Unit - 4 Earth station Technology

Introduction

→ The collection of equipment on the surface of the earth for communicating with the satellite is an earth station, regardless of whether it is a fixed, ground mobile, maritime or aeronautical terminal.

→ Earth stations can be used in the general case to transmit to and receive from the satellite, but in special applications only to receive or only to transmit.

→ Fig 1. is a general block diagram of an earth station capable of transmission, reception and antenna tracking.

→ The following are the major subsystems:

① Transmitter: There may be one or many transmit chains, depending on the number of seperate carrier frequencies and satellites with which the station must operate simultaneously.

② Receiver: Again, there may be one or many receiver/down-converter chains, depending on the number of separate frequencies and satellites to be received and various operating considerations.

(3) Antenna :- Usually one antenna serves for both transmission and reception, but not necessarily. Within the antenna subsystem are the antenna proper, typically a reflector and feed; Separate feed systems to permit automatic tracking and a diplex and multiplex arrangement to permit the simultaneous connection of many transmit and receive chains to the same antenna.

(4) Tracking System :- This comprises whatever control circuit and drives are necessary to keep the antenna pointed at the satellite.

(5) Terrestrial Interface ; This is the interconnection with whatever terrestrial system, if any is involved. In the case of small receive-only or transmit-only stations, the user may be at the earth station itself.

(6) Primary Power ; This system includes the primary power for running the earth station, whether it be commercial, locally generated, battery supplied, or some combination.

(7) Test Equipment ; This includes the equipment necessary for routine checking of the earth station and terrestrial interface, possible monitoring of satellite characteristics, and occasionally for the measurement of special characteristics such as G/T.

