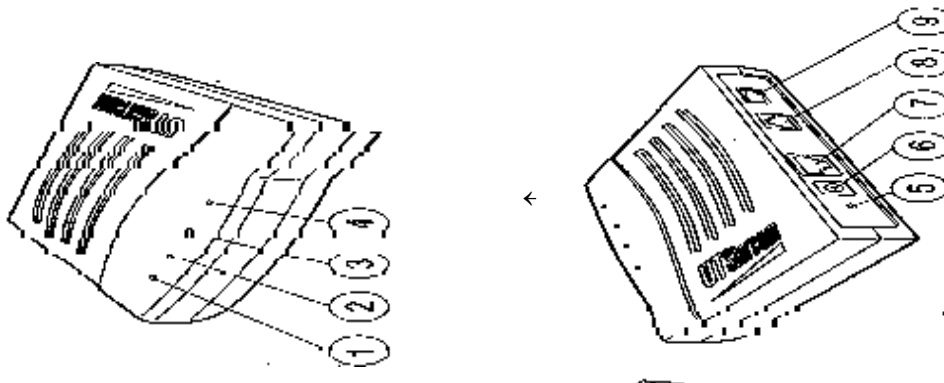


Figure 1

3.3 ADSL MODEM:

(Figure 2 is the Modem being supplied by M/S UTStarcom)



- | | | |
|--------------------------|----------------------|-----------------------|
| 1). ← Power Indicator | 2). ↑ Link Indicator | 3). → PC Indicator |
| 4). ↓ Data Indicator | 5). ° Reset Key | 6). ± Power Interface |
| 7). " Ethernet Interface | 8). ≥ Line Interface | 9). x Power Switch |

Figure 2

3.4 Interface Introduction:

- 1) Power Indicator (red) :

A steady red light means the power connection works properly.

- 2) Link Indicator (yellow):
It shows ADSL Cable status. Flashing means being connected and steady light means the modem is in synchronized condition with the ADSL equipment at the distant end.
- 3) PC Indicator (green):
It indicates the status of connection to the PC Network card. Steady light means connection is good.
- 4) Data Indicator (Green):
It is flashing means the modem is transmitting or receiving data properly.
- 5) Reset Key:
Resets default configuration
- 6) Power Interface:
12 V DC 700 ma.
- 7) Ethernet Interface:
To be connected to a PC with RJ45.
- 8) Line Interface:
To be connected to a Telephone with RJ 11
- 9). Power Switch:
It is used to turn the Power ON/OFF.

3.5 Installation Steps:

- I. Fix the Splitter in an accessible position.
- II. Place the ADSL Modem in a secure and readily accessible position from where the LEDs can be seen.
- III. Connect the LINE port of the splitter and the RJ-11 port (the phone Jack) on the wall (Telephone Rosette).
- IV. Connect the ADSL port of the splitter to the Line Interface ≥ of the ADSL modem, using RJ 11 connector.
- V. Connect the Telephone set to the PHONE port of the splitter.
- VI. Connect the ETHERNET port " of the ADSL Modem to Ethernet port of the computer using the network RJ 45 cable that comes with the modem.
- VII. Plug in the power cord and turn on the power x.
- VIII. Ensure that the red power indicator ← glows permanently.
- IX. Ensure that the AMBER –LINK Indicator ↑ and GREEN- PC Indicator → glow permanently.

Figure 3 shows the typical connection at the customer premises:

