professional dish installation
SES ASTRA is the owner and operator of the ASTRA Satellite System, the leading European Direct-To-Home satellite television system. The fleet of ASTRA satellites delivers over 1300 television and radio channels, and additional interactive and Internet services, to more than 94 million homes across Europe.

The ASTRA satellites have been delivering television and radio programmes to the British Isles for 15 years and at the start of 2004, over 12 million UK households were receiving signals broadcast via ASTRA.

This brochure is published by ASTRA for professional installers in the UK and Ireland to serve as a guide and reminder to the best practices and procedures of installation.

While it is not an exhaustive tutorial for beginners, it is hoped that it will serve as an introduction for inexperienced installers and help experienced installers achieve reliable reception of all the services available via the ASTRA satellites.

This publication is also designed to raise awareness of the added value opportunities available to installers for the provision of additional services to their customers.
Before you start the installation, survey the site and consider the following:

- Where is the main TV located?
- Where will the cable enter the building?
- Where is the best location for the dish?
- What is the best route for the cable(s)?
- Is a telephone extension required?
  - What is the best route for the telephone cable?
  - Where is the best location for the new telephone socket?
- What risks are posed by the installation?
- Can the job be completed safely?
- Has a documented risk assessment been completed?
- Is the customer happy with the proposed installation?

### Health & Safety

The detailed health and safety requirements for antenna installation are beyond the scope of this publication. However, ASTRA recommends that no installation be undertaken until the risks posed by the proposed work have been assessed and a plan formulated to reduce them to an acceptable level.

Guidelines on appropriate Health and Safety techniques may be obtained from the Confederation of Aerial Industries (www.cai.org.uk).

### Planning Permission

The household is responsible for obtaining planning permission, listed buildings consent, landlord’s consent, or any other necessary permission for the installation of a satellite dish. However, the installer should be aware of the requirements and be able to offer reliable advice.

The booklet, ‘A Householder’s Guide For The Installation Of Satellite Television Dishes’, published by the Office of the Deputy Prime Minister, offers advice on planning conditions and can be obtained from DTLR, PO Box 236, Wetherby, West Yorkshire LS23 7NB or downloaded from the ‘planning’ section at www.odpm.gov.uk.
INSTALLING THE DISH

installing the dish

Selecting a suitable location

A dish should usually be installed as close as is practical to the intended location for its set-top box provided that the following requirements are adhered to:

- Confirm direction to the satellite.
- Digital services for the UK and Ireland are broadcast from ASTRA 28.2° East
  - Check the map for azimuth heading and locate with a compass
  - Look at other dishes nearby for a quick guide
  - Determine the elevation angle from the map
  - Choose a discreet location (see page 4-5)
  - Check for clear line of sight to the satellite
  - Trees or bushes will cause interference
  - Stay clear of trees and shrubs that may grow in the future
  - Use a straight edge and inclinometer to confirm clearance
  - If in doubt, locate the satellite with a hand-held dish and meter
  - Don’t create an obstruction
  - Allow adequate clearance above walkways
  - Avoid low-level positions above driveways or roadways

Discreet dishes

The general permission that exists in planning law for satellite dishes requires that each dish be installed so that its visual impact on its surroundings is reduced to a minimum.

In most cases, nothing more than a little thought is required to assure a discreet installation. However, in less straightforward situations, consider positioning the dish on the rear wall of a south-facing house with a stand-off mount to aim the dish over the house roof, or behind a chimney stack or parapet, or shielded from view by trees or plants. It may be possible to locate the dish on a ground mount to provide a more discreet location.

The front wall of a house should be avoided whenever possible, and, in some areas (a Conservation Area, for example), installing a dish on a wall facing a footpath or roadway (or a waterway in the Norfolk Broads) is prohibited.

Where a dish cannot be installed discretely, it may be disguised by painting with lead-free, matt paint.

