Remote Controlled Satellite Receiver

PROJECT REPORT

Submitted By

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Under the guidance of

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in partial fulfilment of the requirements for the award of the Degree of BACHELOR OF ENGINEERING IN ELECTRONICS AND COMMUNICATION ENGINEERING of the Bharathiar University, Coimbatore.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Kumaraguru College of Technology

COIMBATORE-641 006

APRIL 1996

CERTIFICATE

Department of Electronics & Communication Engineering
KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE.

This is to certify that the Report entitled

REMOTE CONTROLLED SATELLITE RECEIVER

was submitted by

Mr.____________________________

in partial fulfilment for the award of degree of Bachelor of Engineering in Electronics and Communication, during the academic year 1995-1996.

21/3/96

Head of the Department
(Prof. M. Ramasamy)
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Faculty Guide
(Mr. K.Ramprakash)

Certified that the candidate was examined by us in the project work viva-voce examination held on ____________ and the University Register No. was ____________________.

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External Examiner.

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March 9, 1996

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This is to certify that Mr GOKULAKRISHNAN P, final year Electronics & Communication Engg student of Kumaraguru College of Technology, Coimbatore, has successfully completed his project work on "**REMOTE CONTROLLED SATELLITE RECEIVER**" at our concern in the year 1995-96.

During this period his character and conduct were found to be good.

We wish him success in all his future endeavors.

for UMS Radio Factory Ltd

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This is to certify that Mr ESWAR SANTHOSH C, final year Electronics & Communication Engg student of Kumaraguru College of Technology, Coimbatore, has successfully completed his project work on "REMOTE CONTROLLED SATELLITE RECEIVER" at our concern in the year 1995-96.

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This is to certify that Mr SIVAGNANAM D, final year Electronics & Communication Engg student of Kumaraguru College of Technology, Coimbatore, has successfully completed his project work on **"REMOTE CONTROLLED SATELLITE RECEIVER"** at our concern in the year 1995-96.

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This is to certify that Mr SHADASIVAM B, final year Electronics & Communication Engg student of Kumaraguru College of Technology, Coimbatore, has successfully completed his project work on **"REMOTE CONTROLLED SATELLITE RECEIVER"** at our concern in the year 1995-96.

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We wish him success in all his future endeavors.

for UMS Radio Factory Ltd

Officer - HRD

Dedicated to our

Parents

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Acknowledgement

We express our heartfelt gratitude to our principal Dr.S.SUBRAMANIAN, B.E., M.Sc.(Engg), Ph.D., for his kind patronage.

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Synopsis

SYNOPSIS

Our project is development of remote control circuitry in a satellite Receiver.

The system features a microcontroller (M491) which stores the video and audio tuning voltages and outputs them to the corresponding sections of the Satellite receiver.

The microcontroller can be remotely controlled through infrared transmission.

The frequency of transmission varies for various functions like audio tuning, video tuning, programme selection and standby function and the differentiation between various channels is done through pulse width modulation. The IC M70BLBI takes care of these.

The pre amplifier UPC 1373H amplifies the voltage picked up by the photodetector in the Receiver.

A display unit consists of two 7-segment displays and shows the channel in operation.

The rest of the circuit is a regular satellite receiver comprising of a tuner, video amplifier, Audio FM demodulator and other amplifiers.

INTRODUCTION

The man has always had the fantasy to see images and pictures of things that occur in distant places. Perhaps this is the reason for the huge success of the commercial Television. And again, there is always an urge for more clear pictures and more and more distant communication.

The technologies which caters to this need is the Satellite Communication in which two places in different parts of the world, 'talk' to each other, through a satellite orbiting the earth.

The nature of this technology itself provides very long distant communication and the high frequency associated with it provides room for frequent modulation of the images which leads to clear, sharp pictures.

But the television sets work on relatively low frequencies and they can adopt only amplitude modulated video signals.

The interface between a Television set and a Satellite is the Satellite Receiving system which downconverts the frequency and converts the frequency modulated picture information into an amplitude modulated one.

Our project is such a satellite Receiving system which can be Remotely controlled.

Invariably, the system has a tuner which downconverts the incoming signal and at the same time picks up the desired channel. The tuner also converts the frequency modulated video information into base band video.

The audio carrier is picked up by a PLL and it outputs the base band audio from the input FM audio.

These audio and video signals are properly amplified and then modulated to suit TV requirements.

The art of remote control is achieved by providing the tuning voltages through a microcontroller.

Chapter I gives an overview of a satellite communication system and explains the functions of various components in it.

Chapter 2 describes a satellite Receiver in detail and the remote control section is discussed in Chapter 3.

The Satellite Communication System

2.1 AN OVERVIEW

The concepts behind satellite broadcasting are rather simple. Signals are beamed into sapce by an "uplink" antenna, received by an orbiting satellite, electronically processed, broadcast back to earth by a "downlink" antenna and received by an earth station located anywhere in the satellite's "footprint".

Most communication satellites are sited in the "Clarke Belt" or the "geosynchronous" arc at 22,247 miles directly above the equator. This circle around the earth is unique because in this orbit the velocity of satellites matches that of the surface of the earth below. Therefore each satellite appears in one fixed orbital slot in the sky above so that a fixed antenna can always be aimed towards any chosen geosynchronous satellite.

The uplink is a complex system using many hundreds of watts of power to send a beam of microwaves to a pin-point target in space. Uplink antennas operate like car headlights which have a small light at the center and a parabolic refelector. High power microwaves aimed towards the antenna surface are reflected into a beam directed into space.

Geosynchronous broadcast satellites receive the uplinked signal, change the frequency of the message and then broadcast it to any chosen geographic area below. Downlink antennas can target upto 40% of the earth's surface with so-called global beams, can broadcast to selected coutries or continents, or can pinpoint smaller areas with spot beams.

WHY MICROWAVES?

Microwaves have been used in satellite communication for five specific reasons. First, higher frequency electromagnetic waves have the potential for relaying larger quantities of information because, as the frequency increases, any given bandwidth becomes a smaller fraction of the operating frequency. For example, a 1 MHz wide bandwidth located in the 10 MHz region of the spectrum occupies relatively more space there than does the same bandwidth in the 10 GHz region. Since more bandwidth is available, wider bands with higher information capacities can be used at microwave frequencies Therefore, microwaves can relay as much information as possible per satellite and thus can pay off the expensive investment in satellite launching, operation and maintenance more quickly.

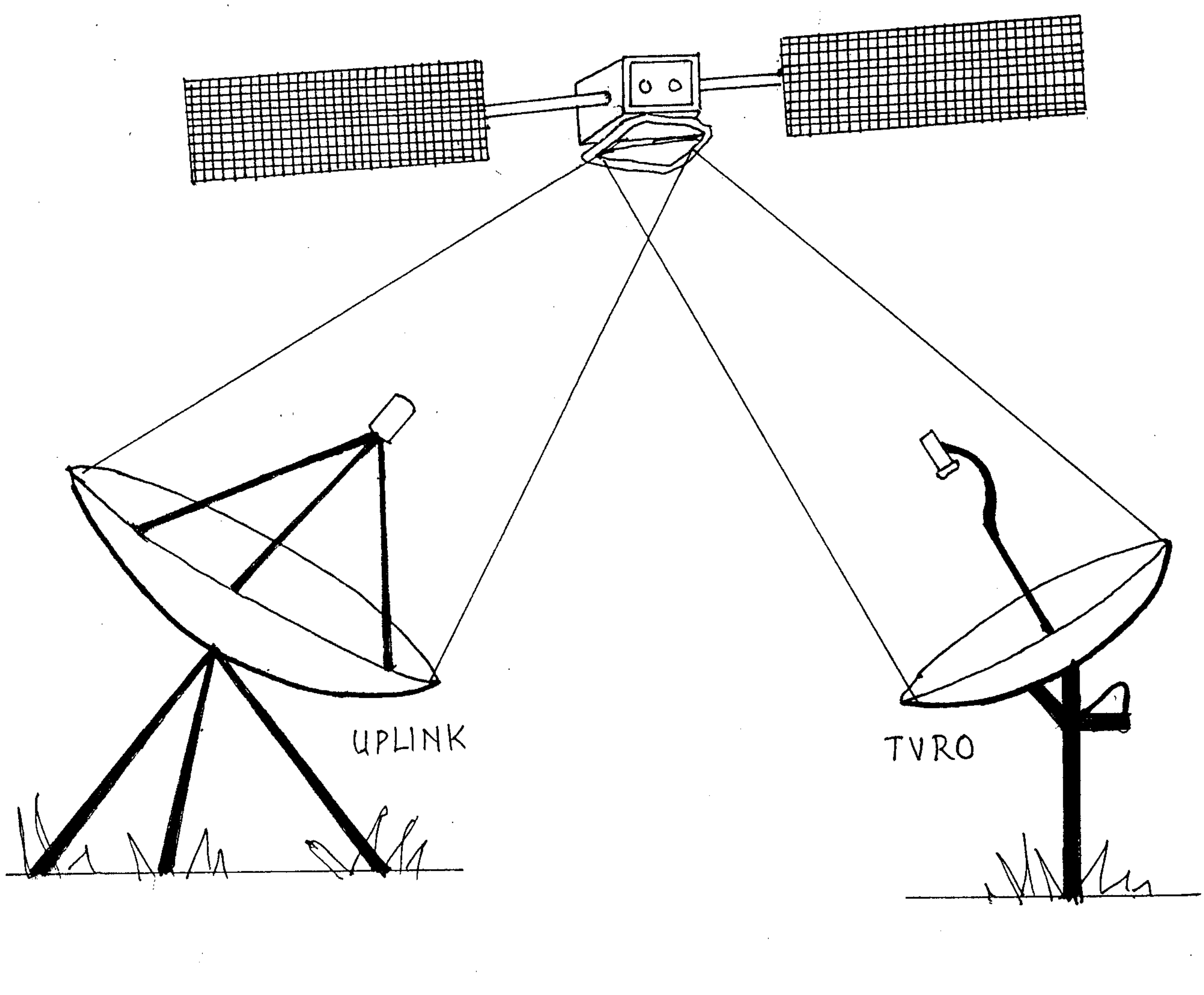
A second reason for using microwaves stems from the requirement for uplink antennas to a aim highly directional beam towards an extremely small target in space. Physics dictates that electromagnetic waves can be better focussed by an antenna that is substantially larger than the wavelength of radiation it is managing. For example, sending a directional beam of AM radio signals having 100-meter long wavelengths would require an extremely large, cumbersome and expensive antenna. Since 6 GHz microwaves have wavelengths of approximately 5 centimetres (2 inches), a 15-foot uplink dish can aim most of its radiation into a very narrow beam, and relatively low power can be used.

Third, microwave transmissions to satellites or between earth-based, line-of-sight relay stations are not as susceptible to noise from atmospheric disturbances as other lower frequency transmissions. To illustrate, several times each year, for periods as long as two or three days, short wave radio is useless for long distance communication because sun spot activity disturbs the required reflection of these relatively low frequency radio waves by the upper atmosphere.

Fourth, the most important property of microwaves that determines their use in satellite communication is their ability to pass through the upper atmosphere into outer space. Below frequencies of approximately, 30 MHz, a radio wave will be reflected back from the ionosphere layer in the atmosphere towards the earth. Since microwave frequencies are far above the 30 MHz range, they easily pass through the ionosphere layer shield.

Fifth, the microwave region of the electromagnetic spectrum was a relatively virgin territory during the late 1950's and 60's when frequency spectrum was being allocated by the FCC and the international telecommunications commission. Lower frequency space was already occupied by many different communication media and users.

SATELLITE COMMUNICATION



MICROWAVE FREQUENCY BANDS

Band Name	Bandwidth (GHz)
L-band	0.39 to 1.55
S-band	1.55 to 5.2
C-band	3.70 to 6.20
X-band	5.20 to 10.9
K-band	10.9 to 36.0

2.2. A SATELLITE EARTH STATION

The earth station consists of a large antenna to collect and concentrate as much of the very weak downlinked signals as possible to its focus. The feedhorn located precisely at the focus, channels radiation reflected and concentrated by the antenna into the first active component, the low noise block converter (LNB). Then the short length of cable relays these signals into a device called a downconverter which lowers a range of frequencies. Following downconvertions this message is cabled in-doors to the video receiver and processed into a form understandable by either a television or a stereo. An earth receiving station is in essence an uplink operating in reverse.

2.2.1. DISH ANTENNA

The earth station antenna is the eye on the sky. It must intercept and capture extremely weak radiation from a targetted satellite and concentrate it to a point where a feedhorn is placed.

The quality of a satellite antenna, often simply called a "dish", is determined by how well the dish targets a satellite and concentrates a desired signal and by how well it ignores unwanted noise and interference.

The most familiar dish used for this purpose is the prime-focus parabola which theoritically focusses all incoming signals directed parallel to its axis to a single point. Any signals arriving from a direction other than that of the targetted satellite will be reflected away from this focal point.

Dish performance is judged by a number of interrelated factors including gain and efficiency, beamwidth, side lobes, noise temperature and f/D ratio.

2.2.2. FEED HORN

Feedhorns have the important function of collecting microwaves reflected from the antenna surface and of ignoring noise and other signals coming from off-axis directions. This must be done with minimal signal losses and without adding significant amount of noise. A poorly designed feedhorn assembly can add as much as twenty K noise to a home satellite system. Feedhorns also select the required signal polarity and reject or discriminate against signals of the opposite polarity.

2.2.3. LNB

LNB is the first electronic component in the satellite system.

The satellite signals received by the feedhorn is usually very weak and requires low noise amplification and frequency downconvertion inorder to feed a usable signal to the satellite receiver. The LNB consists of a low noise amplifier and downconverter. The amplification achieved is around 50 db to 65 db.