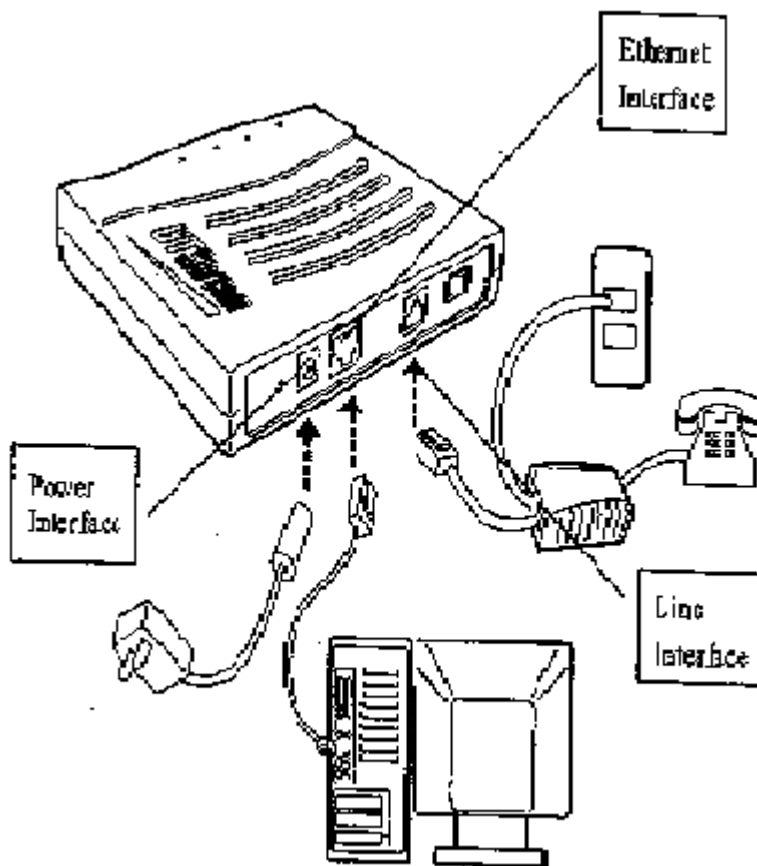


Figure 3

3.6 Types of Connectors:

Figure 4 shows various connectors and their use.

(i). RJ-11 Broadband/Telephone Plug

	<p>The US style RJ-11 plug is a 4-pin version of the RJ-45. It is the smallest in size and is used for DSL/Broadband Internet connections (RJ-11 to RJ-11).</p>
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(ii). British (Telecom) Plug

	<p>The familiar British telephone plug used in over 30 countries around the world. Any analogue device that operates over a telephone line will be connected using this plug. It is often an RJ-11 plug on one end, and a BT plug on the other (RJ-11 to BT).</p>
--	---

(iii), USB Type A (Computer)

	<p>Universal Serial Bus (USB) is the most popular way of connecting peripherals to a computer. To connect most devices, the user will require a type A to B cable (often supplied with the product).</p>
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(iv). USB Type B (Peripherals)	
	The other end of the USB wire features a square shape plug designed to connect to peripherals such as the USB DSL modem or router.
(v). RJ-45 Ethernet Network (Crimped Plug)	
	The RJ-45 connector, featuring 8 pins, is the big brother of the RJ-11. It is used for data communications, specifically Local Area Networks (LANs). Cables can be either straight (for normal use between a hub and a computer) or crossed (for use between two hubs or switches). Each computer requires a Network Interface Card (NIC) to connect to the network.
(vi). RJ-45 Ethernet Network (Moulded Plug)	
	The moulded RJ-45 plug shown to the left performs exactly the same purpose as the crimped version above. Professionally constructed cables are usually moulded by a machine instead others are crimped using a special device called a "crimping tool".

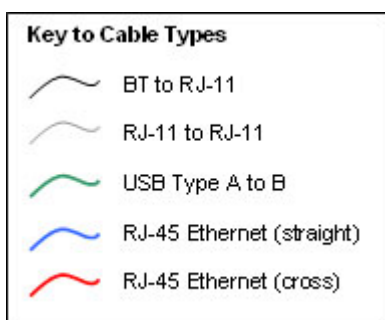
Figure 4

3.7 Wiring Diagrams:

Basic diagrammatic scenarios are based upon:

- Internet connection via a USB Modem
- Internet connection via an Ethernet router/modem
- Connecting additional telephone sockets

A certain amount of software configuration must also be carried out before computers and network peripherals are able to operate or communicate with each other. This includes software driver installation for USB modems, and the correct assignment of IP addresses and related parameters for Ethernet networks.



3.7.1 USB Modem

The easiest, and most popular way to get a single computer online with is via a USB modem (Figure 5). The process involves connecting the USB modem to the DSL side of the micro-

filter, and the computer to the USB modem using a standard type A to B USB cable. Software installation procedure will vary depending upon the equipment purchased.