Selecting the Antenna

- Check the map for correct dish size
- Install only the correct size dish
- Do not install a dish smaller than the recommended size - it may be unreliable in poor weather

Choosing an LNB

- Single Universal LNB - one output for direct connection to a single, standard receiver
- Quad LNB - four outputs for direct connection to a maximum of 4 tuners*
- Octo LNB - eight outputs for direct connection to a maximum of 8 tuners
- Quattro LNB - four outputs (each with one IF sub-band) for connection to an IF distribution system, feeding multiple receivers. Not suitable for direct connection to a receiver

* A standard receiver has one tuner. Sky+ has two separate tuners each of which require a direct connection to a separate LNB output.

Sub-band selection

The ASTRA satellites transmit signals in the frequency range between 10.70-12.75GHz on two linear polarities (Horizontal and Vertical). An LNB receives those signals, amplifies them, divides them into four sub-bands, converts them to an Intermediate Frequency (IF) and passes them to the receiver. The receiver selects the appropriate sub-band by sending the relevant voltage and switching tone (see the chart) to the LNB.

Voltage and tone from LNB to receiver

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Tone</th>
<th>Sub-band</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 volts, 0kHz tone</td>
<td>Vertical Low Band</td>
<td></td>
</tr>
<tr>
<td>13 volts, 22kHz tone</td>
<td>Horizontal Low Band</td>
<td></td>
</tr>
<tr>
<td>18 volts, 22kHz tone</td>
<td>Vertical High Band</td>
<td></td>
</tr>
<tr>
<td>13 volts, 0kHz tone</td>
<td>Horizontal High Band</td>
<td></td>
</tr>
</tbody>
</table>

Intermediate Frequency (IF)

- 10.70 – 11.70GHz
- 920 – 1,186MHz
- 1,980 – 2,705MHz

DEFINITIONS

Azimuth - the angle, in the horizontal plane, between true north and the satellite. Between 134° and 149° for the ASTRA 28.2° East position from the British Isles.

Compass bearing - the angle, in the horizontal plane, between magnetic north and the satellite. Magnetic variation (currently around 4° in the UK) must be added to the compass heading to find the true heading or azimuth.

Elevation - the angle between a line from the dish to the satellite, and the horizontal. Between 16° and 27° for the ASTRA 28.2° East position from the British Isles.

Linear Polarisation - the technique of transmitting signals aligned either vertically or horizontally, so that a frequency range may be reused without interference.

Low Noise Block down-converter (LNB) - the device at the focus of a satellite dish that collects signals reflected by the dish and processes them for onward transmission by cable to a receiver.

Elevation and azimuth

Azimuth, elevation and dish sizes for 28.2° east

Individual dish size:

- 45cm (Elliptical dish size: 38 x 53cm)
- 65cm (Elliptical dish size: 58 x 72cm)
Installing the Dish

Fixing the Dish
- Fix only to a suitable surface (if in doubt, choose another location or get an expert opinion)
- Use correct fixings for the surface (e.g., nylon plugs and coach bolts for brick, steel expansion anchors for concrete)
- Use the correct number of fixings for the mount
- Drill fixings into brick, stone or concrete – not into mortar
- Keep the top fixing at least three brick courses down from the top of a wall
- Use the correct number of fixings for the mount
- On a rendered wall, use fixings long enough to grip the wall not just the render
- Ensure the mount is vertical
- Tighten all fixings correctly to finish
- On a rendered wall, use fixings long enough to grip the wall not just the render
- Never drill into a chimney
- Never fix a dish to wooden parts of a building – even structural members can be damaged by ill-advised drilling

Ground mounts
A tripod or similar ground mount must be bolted to a stable and substantial base.
- A king post in the garden should be galvanised, with at least one third of its length set in concrete below ground. A flange, bolts, or similar must be attached to the bottom of the post to prevent rotation.
- Where a ground mount is used on a flat roof, it must be non-penetrating and cushioned to protect the roof surface.