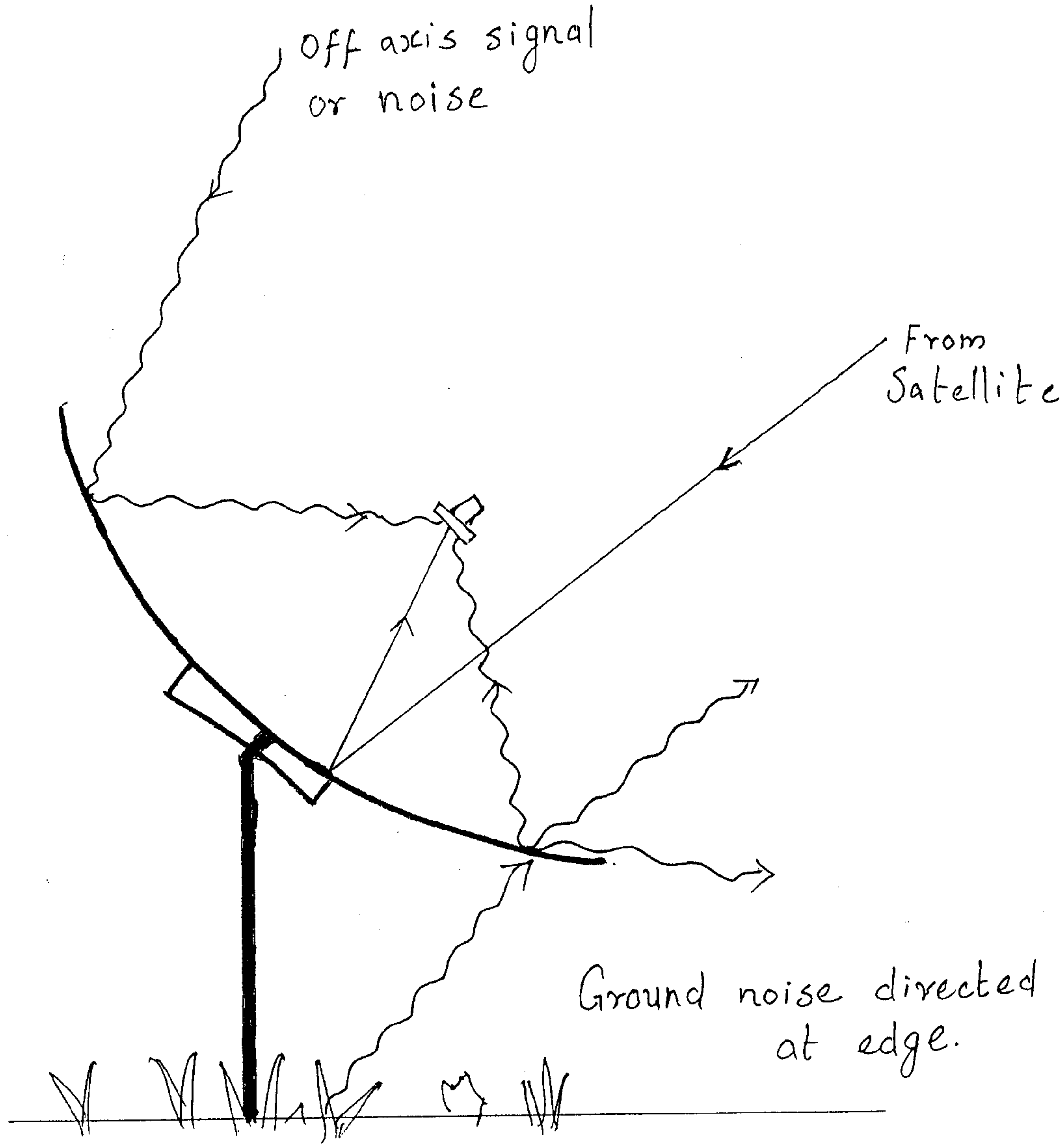
The signals received by the LNB varies in frequency from 3.7 - 4.2 GHz. With the help of LNB they are converted into a frequency of 950 - 1450 MHz. This process of converting the signals into lower frequencies is known as downconvertions. There is a fixed frequency oscillator running at 5150 MHz which is compared with the incoming frequency. The differences in frequencies are 5150 - 3700 = 1450 MHz and 5150 - 4200 = 950 MHz. Thus the entire block of 3700 MHz to 4200 MHz is converted to 950 MHz to 1450 MHz.

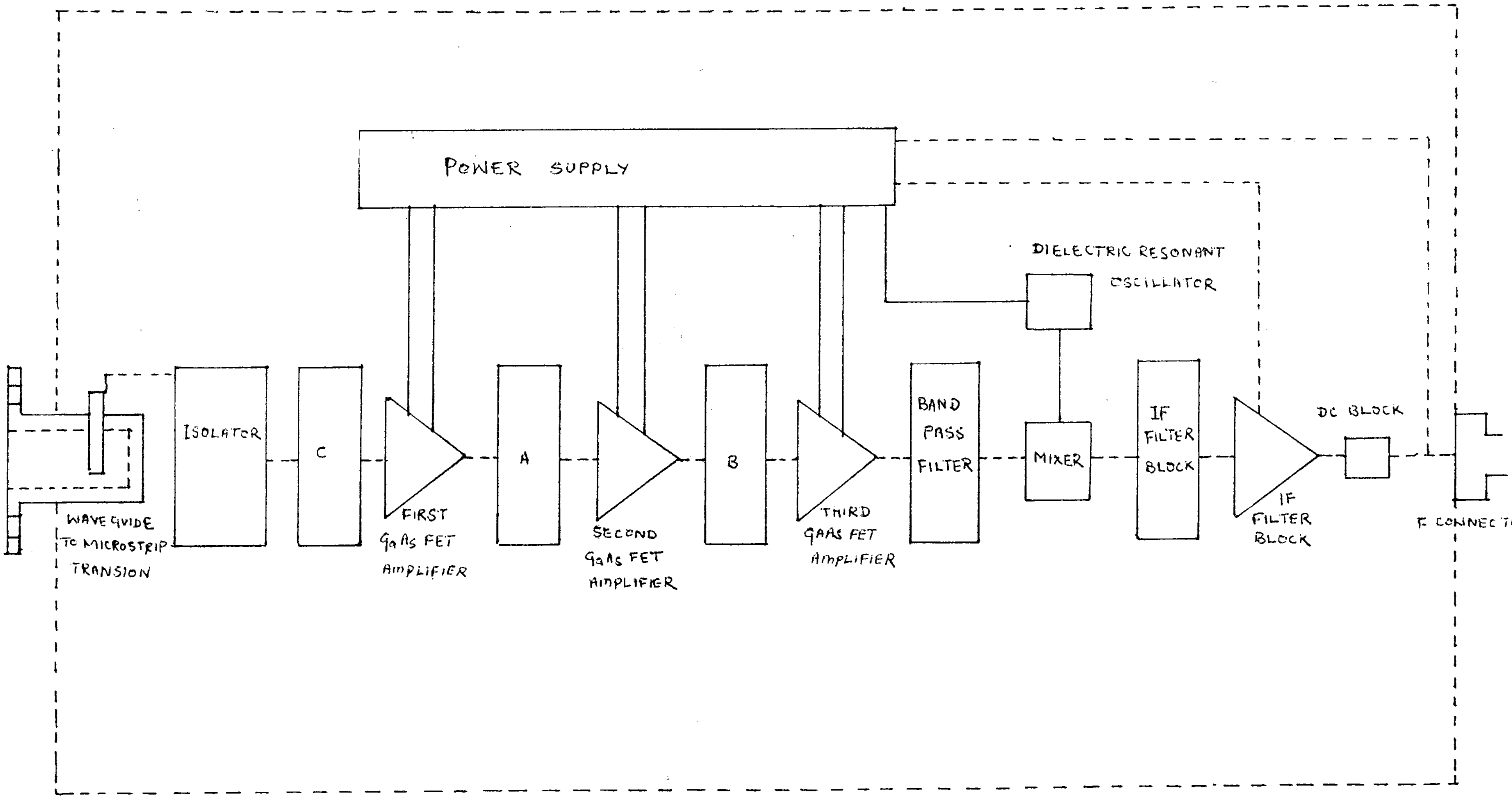
The output of the LNB is fed to the receiver unit through a special type of cable wire normally RG6 type. The supply given to the LNB is around 18 V DC and is given through the same wire from which the signal is sent from the LNB to the receiver. The gain loss in the transferring the signals from the LNB to the receiver is about 15 db.

2.2.4 SATELLITE RECEIVER

The received signal off 950 MHz to 1450 MHz from the LNB is more than the range of tuner of TV receiver. Besides it, in satellite communication both audio and video are based on frequency modulation whereas TV transmission has video signal amplitude modulated and audio frequency modulated. Therefore the satellite receiver converts the frequency modulated video information into and amplitude modulated one. Also necessary amplifications are done.

DISH ANTENNA





BLOCK DIAGRAM OF A LNB

A, B, C – IMPEDENCE MATCHING CIRCUIT

The Satellite Receiver

THE SATELLITE RECEIVER

3.1 DESCRIPTION

The prime function of a satellite receiver can be summarised as below,

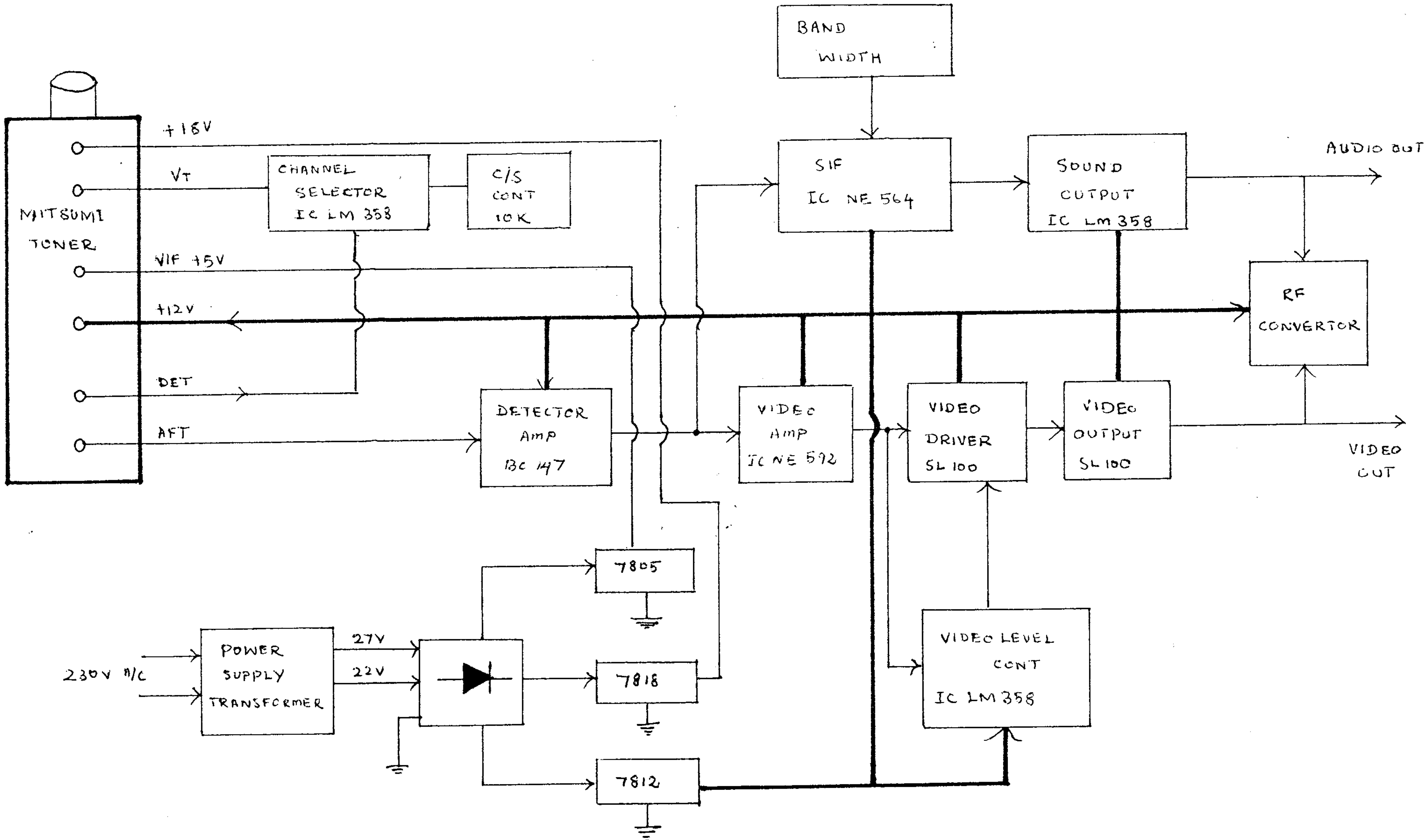
* Down convertion
* Video tuning
* Audio tuning
* Video amplification
* Audio amplification

The tuner deals with down conversion and video tuning. The tuner used in one project has a conbined VIF section so that the output is a base band video signal. The video sectio following the tuner consists of a video amplifier NE592 and the cascaded power transistors at the output stage, proper gain control is also provided through a feed base from LM358 comparator.

The audio section consists of audio PLL FM demodulaated NE564 whose output is the base band audio. Audio tuning is also done in this stage. The LM358 following NE564 provides amplification as well automated gain control.

The RF modulated LM1889 takes in base band video and audio signals and provides an RF output in second channel.

SATELLITE RECEIVER BLOCK DIAGRAM



3.2 CHANNEL SELECTION

This stage consists of a tuner and a circuit for automatic frequency control (AFC).