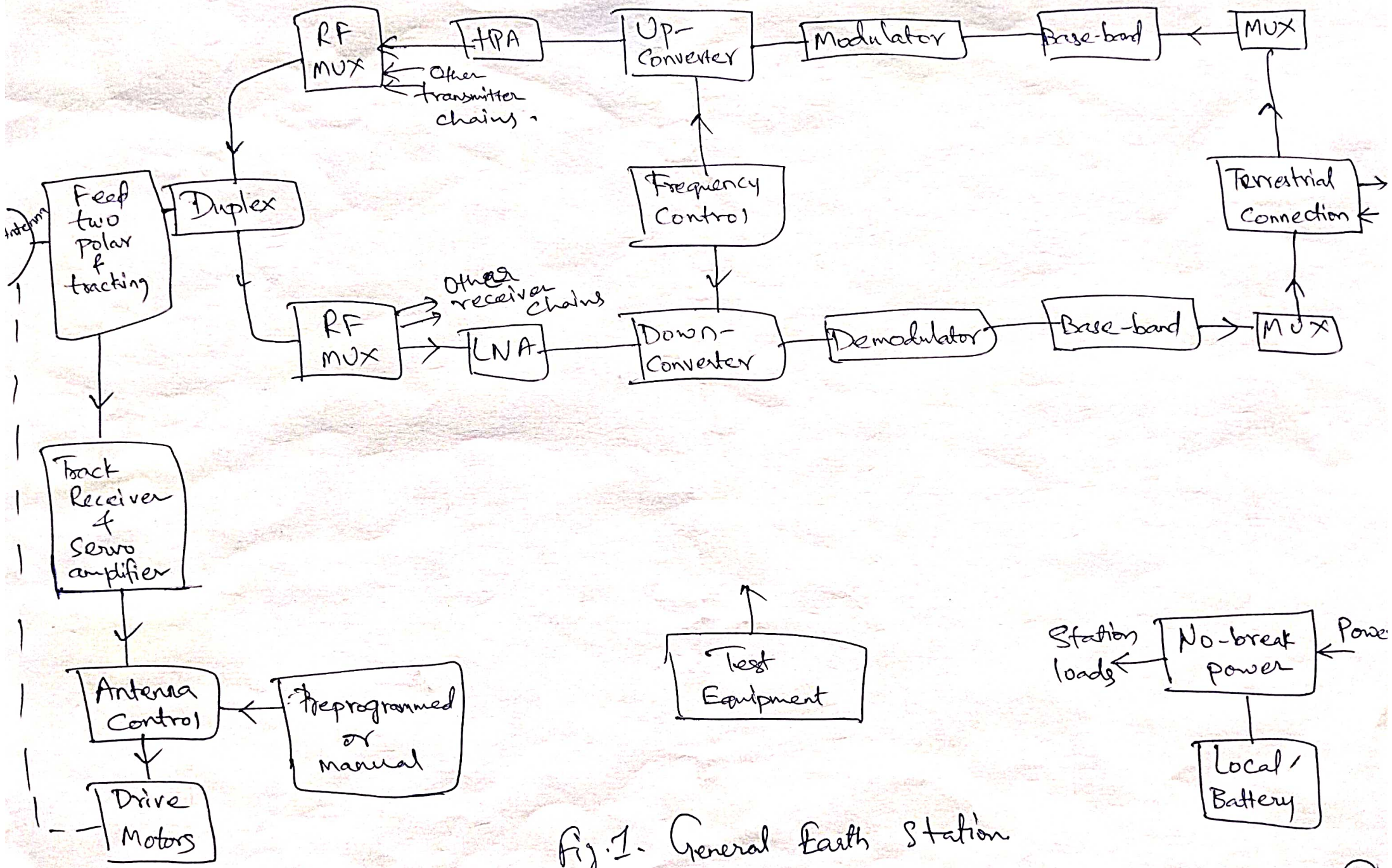

Fig. 1. General Earth Station

Tracking Systems :

→ Tracking Satellites, as distinguished from simply pointing at them in an initial orientation or switching from one satellite to another is required.

→ The pointing and tracking categories are as follows:

(1) Fixed-pointing only: Fixed-pointing systems are usually restricted to wide beam antennas for initial adjustments.

(2) Occasional Repointing: The adjustments are flexible enough so that they can be changed manually without difficulty. Simple motor drives may be added to do it remotely.

(3) Preprogrammed: Once motor drives are available for one- or two-axis control, a variety of methods, both automatic and preprogrammed, can be used. This tracking method has been used frequently in large stations.

(4) Step tracking: Step tracking uses a primitive servomechanism in which the antenna is moved a discrete amount in a step, and if the signal level increases, it is moved again in this direction. As soon as the signal level does not increase, it returns to the previous position. The fineness of this method obviously depends on the size of step.

(5) Fully automatic:- Fully automatic tracking can be provided using methods originally developed for the pointing of radar antennas. The most common is the monopulse or simultaneous lobing system, in which four beams are generated in an auxiliary feed, and combinations of the signals from these four beams provide left-right and up-down error signals.

→ These error signals are detected, amplified, and used to generate control signals for driving the antenna.

→ A block diagram of a general automatic tracking system is seen in fig 1. as an example of this kind.

→ Such systems are complicated and expensive and are required only for narrow beamwidths.