Aligning the Dish
- Align the dish to an approximate heading and elevation
- Connect a suitable meter and set to a known transponder
- Sweep slowly left and right across the horizontal
- Make small changes to the elevation angle at the end of each sweep
- When signal is received, check that the meter identifies the correct satellite
- Find peak signal in the horizontal and vertical planes
- Adjust polarity offset

Secure all bolts making equal adjustment to each
- Recheck alignment to ensure accuracy
  - Pull gently on the edge of the dish to displace aim up, down, left and right
  - Adjust the dish in the direction of increased signal strength if necessary, loosen bolts and adjust the dish
  - Repeat until signal level falls whichever way the dish is pulled

Identifying the satellite
Many hundreds of satellites are located in geostationary orbit around the earth and it is easy to align the dish to the wrong satellite.
- Digital meters and analysers will determine the satellite’s identification from the digital data received. If a simple signal strength meter or buzzer with no satellite identification is used, a receiver and television can be used to confirm reception of the correct satellite.
- From a vertical position, turn the LNB clockwise (as seen with the satellite behind you) to the polarity offset angle
- Adjust the LNB angle, monitoring the received signal’s bit error rate with a suitable meter or analyser
- Tighten the LNB clamp screw(s)

DEFINITIONS
Polarity Offset – The angle by which a linearly polarised signal is rotated relative to true vertical or horizontal at the receive site.
Bit Error Rate (BER) – A measure of the quality of a digital transmission, determined from the proportion of the signal received incorrectly. More accurate for antenna alignment than a simple carrier level measurement.
Coaxial cable forms a vital link between dish and receiver and its performance will have a significant impact on the overall performance of the whole system. Working to the following guidelines will ensure reliability and long life.

ASTRA recommends cable specified to BS EN50117 and certified as suitable for digital signals by the Confederation of Aerial Industries (CAI).

**Cable route and fixing**
- Plan for the shortest run appropriate for concealment
- Use a single length of cable for the whole run
- Secure cable to a dish feed arm or mount using cable ties or UV-stabilised tape
- Run cable straight up and down, and horizontally across walls, not diagonally
- Choose cable colour to match the background
- Ensure all bends exceed the minimum bending-radius specified by the cable manufacturer. If not known, consider the minimum bending-radius to be ten times the outer diameter of the cable
- Use architectural features (rainwater downpipes, bargeboards, etc) to camouflage cables
- Never run cable under carpets, even around the edge of a room
- Use the correct size and colour of cable clips for the cable
- All materials used externally must be UV stabilised
- Fix the cable at intervals no greater than 460mm on horizontal runs and no greater than 750mm on vertical runs
- Fix drip loops at LNB connections and at all points of entry or exit to a building
- Entrance into the building:
  - Drill holes through brickwork or stone, not through window or door frames
  - Use a drill bit no wider than is necessary to accommodate the cable
  - Drill from the inside of the building
  - Check carefully for mains cables and pipes before drilling
  - Drill the hole with a slope down to the outside to prevent water ingress.
  - Slow the drill speed and turn off the hammer action for the final few inches to prevent ‘blow-out’ of the external brick surface or render around the hole
- Connections and Weatherproofing
  - ASTRA recommends crimp-on F-connectors
  - Connector, crimp tool and cable must be to the same specification
  - If an outlet wall plate is used, it must be fully screened
  - All cable holes must be sealed with an external grade sealant
- Seal all LNB connections with self-amalgamating tape wherever physically possible
- Buy cable, connectors, crimp tool and sealant from the same supplier to ensure compatibility
- Can’t tape up LNB connections?
  - Connections to a Twin, Quad or Quattro LNB that cannot be sealed with self-amalgamating tape because of the LNB design, must be waterproofed by some other means.
  - Rubber ‘boots’ must fit tightly over the cable. Applying silicone grease to the inside of the boot will make it easier to fit and improve waterproofing
- Do not rely on a rain shroud. Even small amounts of moisture can cause damage. A shroud should be used only in conjunction with self-amalgamating tape, a rubber boot or silicone grease
- Twist-on F-connectors
  - Twist-on F-connectors offer a less-skilled method of applying connectors to a cable. However, if they are to be reliable, they must be the correct size for the cable and fitted correctly. An over-tight connector will distort the cable, possibly causing signal reflections, and may cut through the cable’s braid creating a poor electrical connection.
connecting the receiver

- Make all other connections before connecting mains power
- Use SCART connections to TV and VCR whenever possible
- Keep mains power and signal cables separated as much as possible

**TELEPHONE LINE**
Connect to a phone socket using the cable supplied with the receiver. See page 15 for details on installing telephone extension sockets.