3.2.1 TUNER

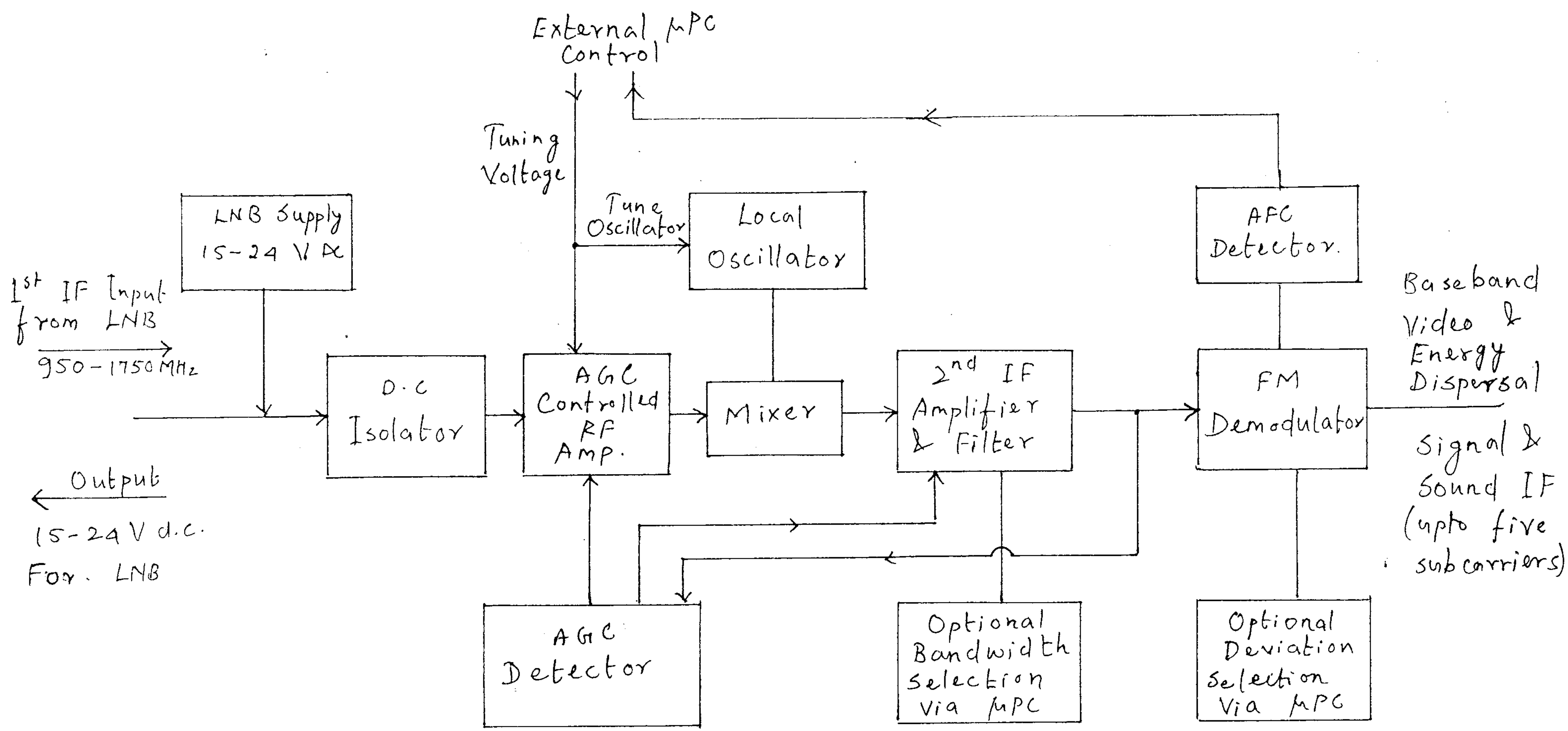
Tuner used in the satellite receiver unit is different from the tuner used in the TV receiver. This tuner is known as wide-band FM tuner.

First of all this tuner selects the frequency of required channel from the 950MHz-1450MHz signal received from the LNB. This is done through a selector section connected in the tuner whose working principle is same as that of an electronic tuner, that is, frequency of required channel is received by varying the voltage. After this the selected frequency is amplified and given to the mixer stage. A local oscillator section is connected with the mixer stage and it generates a signal of 1560 MHz to 2360 MHz. This local oscillator is a type of voltage controlled oscillator (VCO) having tuning voltage input in the range 0-18 Volts. Thus a new frequency known as IF frequency is generated in the mixer stage by combining both the signals entering into it. This IF signal is given to the VIF section where first of all it is amplified and then is filtered by a band pass filter. Again the IF signal is amplified by the IF amplifier and is given to the phase lock loop (PLL) section. PLL section after demodulating this IF signal converts it into base band signal. This signal is received at the output of the tuner and is given to various sections of the receiver.

The tuner used in our project is the commercially available "Mitsumi" tuner (Model TSU2-EO1P), the specifications of which are

* frequency bank : 920 - 2150 MHz
* Systems : PAL, SECAM, NTSC, P.MAC/D2.MAC Etc.
* PLL tuning
* Fixed or switchable IF bandwidth (27/32 MHz)
* 5 V supply, low power consumption (1 Watt)
* Single of Dual antenna inputs
* F-connector inputs
* PLL demodulator for threshold extension
* PC control of tuning functions, inputs and bandwidth switching, interval AFC detector.
* Base band video polarity; positive

TUNER BLOCK DIAGRAM

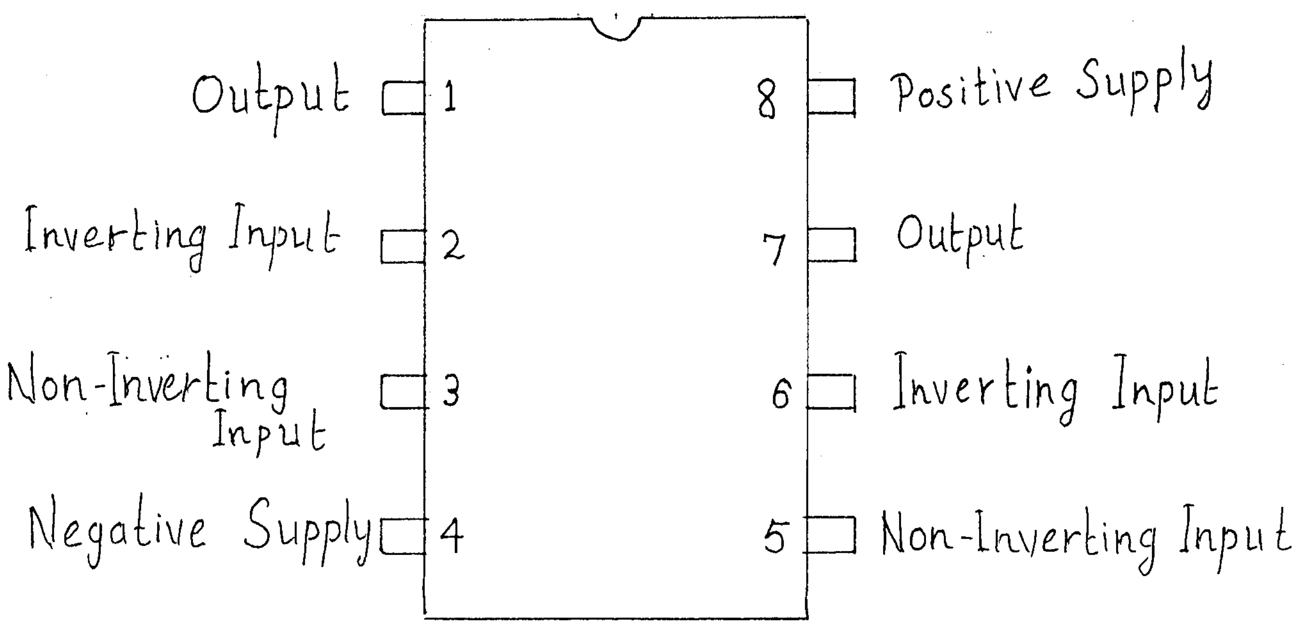


3.2.2 AUTOMATIC FREQUENCY CONTROL

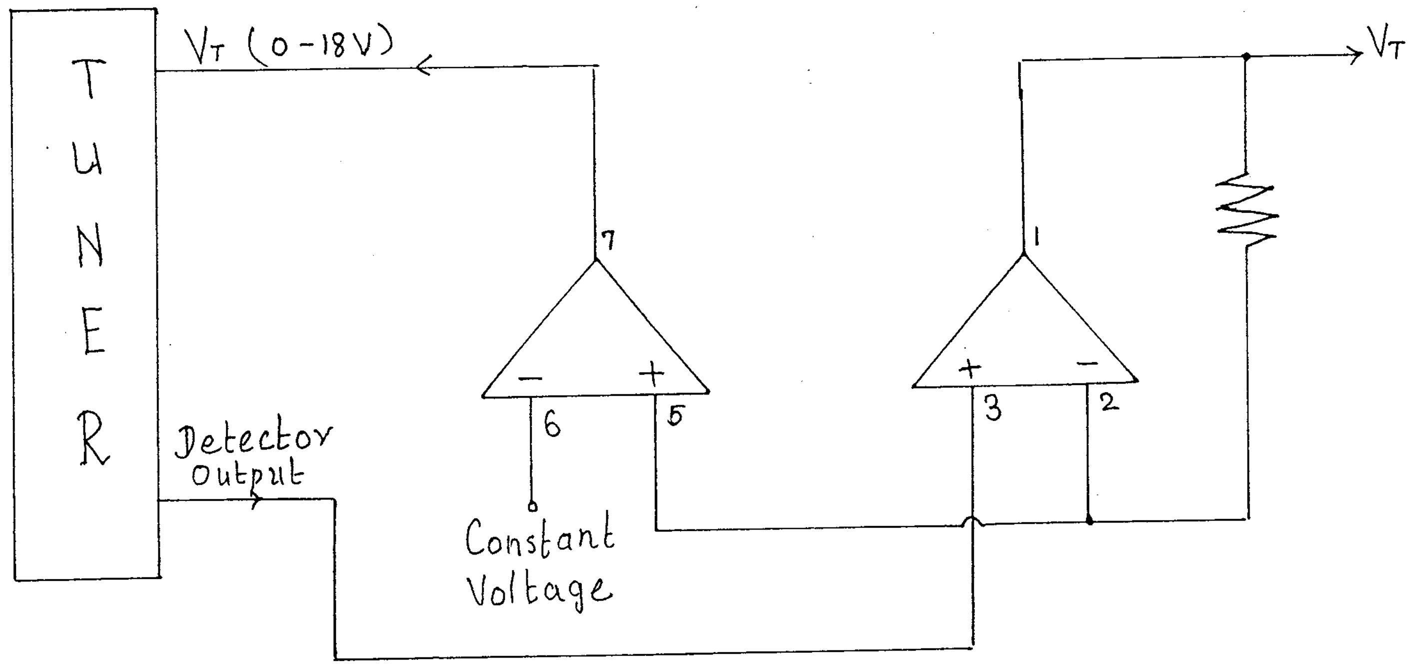
The comparator IC LM358 is used for this purpose. This IC is operated in differentil amplifier configuration.

The tuning voltage is fed to the inverting input (pin2) of first amplifier and also to the non inverting input (pin5) of second amplifier. The inverting input (pin6) of second amplifier is kept at a constant voltage and the output of the second amplifier is fed to the tuner. The non inverting input of the first amplifier is fed with the detector output of the tuner. Thus any deviation from the tuned frequency changes the detector output which causes the output of the first amplifier to vary. From the configuration we find that this variation causes changes in tuning voltage input (pin5) of second amplifier. This in turn changes the output to the tuner. Thus automatic frequency control is achieved.