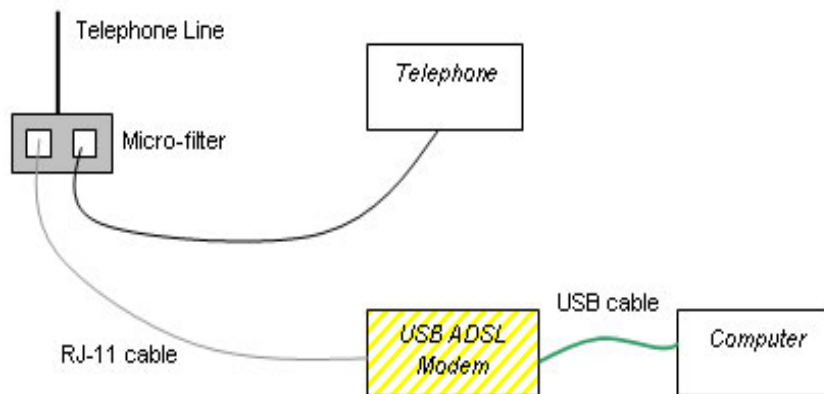


Figure 5

Many users choose to share their USB Broadband connection using software such as *Microsoft Internet Connection Sharing (ICS)*. In this scenario (**Figure 6**), the computer will act as a gateway for other computers to access the Internet via a Local Area Network (LAN).

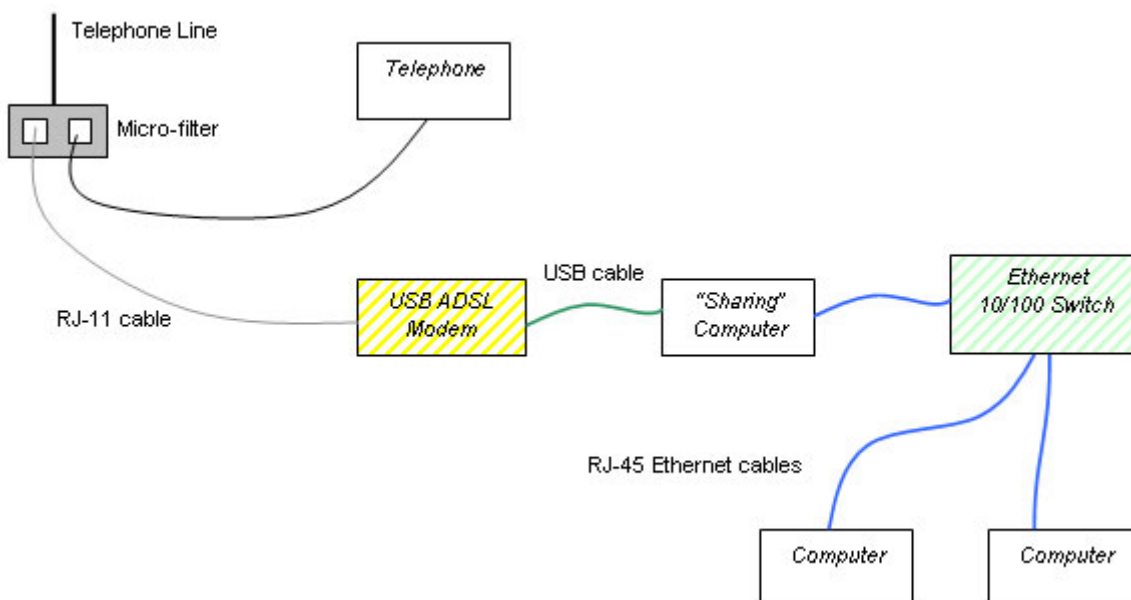


Figure 6

The same concept can be extended to wireless network cards instead of the more restrictive fixed approach above. This configuration is often referred to as "ad-hoc networking mode" with the *sharing computer* operating in "infrastructure mode". However, most users will find that sharing their USB connection over a wired network is adequate. **Figure 7** shows the wiring diagram for the above option.