**AERIAL IN**
Connect to terrestrial TV aerial. For best reception, the aerial must be mounted outside, clear of local obstructions. The connecting lead between a wall socket and set-top box must be CAI approved for digital signals.

**RF OUT 1**
Carries Radio Frequency (RF) signals from the set-top box to TV and VCR. The output frequency can be altered to avoid interference with channels received by the aerial. The SCART output should be used in preference to RF OUT 1.

**RF OUT 2**
Connect to a second TV set in another room, or to an RF distribution system. The secondary TV set(s) must be tuned to the RF channel number set for RF OUT 1.

**TV SCART**
Connect to the main TV set with a fully wired, individually shielded SCART lead. RGB video output will give best picture quality on a compatible TV. Set Picture Format to match the screen format of the customer’s main TV. A fully wired SCART will also carry widescreen switching commands (where they are included in the broadcast stream) to automatically change aspect ratio to suit the programme.

**VCR SCART**
Connect to VCR or DVD recorder for recording and playback.

**AUDIO OUT (Left and Right)**
Connect with a screened stereo phono cable to the customer’s hi-fi or surround sound system. Placing speakers either side of the TV screen will give the best sound reproduction.

**DISH INPUT 1**
Connect to the LNB. Use only CAI certified cable and crimp-on connectors, including between a wall outlet and receiver where necessary.

**DISH INPUT 2 (Sky+ only)**
Connect to a second, independent signal source (see Section 2 – Choosing an LNB).

**TV SCART**
Connect to the main TV set with a fully wired, individually shielded SCART lead. RGB video output will give best picture quality on a compatible TV. Set Picture Format to match the screen format of the customer’s main TV. A fully wired SCART will also carry widescreen switching commands (where they are included in the broadcast stream) to automatically change aspect ratio to suit the programme.

**S-VIDEO (Sky+ only)**
An alternative high quality video output signal. Connect with an S-video mini-DIN cable to a TV set, VCR or DVD recorder equipped with S-video input. Provides a video signal only and must be used in conjunction with the Left and Right analogue or digital audio outputs. SCART connection is usually preferred over S-video.

**OPTICAL AUDIO OUTPUT (Sky+ only)**
Connect with an optical digital audio lead to the customer’s hi-fi or surround sound system for high quality sound. Select Stereo or Dolby Digital for the Optical Output, as appropriate, in the Sound Settings menu.

**RGB**
Highest quality video signal available from the receiver, supplied to a suitable TV by a SCART connection. RGB output must be configured in the receiver's software.

**DEFINITIONS**
Homes built since the launch of digital services often have a telephone socket close to the most likely TV location, but in many homes a new extension socket must be installed for the set-top box. An extension telephone socket should be fitted close to the set-top box in preference to using a long extension lead. The telephone cable supplied with a Sky Digibox should be considered the maximum length for a loose connection lead.

Adhering to a few basic rules will make installation a straightforward job:

- Do not disturb the telephone master socket. An approved splitter is the preferred option for adding a new extension
- Complete the new extension before connecting it to the telephone system
- Keep each extension cable below 50 metres with no more than 100 metres in total after the master socket
- Follow the guidance on page 10 for routing and fixing cables
- Cables routed externally must be UV stable and specified for outdoor use
- Connect using the following colour code:
  1. Green with white rings
  2. Blue with white rings
  3. Orange with white rings
  4. White with orange rings
  5. White with blue rings
  6. White with green rings
Where there are no green wires, connections 1 and 6 are not used.

Total REN of all devices connected to the telephone line must not exceed four, except where a REN booster is used.

**DEFINITIONS**

REN (Ring Equivalence Number) – A measure of the load placed on the telephone system by all the devices connected to the telephone line. All devices approved for connection to the telephone system have a REN number printed on the information plate on the device, or within its instruction book.

If the viewer is to have access to interactive services, the digital set-top box must be connected to a telephone line. Without a telephone connection, only the most basic interactivity is possible.
tv around the home

Connecting a digital set-top box to a distribution system provides access to a complete range of services at any number of televisions around a home.