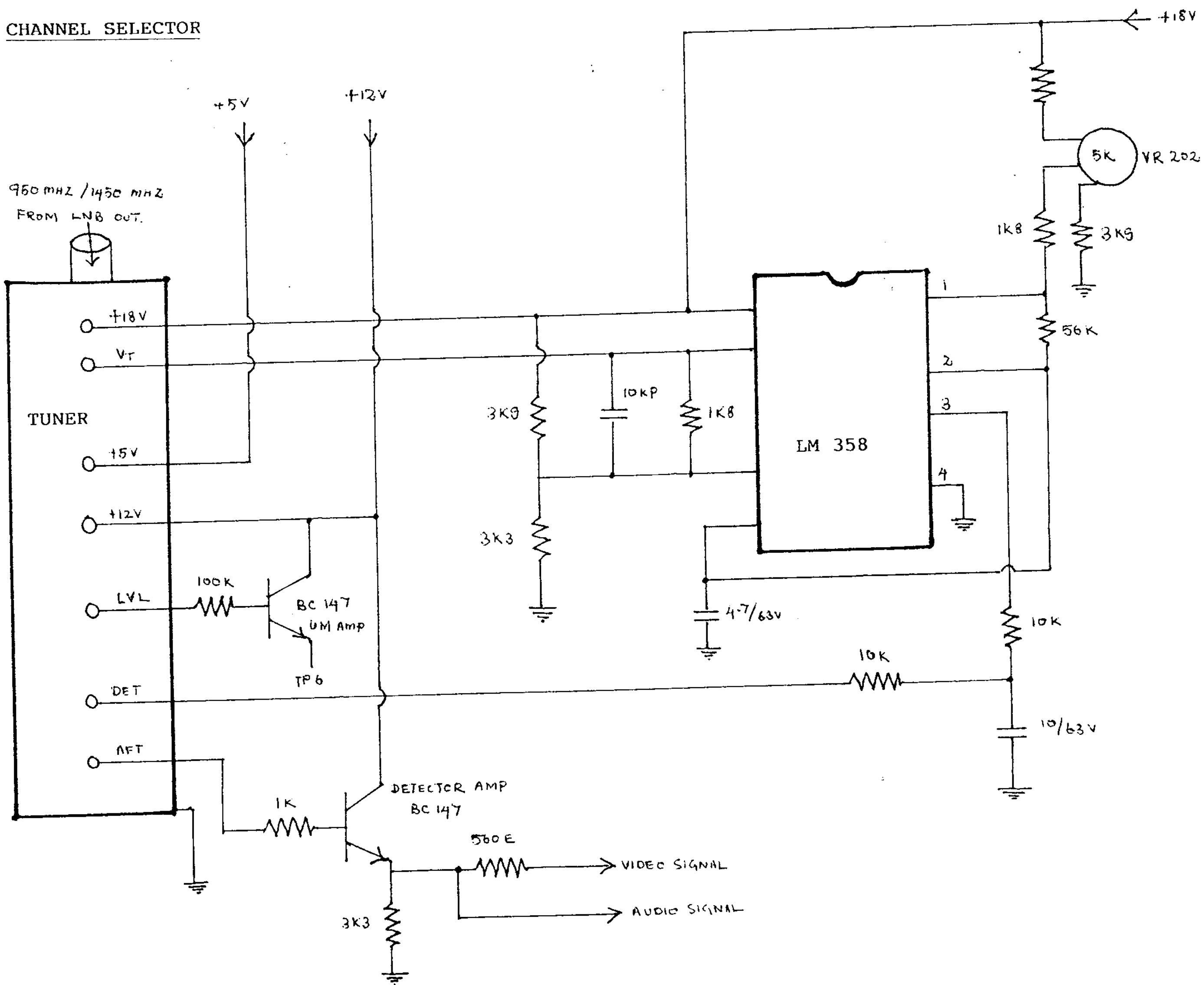
PIN CONFIGURATION OF IC LM 358



AFC



CHANNEL SELECTOR

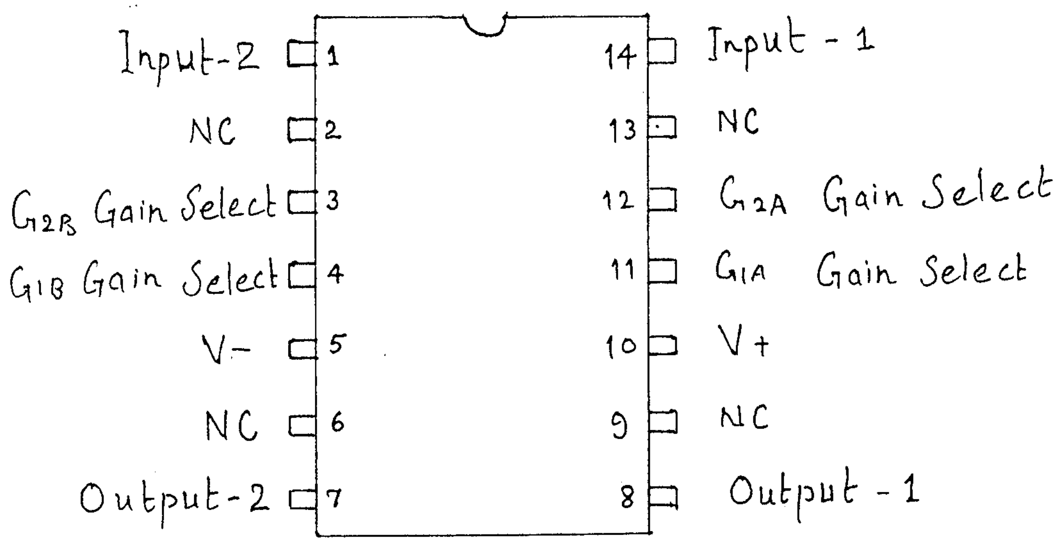


3.3 VIDEO SECTION

3.3.1 VIDEO AMPLIFIER NE592

This IC is a two stage differential output wide band (120 MHz) video amplifier. It offers fixed gains of 100 and 400 without external parts and adjustable gains from 0 to 400 with the use of one external resistor. The input stage of this IC has been designed so that with the addition of few external reactive elements or components, the circuit acts as a high pass filter, low pass filter or a band pass filter. Due to this characteristic of the circuit (built in association with IC NE592), it is ideal for use in telecommunication, the floppy disc head amplifier of computer and video recording system.

PIN CONFIGURATION OF IC SE/NE 592

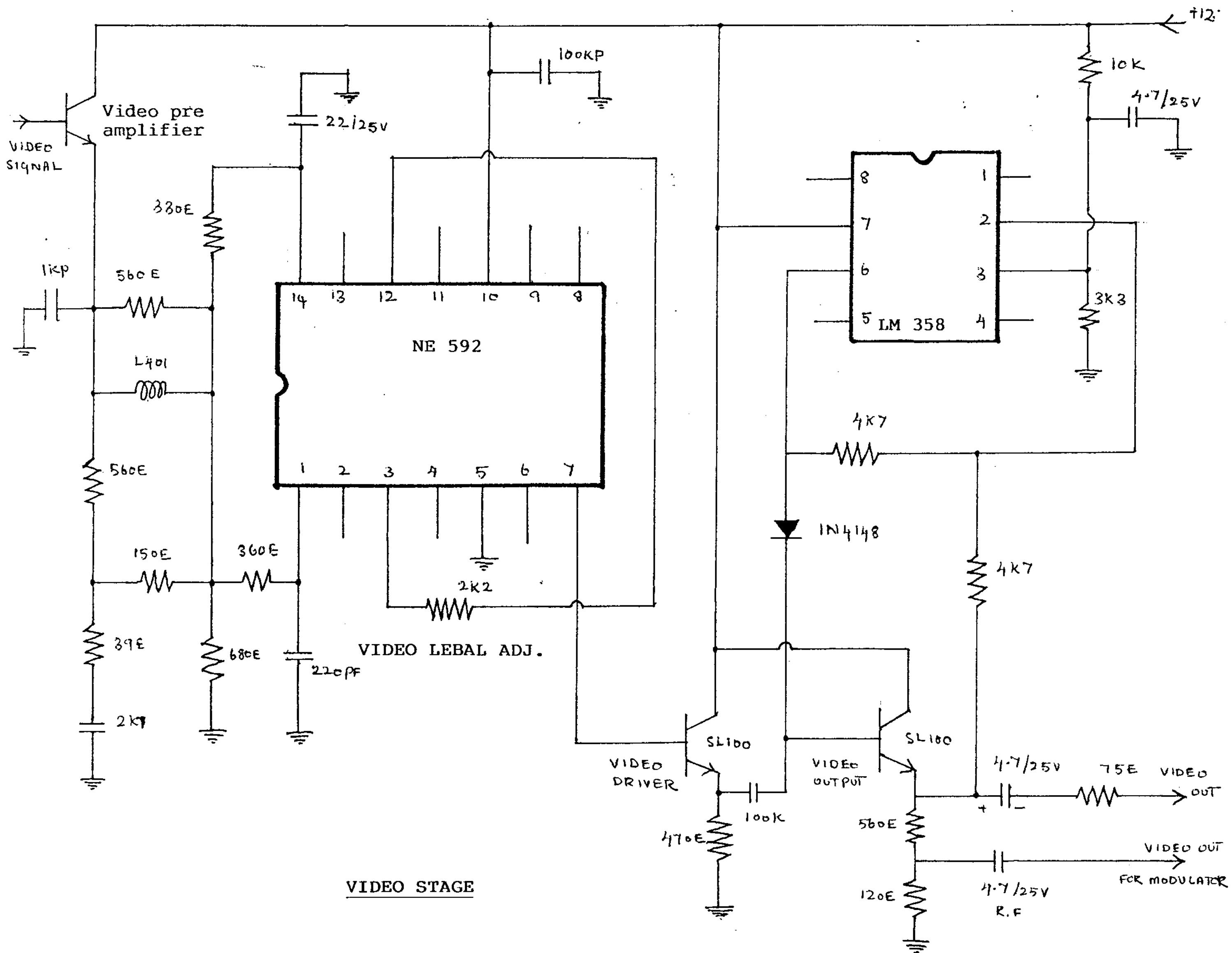


SYMBOL AND PARAMETER	RATING	UNIT
Supply voltage	±8	V
Differential input voltage	±5	V
Common mode input voltage	±6	V
Output current	10	mA
Operating temperature range		
SE 592	-55 to +125	°C
NE 592	0 to +70	°C
Storage temperature range	-65 to +150	°c
Power dissipation	500	mA

3.3.2 VIDEO STAGE DESCRIPTION

The prime function of this stage is amplification. The video signals are widespread having 5 MHz bandwidth. To amplify these signals, we use a special wide band amplifier namely NE 592. Pre amplification is done using transistor BC147 prior to applying the signal to NE592. Two cascaded stages of power transistors SL100 are used to boost the video signal power level.

The output of the second SL100 transistor is fed to the inverting input (pin20) of first comparator in LM358, operated in differential mode. The other input (pin3) is kept at a constant voltage of 3 V. The output of this comparator is fed as non inverting input of second comparator in LM358, whilst the other input is grounded. The output of the second comparator serves as the supply for the first power transistor (video driver). Thus any increase in the output video voltage causes the output of the first comparator to reduce which in turn causes the output of the second comparator to reduce. This causes the video driver's gain to reduce. Similar action takes place for reduction in output voltage. Thus automatic gain control is achieved.


+12
10K
4·7/25V
100KP
22/25V
Video pre
amplifier
VIDEO
SIGNAL
330E
1KP
560E
L401
560E
150E
360E
39E
680E
2K7
220PF
NE 592
14
13
12
11
10
9
8
1
2
3
4
5
6
7
2K2
VIDEO LEBAL ADJ.
LM 358
8
7
6
5
1
2
3
4
3K3
4K7
IN4148
4K7
SL100
VIDEO
DRIVER
100K
470E
SL100
VIDEO
OUTPUT
560E
120E
4·7/25V
75E
VIDEO
OUT
VIDEO OUT
FOR MODULATOR
4·7/25V
R.F

VIDEO STAGE

3.4 AUDIO SECTION

3.4.1 PLL FM DEMODULATOR

The NE 564 is a versatile, high guaranteed frequency phase lock loop designed for operating upto 50 MHz. The NE 564 consists of

1. A VCO (Voltage Controlled Oscillator).
2. Limiter.
3. Phase comparator.
4. Post detection processor.

The post detection processor makes it very versatile PLL.

The VCO in NE564 uses an emitter-coupled oscillator construction to enable it to go to 50 MHz. and whose centre frequency can be set by an external capacitor. The phase comparator is basically a double balanced modulator with a limiter-amplifier to improve AM rejection.

The post detection processor consists of a unity gain transconductance amplifier & a schmitt comparator with an adjustable hysteresis. The amplifier of the post detection processor can be used as a DC retriever when PLL is used as an FSK demodulator & as a post detection filter when it is used as a linear FM demodulator.

Operations possible with single 5V supply are as follows

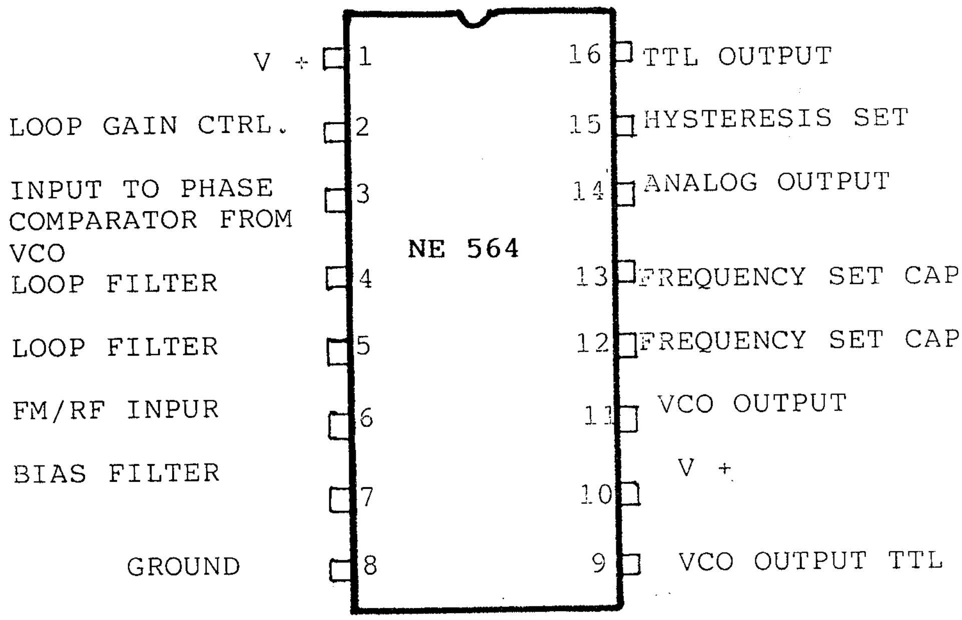
1. TTl compatible inputs and outputs.
2. Reduced carrier feedthrough and external loop gain control.