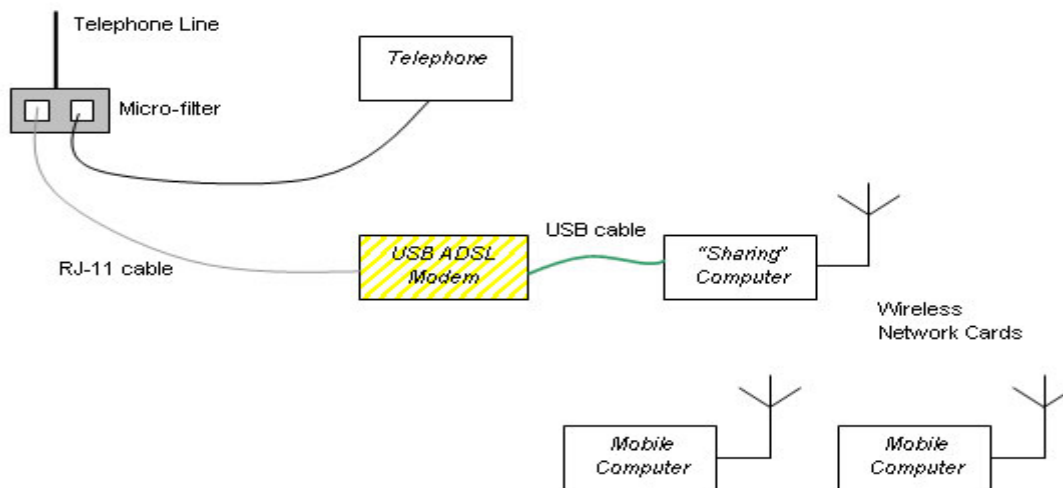


Figure 7

3.7.2 Ethernet Router & Local Area Network

The following **Figures 8 and 9** show sample configurations for Internet access via an Ethernet router/modem. Many routers feature a 2, 4 or 8 port inbuilt Ethernet hub or switch (a device used to connect computers together). In this scenario, computers can be connected directly to the router. Each computer is wired using a standard Ethernet cable with one end connected to a spare port on the inbuilt hub/switch and the other end connected to the computers network card.

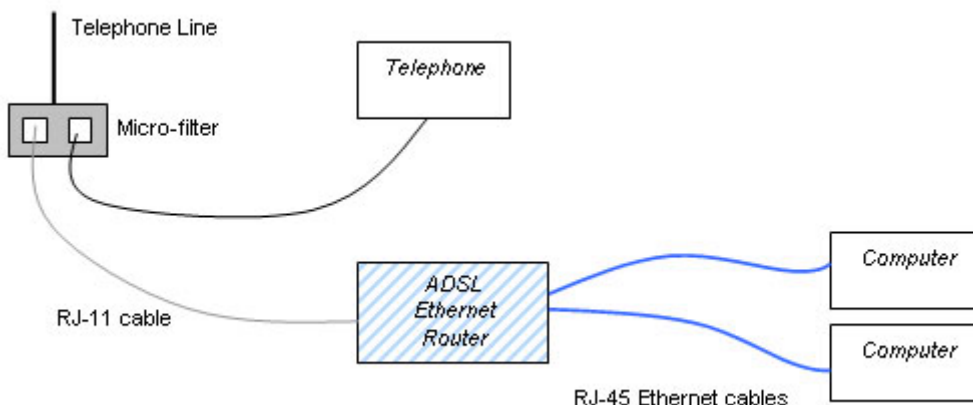


Figure 8

If the user's Ethernet router only has 1 network port, or he wants to connect more devices to the network than there are available ports, an Ethernet switch can be used in combination with a cross-over cable to extend the size of his network.