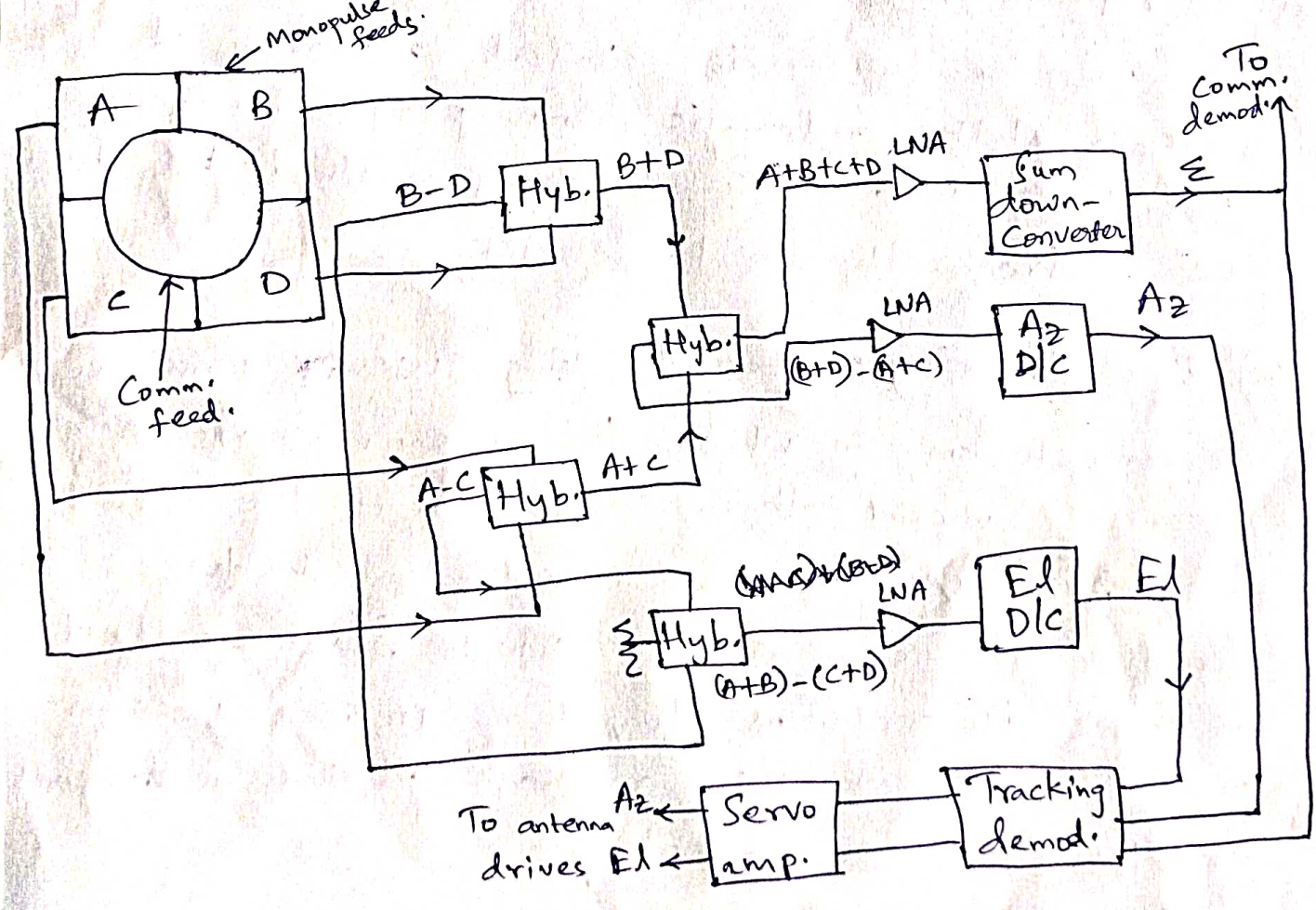

fig 1. Tracking System

Terrestrial Interface:

→ The terrestrial interface comprises a wide variety of equipment. At one extreme, when the terminal is a mobile or receive-only station, there may be ~~not~~ no terrestrial interface equipment at all.

→ The operating devices, such as TV receivers, telephones, data sets, and so on, are used right at the earth station.

→ At the other extreme, we find the interface equipment necessary in a large commercial satellite system for fixed service.

→ In such cases, hundreds of telephone channels, together with data and video, are brought to the station by microwave and cable systems using either frequency or time-division terrestrial multiplex methods.

→ The signals must be changed from those formats into formats suitable for satellite transmission.

→ Individual telephone channels, for instance may all be transmitted on same carrier, which is received by many earth stations in the network.

→ The return channels for particular conversation circuits will be coming in on various carrier frequencies, depending on their source, and they must be tagged and put together with the corresponding outgoing circuit to make up a terrestrial circuit.

→ Television video signals must often be separated from order wire channels, program sound channels, and so on, and then matched up again at the proper point.

Primary Power:

→ Primary power systems vary from plain battery- or solar-cell-operated remote transmitters for data gathering to huge, combined commercial power and diesel generator systems for large stations.

→ Most transmit and receive earth stations require some kind of "no-break" power system, that is emergency power to continue the communications during commercial power outages.

→ Such power outages are frequent, even in highly organized industrial areas.

→ The no-break transition derives its name from the necessity to make the change over from one power System to another without any interruption in service.

→ Almost all systems today use batteries to effect this transition.