Typical application of IC NE564 includes

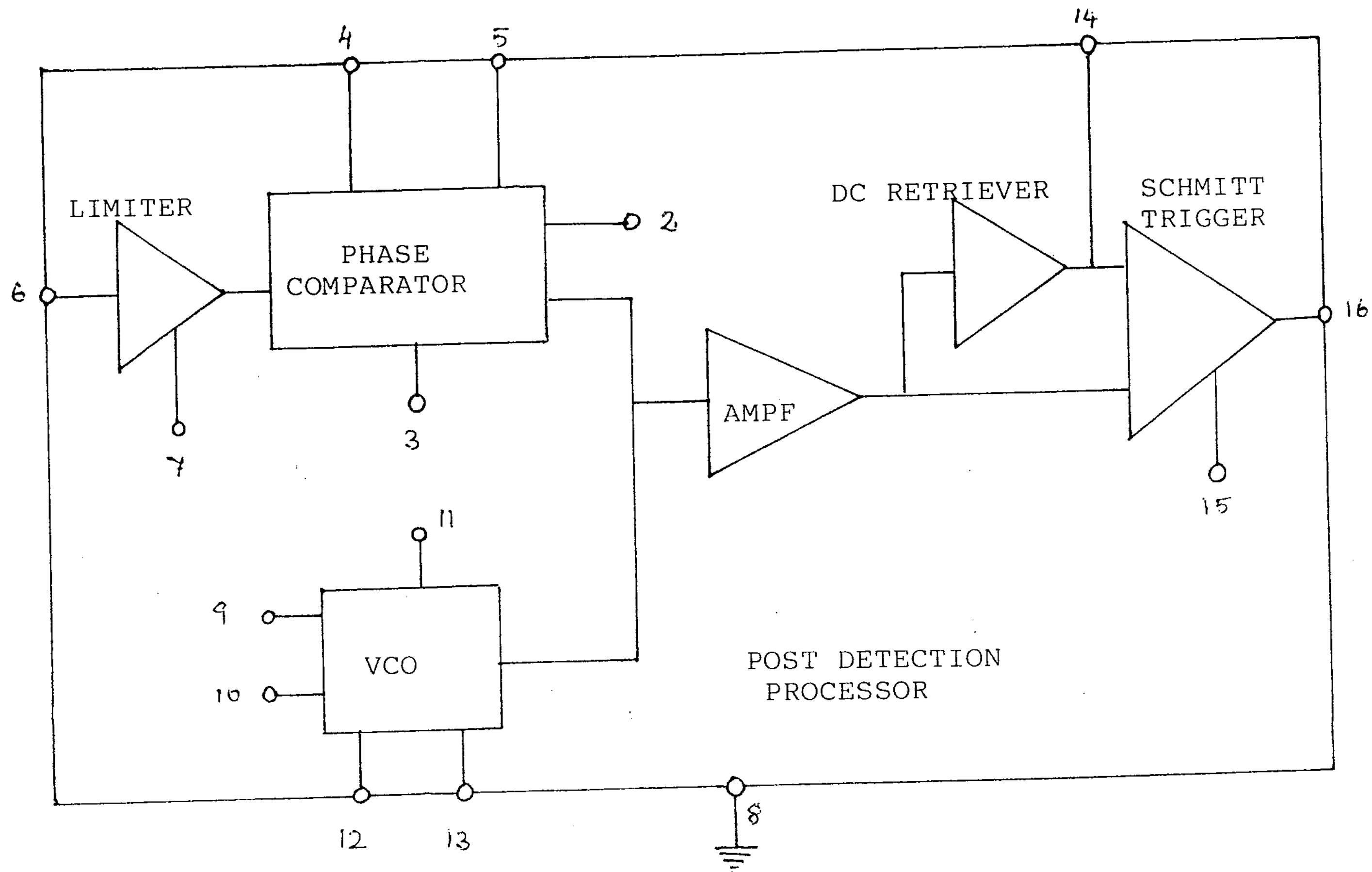
1. High Speed Modems.
2. FSK Transmitters and Receivers.
3. Frequency Synthesizers.
4. Signal Generator.

PARAMETER	RATING	UNIT
V+ Supply voltage		V
pin 1	14	
pin 10	6	
P_D Power dissipation	500	mW
T_A Operating temperature		
NE	0 to 70	°C
SE	-55 to +125	°C
t_{stg} Storage temp. range	-65 to +150	°C

PIN CONFIGURATION



BLOCK DIAGRAM OF IC NE564



3.4.2 AUDIO STAGE DESCRIPTION

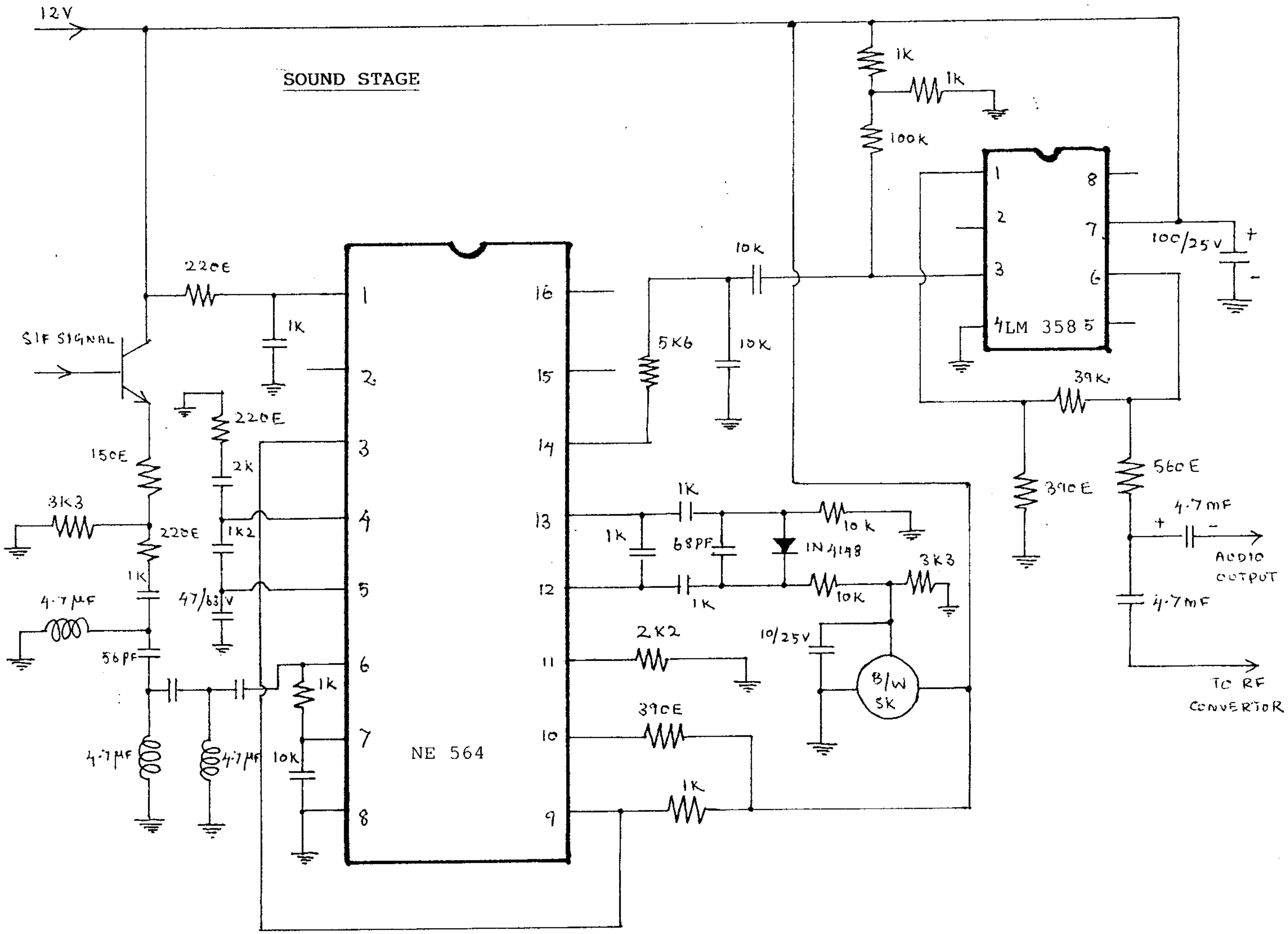
As explained before the output of the tuner has a bandwidth of 10MHz. and it contains both video and audio information. The video signal covers frequencies 0-5 MHz and the audio information is in frequencies 5.5-9.8 MHz. The audio carrier may led anywhere in this range. So the purposes of this stage can be summarised as below

* Video band rejection (0-5 MHz)
* Audio tuning
* Audio demodulation
* Audio amplification and
* Gain control

Band rejection filters are provided before audio tuning. Audio tuning and audio demodulation are done using IC NE564. This IC has a voltage controlled oscillator whose oscillating frequency can be changed by varying the capacitance across the frequency control pins 12, 13. The variation in capacitance in picofarads range is achieved by supplying varying negative bias to a diode.

The audio carrier is then locked to the local oscillator frequency. Any deviation from the locked frequency generates an error voltage which is nothing but the base band audio signal. This error signal is amplified inside the IC and is available at pin NO.14. Further amplification is done using LM358 and automatic gain control is also provided through proper feed back.

SOUND STAGE



12V
S1F SIGNAL
220E
1K
150E
3K3
220E
1K
4·7MF
56PF
4·7MF
4·7MF
220E
2K
1K2
47/63V
1K
10K
NE 564
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
10K
5K6
10K
1K
1K
68PF
1K
IN4148
10K
10K
3K3
2K2
10/25V
B/W
5K
390E
1K
1K
1K
100K
4LM 358
1
2
3
8
7
6
5
100/25V
+
-
39K
390E
560E
4·7MF
+
-
AUDIO OUTPUT
4·7MF
TO RF CONVERTOR

3.5 R.F. MODULATOR LM 1889

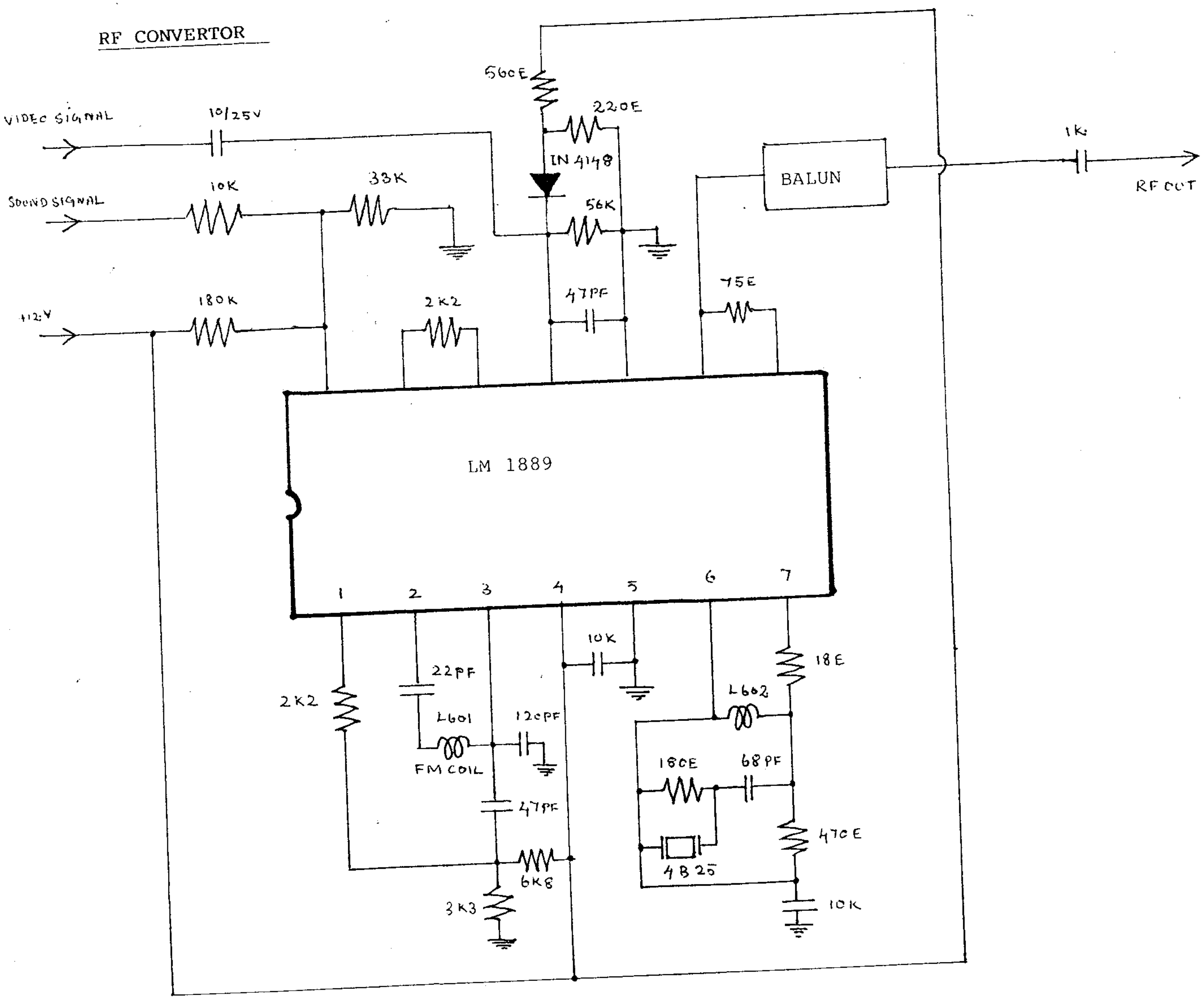
The received audio and video signals from the satellite receiver are converted to RF signals through the modulator section. The TV video modulator used in our project is LM 1889.

In this section a carrier frequency signal of specified value (48.25 MHz) is added to the audio and video signals to make them a RF signal.