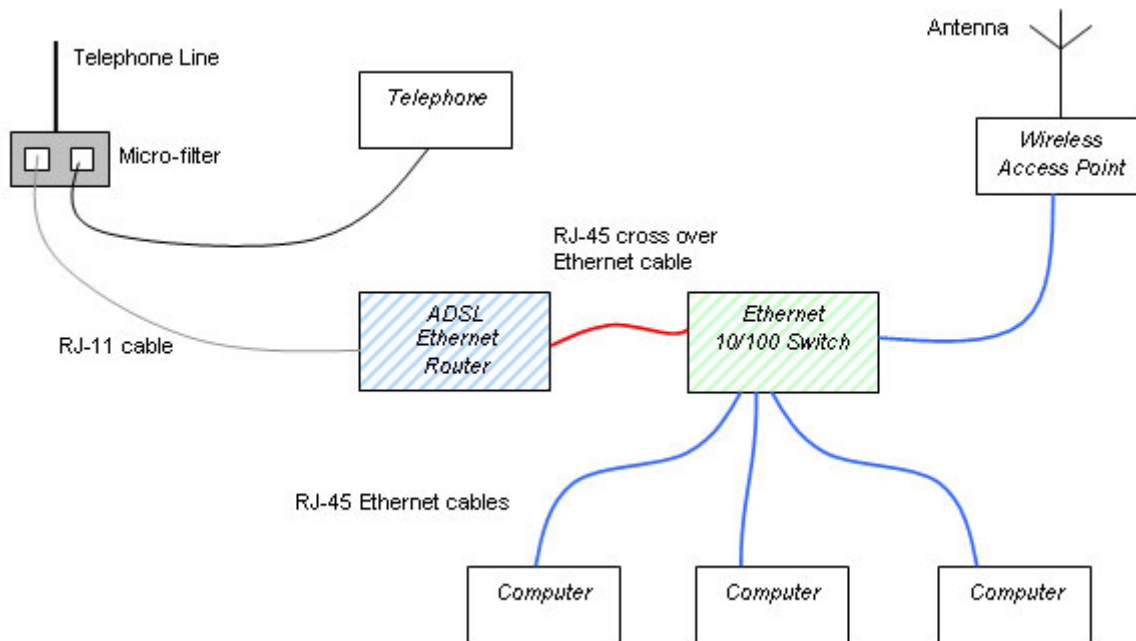


Figure 9

3.7.3 Micro-Filters and Additional Telephone Sockets

Micro-filters must be used to separate the two different frequency bands used over the telephone line (voice and data) and prevent the analogue devices from interfering with the Broadband frequency ranges used by the modem/router.

Simple method is by counting how many phones are plugged into a phone socket (on the same line) and ordering the same number of micro-filters. Simply unplug each phone and plug them into the splitter and reconnect to the phone line.

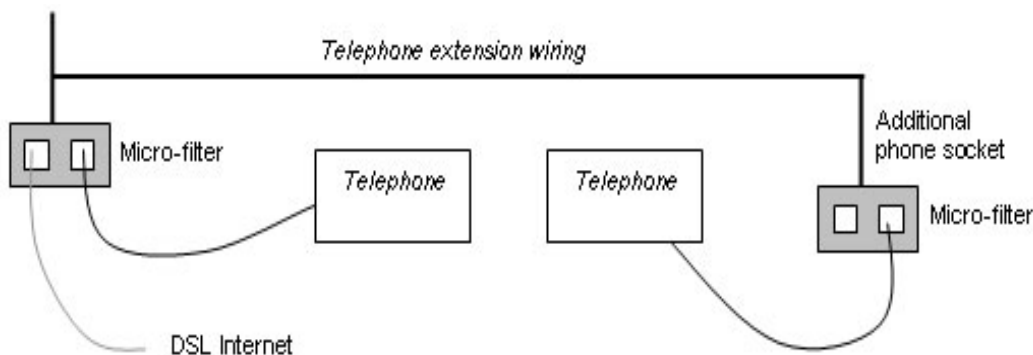


Figure 10

It can also be done with a single micro-filter and plugging this into the master socket and running all the phone extensions off the phone side of the micro-filter. Finally, an extension from the ADSL side of the splitter can be run to the ADSL modem (Figure 11).