A basic distribution system is able to carry the following:
- All locally available terrestrial channels
- The output from a digital satellite set-top box
- The output from a digital terrestrial set-top box
- The output from a VCR
- The output from a DVD player (with an additional external modulator in some cases)
- The output from one or more CCTV cameras

**RF Distribution**

Distribution at UHF Radio Frequency (RF) provides access to the services detailed above via a single coaxial cable to each TV.

- For a single TV set, run a continuous cable from the digibox RF OUT 2 output to the TV
- For multiple TV sets, connect RF OUT 2 to the input of a compatible amplifier and run a coaxial cable from each TV to the amplifier
- Any coax plug used in the system must be soldered
- For efficient screening, only use coaxial cable certified by the CAI as suitable for digital signals
- Follow the guidance on page 10 for routing and fixing cables

**Remote control**

Any or all of the secondary TV sets can be given control of the set-top boxes with the addition of a remote control extension device.

- The infrared (IR) pick up must be compatible with the digibox RF OUT 2 output
- If an RF distribution amplifier is used it must be compatible with the IR system
- For control of other equipment (VCR, DVD, etc) a separate infrared cabled or wireless relay system can be used

**Can’t be cabled?**

If linking a secondary set to the satellite receiver is only temporary, or laying cable is not practical, then a wireless device may be used.

Wireless links are sensitive to a building’s construction and even to people passing between the units, but they have a typical effective range of several metres.

A wireless device usually will not provide the picture quality of a cabled link, but many models carry stereo audio and provide a return link for control of a digital set-top box and other devices from the secondary TV location.
The limitation of an RF distribution system is that only a single satellite channel is available throughout the home. Distributing satellite signals from the dish (IF distribution) allows independent selection from the full range of satellite services through a dedicated receiver at each location.

- Use a Quad LNB for up to four receivers
- Use an Octo LNB for up to eight receivers
- Use a Quattro LNB and Multiswitch for more connections
- Site the Multiswitch in a central location with mains power, suitable for occasional access (e.g. the loft)
- Connect TV and radio aerials to the Multiswitch for distribution of terrestrial TV and radio to each outlet

Use a Quad LNB for up to four receivers
Use an Octo LNB for up to eight receivers
Use a Quattro LNB and Multiswitch for more connections
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Connect TV and radio aerials to the Multiswitch for distribution of terrestrial TV and radio to each outlet

Optionally, connect VCR RF output to Multiswitch terrestrial input for distribution of terrestrial TV and radio and video playback to each outlet
Connect each receiver directly to the LNB or Multiswitch with a single length of cable
Follow the guidance on page 10 for routing and fixing cables
Where an outlet plate is fitted, it must be fully screened and triplexed to provide separate satellite, TV and radio signals
Running two cables to every outlet will allow for future use of a Sky+ receiver

IF Distribution

Audio Distribution

‘Whole house’ or ‘multi-room’ entertainment systems can be extremely complex and are beyond the scope of this publication. However, provision of even a simple switched speaker system will add value to an installation and enable the customer to make the most of the high quality radio stations and other audio services received via the ASTRA satellites.

To construct a switched speaker system:
- Connect the customer’s hi-fi and satellite receiver as detailed on pages 12 and 13
- Connect the hi-fi’s speaker outputs to the speaker switch input. Impedance matched switches are recommended
- Connect the hi-fi speakers to the first position on the speaker switch
- Install speaker pairs to wall or ceiling as appropriate to the location
- Run a pair of two-core speaker cables to each new location observing the general advice on cable routing on page 10. Speaker cables routed externally must be protected by conduit or similar physical barrier
- Connect speakers making sure to maintain the correct polarity
- Volume controls will give greater control at each listening location. Transformer-based controls are recommended

More complex systems allow for independent selection of multiple audio sources from multiple locations with remote control of the source devices from each listening point.

Switched Loudspeakers

Warning: an incorrectly designed or constructed system may cause irreparable damage to the connected amplifier and speakers. If you are uncertain of the technical requirements for successful installation, you should take advice from your component supplier.

Correctly specified loudspeakers must be used to avoid damage to the customer’s amplifier or to the loudspeakers.
- Impedance (e.g. 4ohms or 8ohms) must be matched throughout the system and within the capability of the amplifier
- Power handling (watts RMS) must be the same or greater than loudspeakers in the existing hi-fi system, and the amplifier’s maximum power output

DEFINITIONS

Quattro LNB – LNB with four outputs, each providing a single IF sub-band. Not suitable for direct connection to a receiver.