LM 1889 Pin description:

pin 4	: +12 V (positive supply)
pin 5 & 10	: grounded (negative supply)
pins 2,3	: FM coil (sound section) Using this coil frequency tuning is done.
pins 6,7	: RF channel selector Across these pins a crystal is connected which generates a frequency of 48.25 MHz (Channel II)
pin 9	: RF frequency output
pin 11	: Video signal input
pin 14	: sound signal input

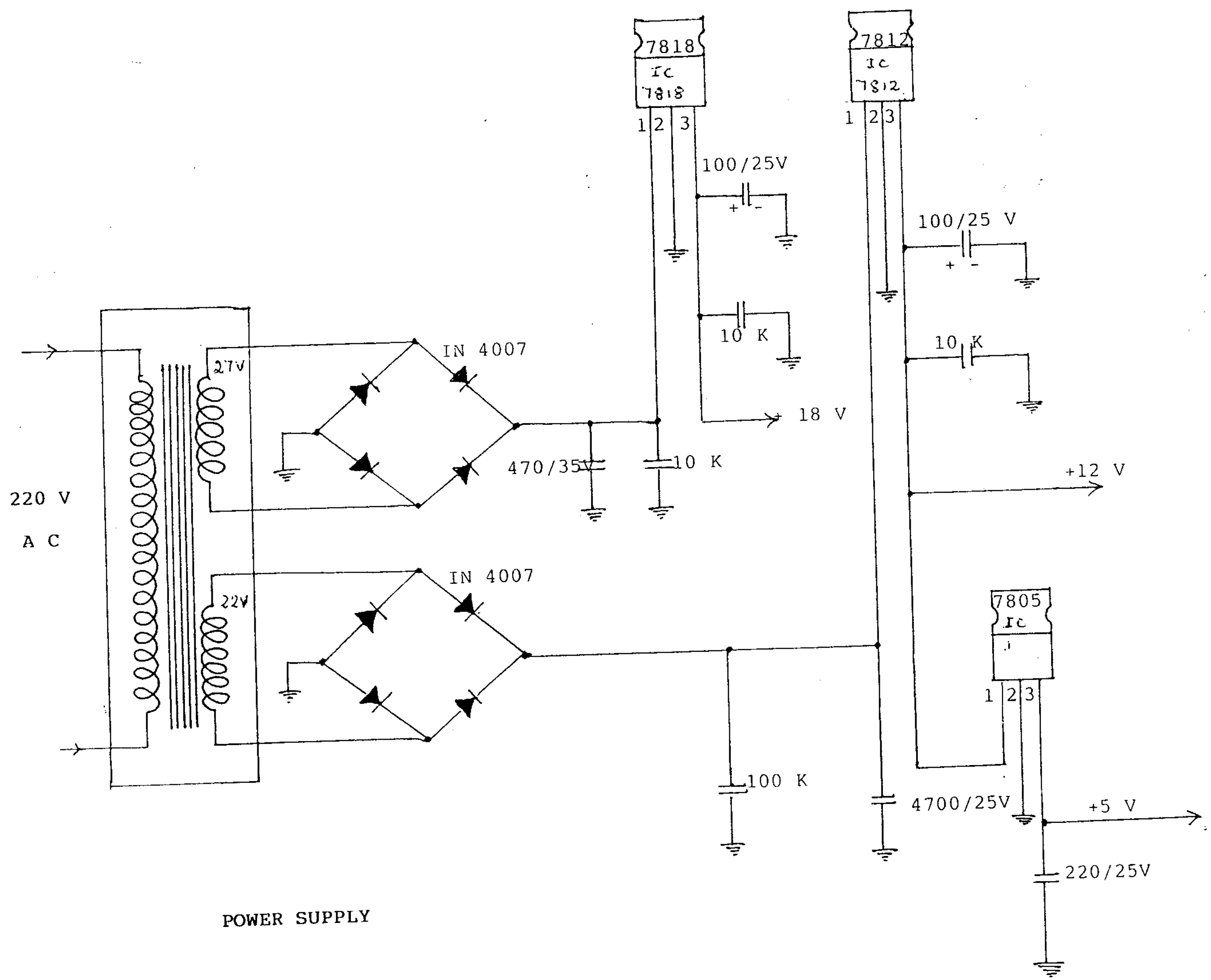
RF CONVERTOR



3.6 POWER SUPPLY

In this section AC of 220 V is stepped down by a transformer into 27 V and 22 V by two separate secondaries. The voltages in the secondaries are rectified by using full-wave rectifiers.

The supply to the tuner (18 V) is fed by IC 7818 through the first secondary of 27 V. The voltage from the second secondary is filtered and input to the voltage regulator IC 7812. The 12 V supply from this IC is used for most sections of the Receiver. The output of 7812 is given to another voltage regulator 7805 which provides 5 V supply to the tuner.



POWER SUPPLY

Remote Control Section

REMOTE CONTROL SECTION

Introduction:

The two values which are to be fed externally and which govern the channel selection are:-

1) Video tuning voltage &

2) Audio tuning voltage

The video tuning voltaage has to be fed to the tuner where as the audio tuning voltage has to be fed to the audio PLL IC.

First, we will be storing up these values in a microcontroller. The microcontroller used by us can store 16 sets of these values.

Later, we access these values from the microcontroller and feed them to the respective parts in the satellite reciever.

The accessing of these values can be controlled remotely using the remote handset.

The remote handset transmits infra red rays of different frequencies for different functions like audio tuning, video tuning, programme selection. etc. Also it transmits different sets of infra red pulses for different programs. These functions are achieved using the IC M70BLBI.

Each variety of the infra red pulses trigger the microcontroller to output a particular set of tuning voltages. Thus programme selection can be made.

What a user needs to do is

1) Select the channel number either using remote handset or by using controls in the front panel of the receiver.

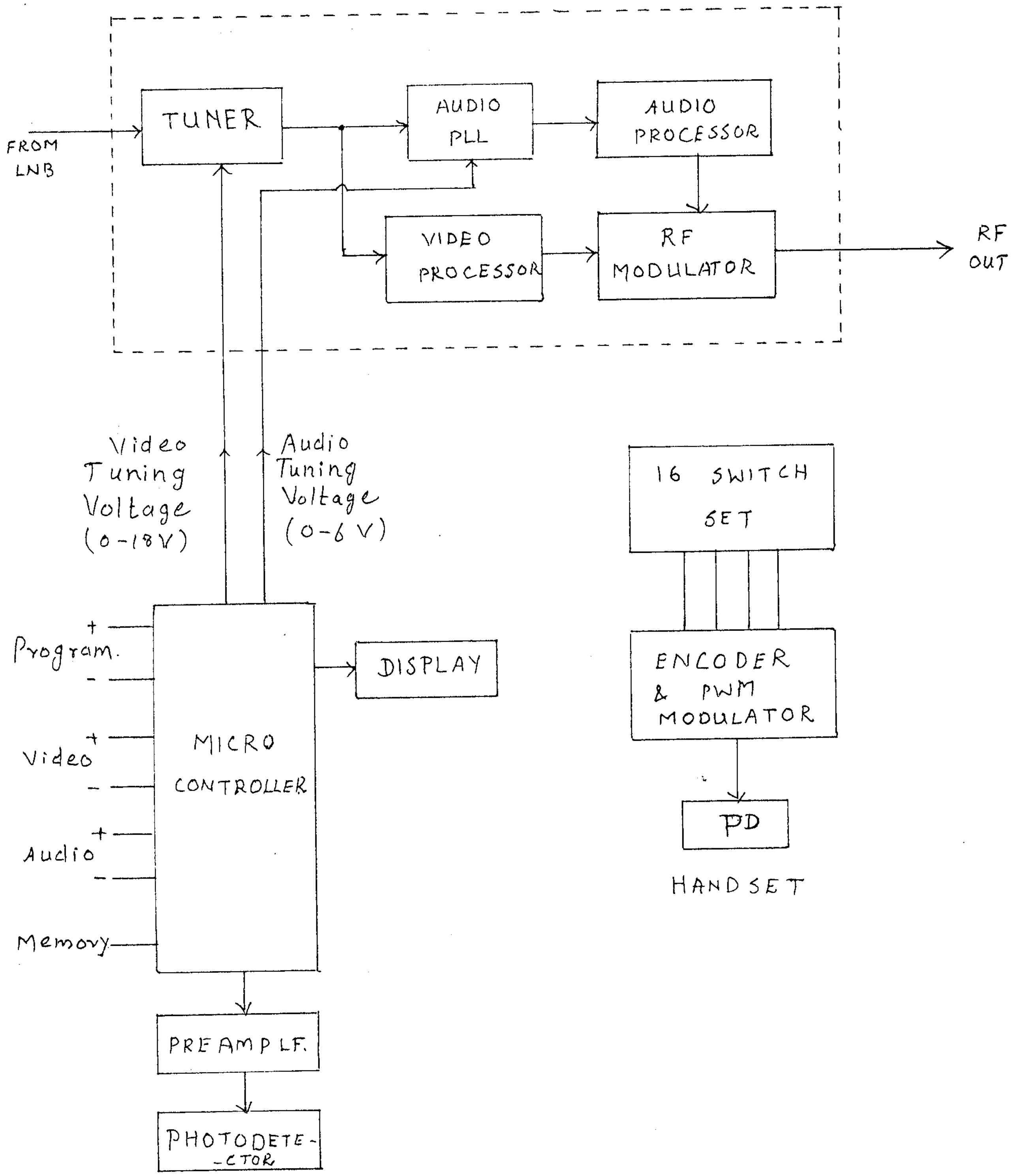
2) Tune the video. Again this can be done either using the handset or through the front panel of the receiver.

3) Tune the audio. The controls for this are provided both in the handset and on the front panel.

4) Memorize these values using the memory button.

5) Similarly, tune for various channels upto a maximum of 16.

With these the works of a user are almost over. Later, all he has to do is select the programme using buttons provided in the handset or by using programme +/programme- buttons in the front panel of the receiver.



TUNER
FROM LNB
AUDIO PLL
AUDIO PROCESSOR
VIDEO PROCESSOR
RF MODULATOR
RF OUT
Video Tuning Voltage (0-18V)
Audio Tuning Voltage (0-6 V)
16 SWITCH SET
ENCODER & PWM MODULATOR
PD
HANDSET
Program
Video
Audio
Memory
MICRO CONTROLLER
DISPLAY
PREAMPLF.
PHOTODETE-CTOR

REMOTE CONTROLLING SECTION

4.1 DESCRIPTION

The objective of the remote section is to control the micro controller (M491). For each channel selected there is a distinct video tuning voltage and audio voltage. To activate a channel infra red rays are used. The switch set in the transistor is arranged in binary code according to the channel number. This is encoded in M70 BLB1 and the corresponding code is generated using pulse width modulation. An LED get this code and transmits in the form of infra red rays.

In the remote receiver section a photo detector detects the infra red rays and converts them to the corresponding code. A preamplifier (UPC 1373) is used before feeding the signal to the micro controller. Two 7 segment displays are used for showing the selected channel number.

4.2 REMOTE HAND SET

The remote hand set has to

(i) output different frequencies for different functions and

(ii) output different sets of pulses for different channels

The handset has an encoder which encodes the keys for different channels in binary form. For example, if the first key is pressed the output of the encoder will be 0000 for the second channel, 0001 and so on.

And these codes are used as pulse width modulating signals to generate pulsed infra red rays.

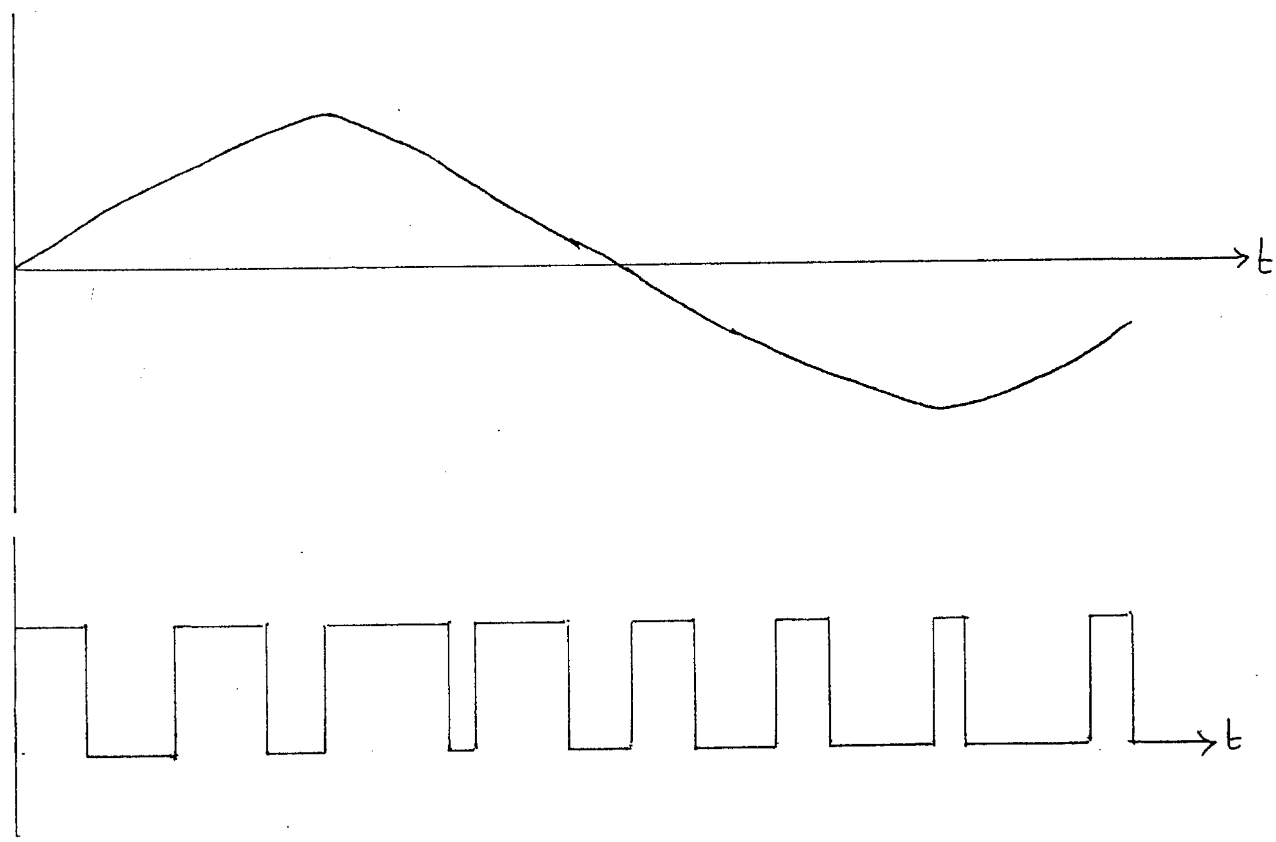
Also, for video+ and video-, separate frequencies have to be transmitted. All these functions are achieved with the help of M70BLBI IC. A photodiode is used to emit infra red rays.

4.2.1 INFRA-RED TRANSMISSION:-

This is achieved with a photo diode. The input to the photo diode is the pulse with modulated (pcom) encoded binary values corresponding to different switches.