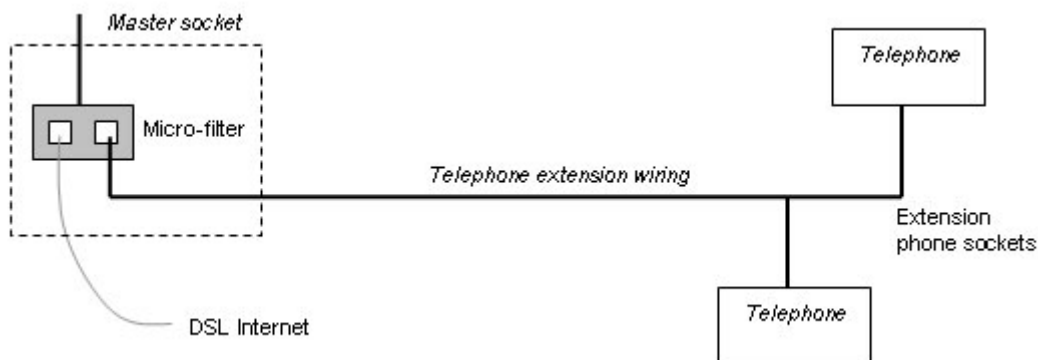


Figure 11

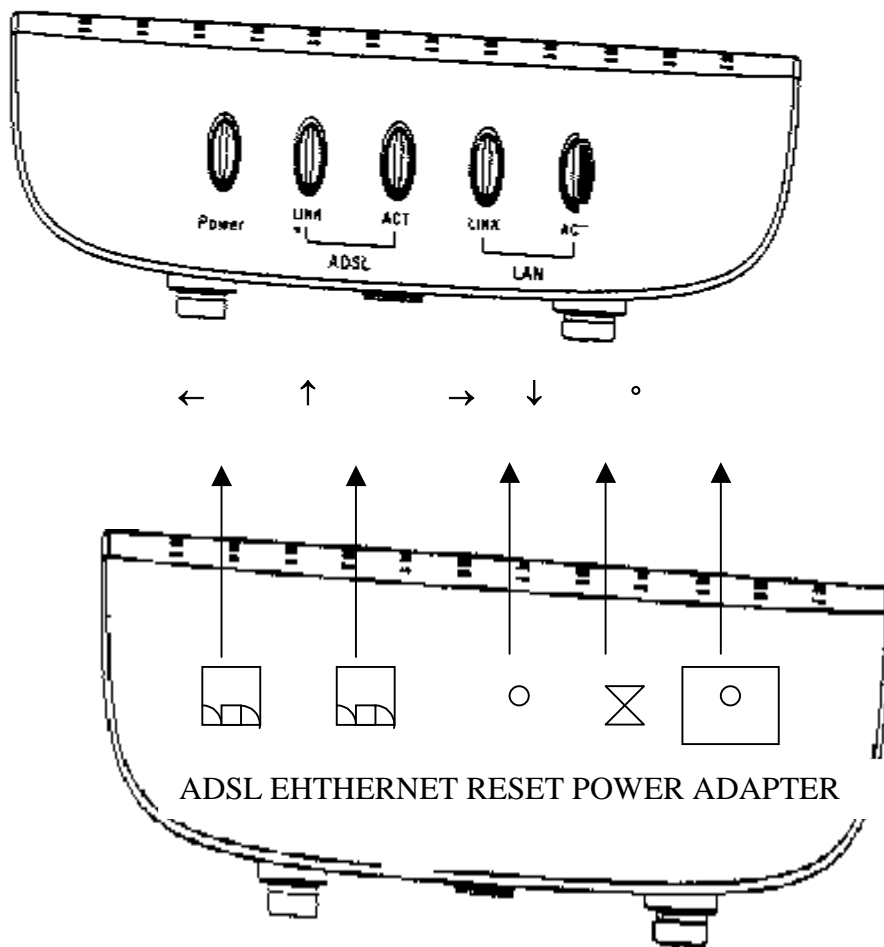
4.0 Installation of SmartAX MT 800 (Supplied by M/S HUAWEI)

The Package content includes the following:

- I. One SmartAX MT 800 ADSL CPE
- II. One dedicated support Base
- III. Two twisted pair telephone cables
- IV. One straight through Ethernet Cable
- V. One dedicated power adapter
- VI. One external splitter
- VII. One quick Installation guide
- VIII. One warranty card
- IX. One qualification card.