Multiswitch – When supplied with four IF sub-bands from a Quattro LNB replicates the switching method used in a direct LNB connection so that multiple receivers may be connected to a single dish.
home cinema

A home cinema system recreates the cinema experience in the home. Digital satellite TV is the best source for a variety of content in a home cinema installation.

**Display**
- **CRT** – Cathode Ray Tube. Screen sizes up to 40 inches. Still considered by many to offer the best picture quality.
- **Plasma** – flat screen with a slim profile. Can be hung on a wall.
- **LCD** – Liquid Crystal Display. Alternate flat screen technology.
- **Projectors** – CRT, LCD and DLP (Digital Light Processing) options. Often the preferred option for home cinema, but can be cumbersome for normal TV viewing.

**Sound**
Many of the movies, sports events and entertainment programmes broadcast via the ASTRA satellites include surround sound signals. A suitable amplifier or surround sound processor is a key component in a home cinema setup.

- **Dolby Digital 5.1** is broadcast in addition to the stereo soundtrack especially for home cinema sound systems.
  - Connect a Dolby Digital amplifier to the optical Digital Audio output of a Sky+ receiver.
  - Connect six speakers to the amplifier - left and right front, centre, left and right rear and a (usually) non-amplified output to an active sub-woofer for realistic low frequency effects.
  - Dolby Digital amplifiers usually also provide Pro-Logic decoding for programming not provided with Dolby Digital soundtracks.

**High Definition TV**
In the near future, High Definition TV services will be available via the ASTRA satellites. Consumers buying large screen displays now are advised to ensure that they are HD TV ready.

- The minimum native resolution of the display must be at least 720 physical lines in wide aspect ratio.
- The display must have DVI or HDMI connections and analogue component (Y, Pb, Pr) connections.

**High Definition TV Formats**
- 1280 x 720 @ 50 and 60Hz progressive (720p)
- 1920 x 1080 @ 50 and 60Hz interlaced (1080i)

**HD TV Features**
- The DVI or HDMI input must support HDCP copy protection.

**DEFINITIONS**
- **Progressive scanning** – Each frame is created by scanning picture line from top to bottom in order.
- **Interlaced scanning** – Each frame is created by scanning two separate fields, the first with odd-numbered lines, and the second with even-numbered lines.

**Look for the logo on HD ready display devices**

---

| Centre Speaker (C) | - directly above or below the TV |
| Front Left (FL) and Front Right (FR) | - at equal distance no more than 1.5 metres from the TV |
| Rear Surround (RS) | - above ear level, in line with or slightly behind viewing position |
| LFE | - (low frequency effect or sub-woofer) position on floor level almost anywhere (non-directional), but avoid corners and large sofas |

Always use the amplifier’s white noise function to adjust individual speaker levels.

broadband via satellite

A digital satellite TV system can easily be expanded to provide high speed Internet access where terrestrial broadband Internet access is not available:

- In remote areas beyond the reach of terrestrial networks
- In mobile leisure applications – caravans, boats, etc.
- In other mobile or temporary applications – emergency service access, ad hoc shows and exhibitions, on board trains, ships and planes, etc.

Signal reception equipment is identical to that used for digital television, with the addition of a computer-based receiver and related software.

A variety of receivers are available:

- **USB** – installed externally, with no need to open the computer, with separate power supply and connecting lead
- **PCI** – installed internally and shares the computer’s power supply
- **Ethernet** – located externally on a network. Simple installation, compatible with any operating system and can easily be shared by more than one computer

**Free-to-air TV and Radio**

USB and PCI receivers will receive free-to-air digital satellite TV channels and radio stations in addition to a high-speed Internet service.

Free-to-air channels (the BBC channels, for example) are broadcast unencrypted. Channels that are broadcast encrypted but free of subscription charges are known as free-to-view and can only be viewed using the relevant decoder and viewing card. At the time of writing, computer receivers are not available with the correct decoder for encrypted UK digital services.

Further information

**ASTRA**
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