Pulse width modulation (PWM)

This is the type of the pulse modulation in which the width of the pulse varies in accordance with the amplitude of the input signal. For example considering a sine wave input, the pwm output will be as follows



Here the input to the pulse width modulator is the binary encoded value of the depressed key. We have totally 16 keys corresponding 16 channels. The encoded output of the 16 channels are as below

Channel No.	Encoded output of M70BLBI
1	0000
2	0001
3	0010
4	0011
5	0100
6	0101
7	0110
8	0111
9	1000
10	1001
11	1010
12	1011
13	1100
14	1101
15	1110
16	1111

Logic O' corresponds to O V and logic 1' corresponds to 5 V. These values are the input values to the pulse width modulator built in the IC (M70BLBI). Hence the output supplied to the photo diode are unique and different.

The photo diode produces infra red emission in accordance with these input voltages. The wavelength of emission is typically around 970 nm.

4.2.2 THE TRANSMITTER

The M70BLBI IC is the heart of the handset. It takes care of both encoding and pulse width modulation. The IC has 20 pins whose descriptions follow:-

pins 1,16,20	: positive supply pins
pin 15,17,18	: Negative supply pins
pin 2,3	: Oscillator pins The crystal connected across these pins determines the transmitted frequency. When crystal is connected, +3V appears on pins 5,6,7,8 of the IC. This positive voltage reaches the input pins 9 to 14 of the IC through keyboard switches.
pin 5	: +3V is supplied from this pin to V-, V+, channel switches 13-16.
pin 6	: Voltage from this pin is given to p+, p- buttons and channel switches 9-12.
pin 7	: Voltage from this pin is given to audio switches (A+/A-) and channel switches 5-8.
pin 8	: Voltage from this pin is given to on/off switch and to the channel switches 1-4.
pin 9	: When on/off, p+, A+, v+ switches are pressed a trigger voltage of 3 V appears on this pin. As a result, a voltage of 5 volts appears on pin 19.

pin 10 : When v-, a-, p- switches are pressed, a trigger voltage of 3 V appears on this pin. As a result 5 volts is output from pin 19.

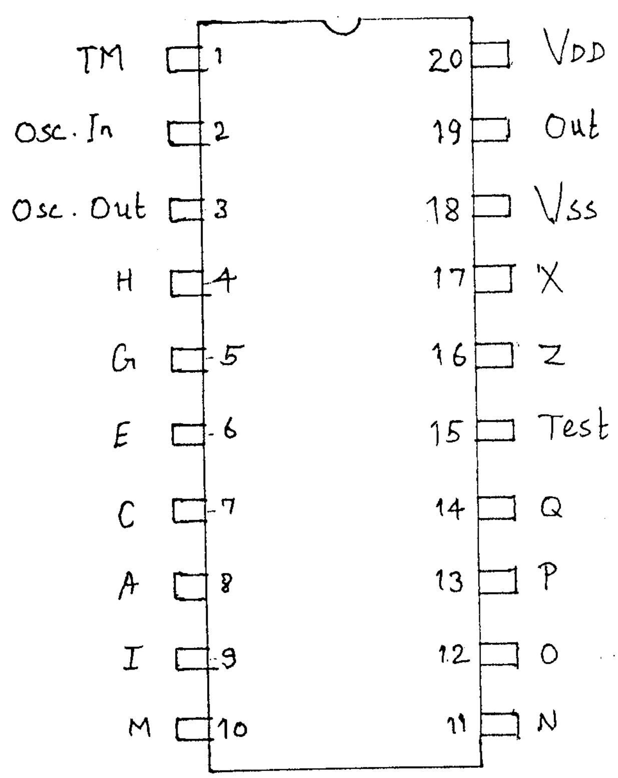
pin 11 : When the channel switches 1,5,9,13 are pressed, a trigger of 3 volt appears on this pin. As a result 5 volt is output from pin 19.

pin 12 : When the channel switches 2,6,10,14 are pressed a trigger of 3 volt appears on this pin. As a result 5 volt is output from pin 19.

pin 13 : When the channel switches 3,7,11,15 are pressed a trigger of 3 volt appears in this pin. As a result 5 volt is output from pin 19.

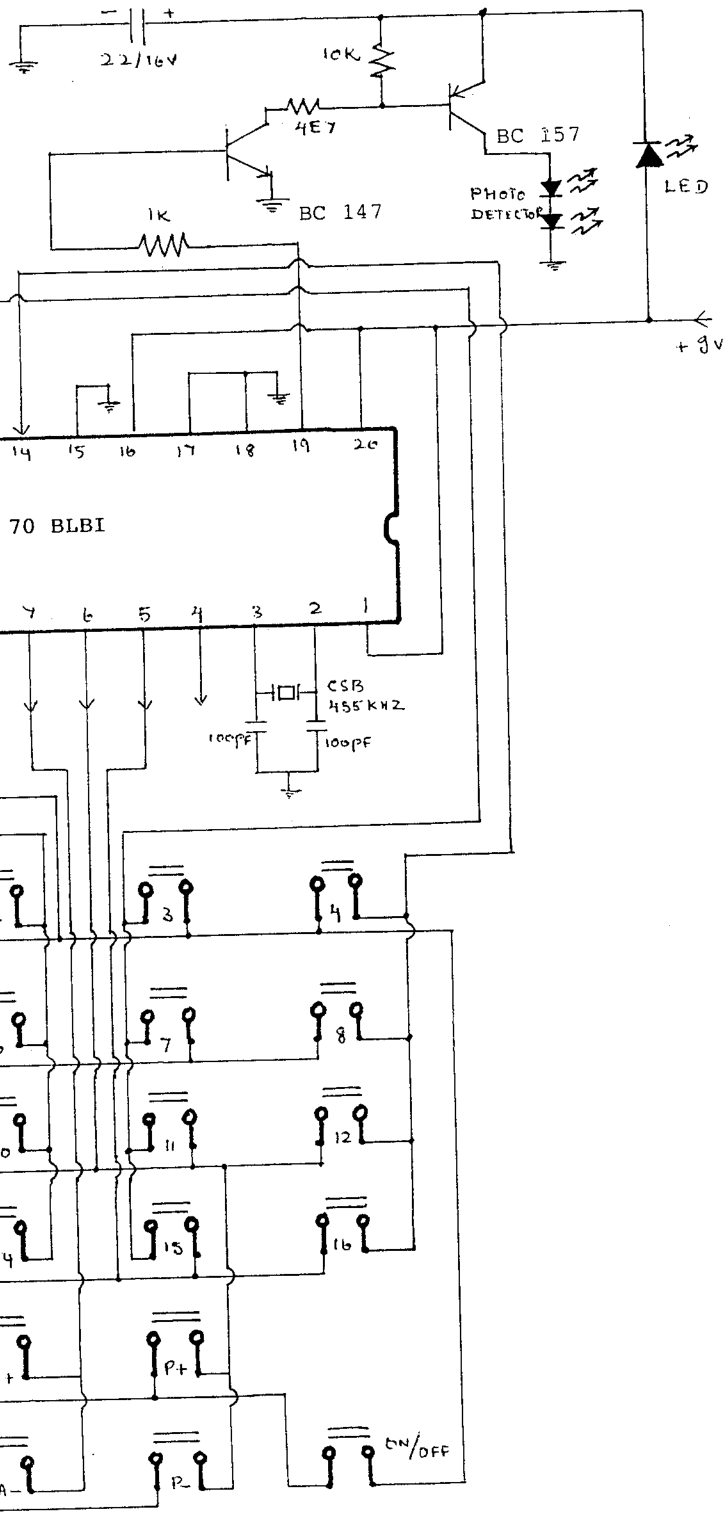
pin 14 : When the channel switches 4,8,12,16 are pressed a trigger of 3 volt appears on this pin. As a result 5 volt is output from pin 19.

PIN CONFIGURATION OF IC M70BLB1



REMOTE CONTROL

TRANSMITTER



From the circuit we find that

(i) the switches 1,2,3,4 are connected to pin 8 of the encoder IC (M70BLBI).

(ii) The switches 5,6,7,8 are connected to pin 7.

(iii) The switches 9,10,11,12 are connected to pin 6.

(iv) The switches 13,14,15,16 are connected to pin 5.

The other ends of the switches

(i) 1,5,7,9 are connected to pin 11.

(ii) 2,6,10,14 are connected to pin 12.

(iii) 3,7,11,15 are connected to pin 13.

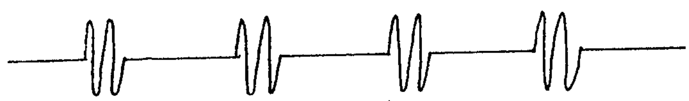
(iv) 4,8,12,16 are connected to pin 14.

Thus, when switch 1 is pressed, pins 8 and 11 are shorted and so on. The various shorts are tabulated as below

Switch depressed	Pins shorted
1	8,11
2	8,12
3	8,13
4	8,14
5	7.11
6	7,12
7	7,13
8	7,14
9	6,11
10	6,12

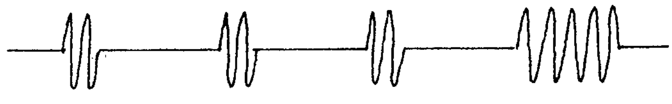
Switch depressed	pins shorted
11	6,13
12	6,14
13	5,11
14	5,12
15	5,13
16	5,14

Consider the case when pins 8 & 11 are shorted. Due to this short, a pulsed IR wave as below is generated.



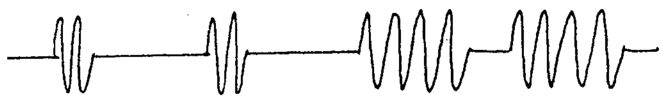
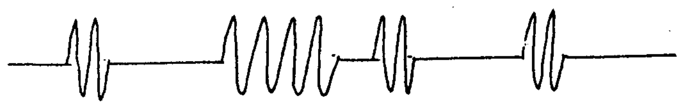
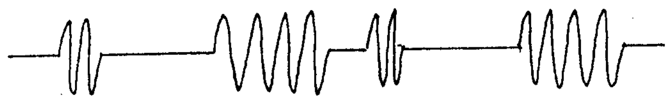
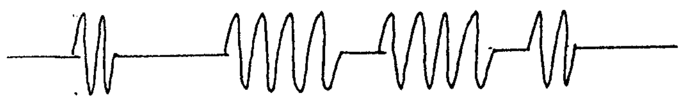
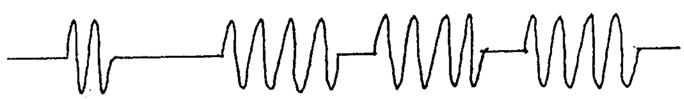
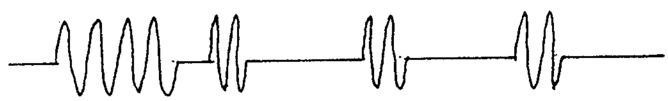
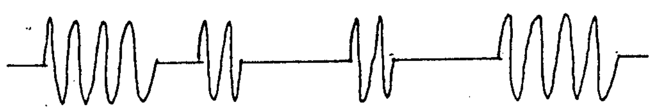
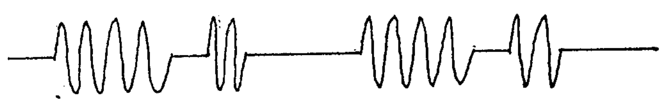
We find that this pulsed IR wave form corresponds to a pulse width modulated code for 0000 which represents channel 1.

Consider the next case when channel switch 2 is depressed. This causes pins 8 & 12 to be shorted. A wave form given below is generated.

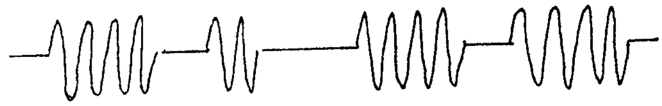


This waveform corresponds to PWM code for 0001.

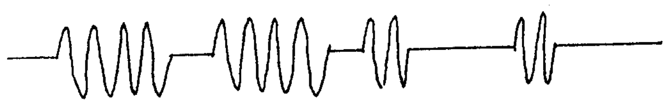
Similarly waveforms are generated which are tabulated as below:-

Key depressed		Waveform
4	0011	
5	0100	
6	0101	
7	0110	
8	0110	
9	1000	
10	1001	
11	1010	

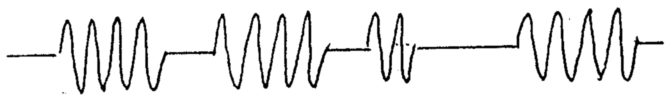
12 1011



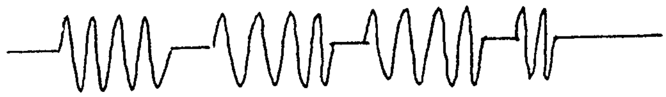
13 1100



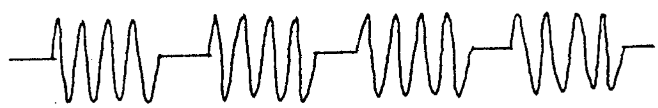
14 1101



15 1110



16 1111



Thus we find that

(i) when pin 8 is involved in the short, it produces to 0 0 IR pulses in the front.

(ii) when pin 7 is involved in the short, it adds 01 to the front.

(iii) when pin 5 is involved, it adds 10 to the front.

(iv) when pin 5 is involved, it adds 11 to the front.

The concatenation to these two pulsed is obtained by connecting switches to pins 11,12,13 or 14.

1. When pin 11 is involved in the short, 00 is added at the last.

2. When pin 12 is involved in the short 01 is added at the last.

3. When pin 13 is involved in the short, 10 is added at the last.

4. When pin 14 is involved in the short, 11 is added at the last.

Thus different waveforms are produced for different channels.

The other functions that are available are:-

(i) video tuning voltage variation: The buttons v+ and v- are used for this purpose.