4.1 Installation Procedure:

- I. Place MT 800 in a secured and a steady accessible location where LED indicators can be easily viewed.
 - II. Insert one end of the twisted pair ADSL cable into the ADSL port of the rear panel of MT 800 and insert the other end in to the wall socket.
- OR
- III. Insert one end of the twisted pair ADSL cable into the modem port of the external splitter and insert the other end into the ADSL port of the back panel of MT800.
 - IV. Connect telephone to the phone port of the external splitter.
 - V. Use the Ethernet cable provided to connect MT 800 with the computer through hose 10/100 Ease – TX Ethernet ports.
 - VI. Plug the power adaptor to a suitable power source. Switch the power switch to the ON position and check that the power LED indicator lights.
 - VII. Check and make sure that the LAN LINK and the ADSL LINK indicators light up in GREEN. This indicates valid connection between ISP and the users PC.



(ii). REAR Panel Connectors of MT 800

Figure 12

4.1.1 LED indicators in the FRONT Panel of MT 800.

LED indicators	Description
POWER	Steady green light indicates that the unit is powered on
ADSL LINK	It blinks when the ADSL link is in the process of being activated It stays green when the ADSL link is activated
ADSL ACT	It blinks in green when there is ADSL traffic passing through the ADSL CPE.
LAN LINK	Steady green light or Amber light indicates a valid LAN connection. Green light indicates that the speed of data transfer is 10 Mbps. Amber light indicates that the speed of data transfer is 100 Mbps.
LAN ACT	Blinking indicates an ACTIVE Ethernet session

4.1.2 Connectors in the REAR Panel of MT 800

Symbol (refer diagram)	Description
←	Connect to ADSL cable
↑	Connect MT 800 and PC
→	Reset Button
↓	Power Switch
◦	Connect to Power Adapter.

4.2 RAS PPOE Software Installation in the PC:

RAS PPPOE s/w can be installed from a centralized place like NMS or can be individually installed at the customer premises.

- I. When the Operating system in the Subscriber end PC is WINDOWS XP, there is no need for separate installation of the RAS PPPOE software. Windows XP has built-in PPPOE dial-up application. Click NETWORK to initiate a connection and then select ADSL to be the connection type. A window will appear asking user name and password. Type the user name and password. PPPOE connection is thus set up.
- II. PPPOE software installation in the PC with WINDOWS 98 OS.
 - Insert the PPPOE Client software in the subscriber PC.
 - From the Desktop, access the PPPOE software CD by CDROM drive.
 - Open the folder 'PPPOE'.
 - Double click 'PPPOE98'.
 - Then RASPPPOE-Installation message will appear. Click 'YES'.
 - Windows will automatically add the PPP over Ethernet protocol.
 - (Note: If it asks for 'Insert Windows 98 CD' either select the 'WIN98' folder backup or insert the windows 98CD).
 - After successful installation, it will ask for 'reboot the system'. Click 'yes'.
 - (Note: IF it is already installed, remove the 'PPP over Ethernet Protocol; by 'Remove' button).
 - After successful installation, the message will appear as 'RASPPPOE Installation complete'. Click 'OK'.
 - Click in the Network Neighborhood'-properties and check whether 'PPP over protocol is added or not.
 - Dial up connection icon is automatically created in the Desktop now and is now ready for connecting to the internet.
 - Then double click the Dial-up icon as 'Connection through Ethernet card'.
 - Enter the allotted username and password and click connect.

- After successful login. The network connection icon will appear in the taskbar.
- The subscriber is now ready for browsing the known sites by clicking the web-enabled browser.

5.0 References:

Following Engineering Instructions may also please be referred for further information during installation:

Sl. No.	EI No.	Subject
1	Local Area Network/Subs Network/I-002	Installation Procedure of 5 Pair PIJF Cable and 5 Pair Internal D.P.
2	Electronic Switching/ISDN/I-001	Subscriber Equipment in ISDN System
3	Electronic Switching/ISDN/I-002	Termination Techniques in ISDN System
4	Electronic Switching/LAN/D-001	Telephone Wiring in Multi-storied Building in Commercial Places
5	Electronic Switching/LAN(OFL)/I-001	Installation of DPs and Drop wire using new type of drop wire accessories

= THE END =