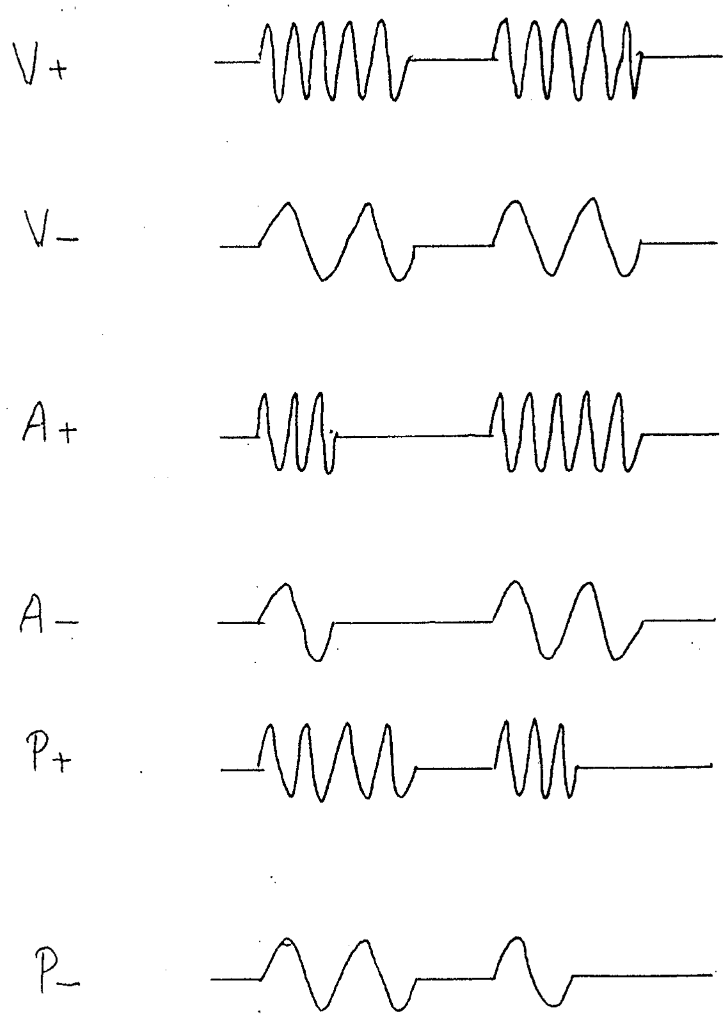
(ii) audio tuning voltage variation: The buttons A+ and A- are used for this purpose.

(iii) programme selection : The button p+ and p- are used for this.

The v+/A+/p+ buttons when depressed transmit a frequency differently, than that when v-/A-/p- buttons are depressed.

Different codes (2 bit) are transmitted for audio control or video control or programme control and thus they are differentiated. The waveforms are show below:

Key depressed   Wave form



The transistor which drives the photo diode has two photo detectors in series connected to the emitter arm. This arrangements serves as a feed back control. The output of the transistor is enhanced when the output of the photo diode is feeble. On the contrary it is reduced when the photo diode output is too strong. Thus the photo detectors ensure constant drive for the photo diode.

4.3 INFRA RED SYNTHESIZER

4.3.1. DETECTOR

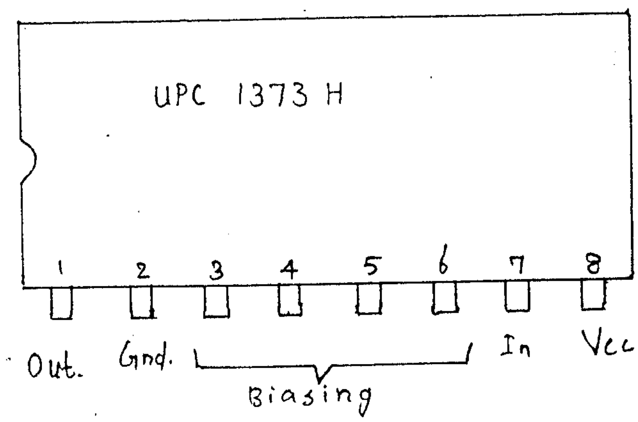
The detector used is a photo detector which produces varying output voltage depending on the intensity of the infrared rays received.

The photo detector is connected to the input pin 7 of the pre amplifier UPC 1373H. The photo diode is biased negatively by a +4V supply to its cathode. This ensures that there is no leakage current in absence of infrared rays. When the intensity of the incoming infrared rays are strong enough to bias the photo detector positively, the photo detector produces a output of around +1V. The capacitor connected across the photo detector reduces ripples in the output which may be caused due to varying strengths of input infrared rays. This variation in intensity of the infrared rays may be attributed to the disturbances along its path.

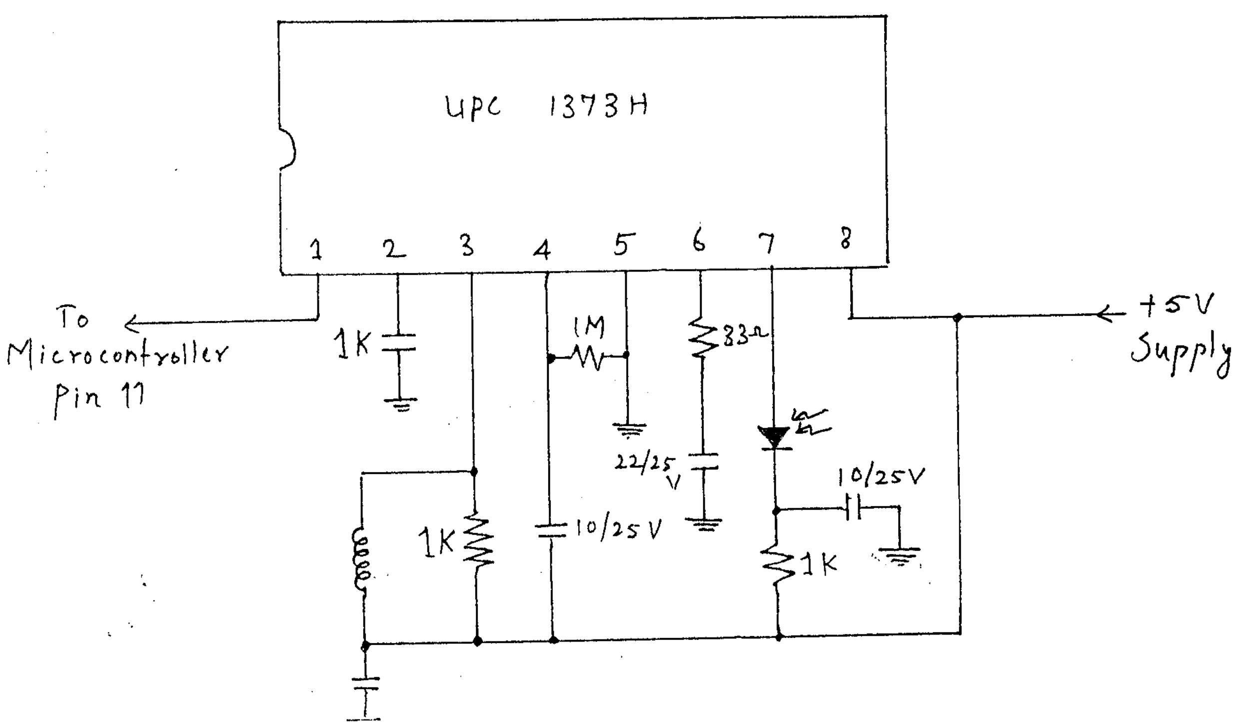
4.3.2 PRE AMPLIFIER

The output of the photo detector is around +1V. This has to be amplified before being fed to the micro controller. The pre amplifier UPC1373H saves this purpose.

The pre-amplifier IC is 8 pin IC and the pin configuration is as follows:-



Both the current and voltage amplification achieved using this pre amplifier. The output voltage of the pre amplifier is about +2V. The circuit configuration is as shown:



4.3.3 MICRO CONTROLLER

In the Remote receiver the pulse width modulated wave is decoded and a particular channel is selected. The video and audio tuning voltages for the desired channel are provided by command SC M491.

M 491 Pin Description:

pin 7,8 : oscillator pin, the value of which is equal to attached crystal in remote oscillator.

pin 18,19,20 : Trigger output 1V.

pin 21 to 24 : Trigger input pin, trigger is given from key board.

pin 4,5 : According to the switch of the key board that is pressed, different voltage are output from those pins.

pin 27 to 36 : negative supply for the display is provided by these pins.

pin 11 : Infrared input pin. In this pin pre amplifier section is connected.

pin 1 : pre amplifier output pin

pin 7 : pre amplifier input pin

pin 18 : voltage of this pin is given to the memory section.

pin 19 : voltage of this pin is given to the audio switches (A-/A+), through panel on off diode IN4148.

pin 20 : output from this pin is connected to audio switches (A-,A+), video switches (v-,v+) and program switches (p-,P+) through diode IN4148.

pin 21 : When A-, and V- are pressed then 1 V is obtained in pin 21 of IC. It is obtained in the form of trigger. When the switches are pressed then output voltage of pins 4 & 5 of the IC are less and the transistor attached to this pins has lower voltage across it.

pin 22 : When the switches of memory, A+, V+ are pressed than trigger voltage is obtained on the pin. When these switches are pressed then output voltage of pin 4 & 5 are more and hence the transistor connected across these pins develop more voltage.

pin 24 : When the program switches are pressed trigger voltage is obtained in this pin. Due to this output voltage of pin 5 changes acccording to the mode and different negative volts are obtained from the pins of the display.

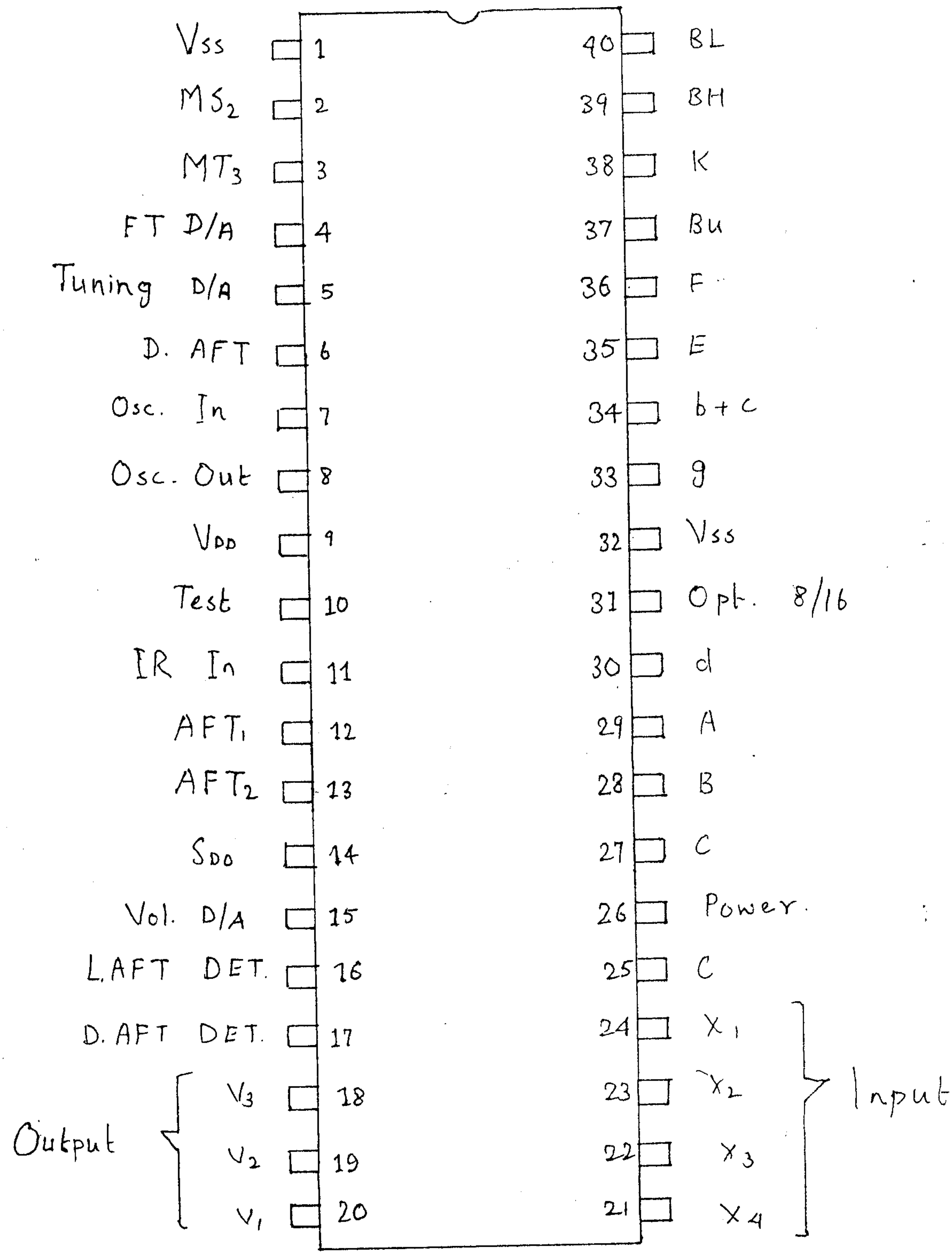
pin 26 : When power switch is pressed then 1 V is output from this pin which is provided to the attached transistor. ;The transistor drives a relay, when the power switch is provided again no voltagae is output from this pin thus tuning of the transistor and the relay.

Description:

The objective of using the command IC is to store the video and audio tuning voltages for each channel. The desired channel is selected by means of p+/p- switches to in the remote handset. The video tuning voltage for clear picture is obtained by v+/v- switches. The micro controller feeds the video tuning voltage to the tuner. Similarly the audio tuning voltage is adjusted through A+/A- switches. This voltage is fed to NE564 (PLL & demodulator IC) by the micro controller. After clear video and audio are accepted the tuning voltages are stored in the memory of the micro controller. This is achieved through the memory button.

The number of the selected channel appears with the help of two 7 segment displays connected to the micro controller. The supply for the display is provided through the diode IN4148. Pins 27 to 36 provide the code necessary for the display.

PIN CONFIGURATION OF IC M491



The Complete Circuit

CONCLUSION

Commercially available satellite Receiver employ manual tuning and are tidious to operate. The objective is to make the satellite receiver user friendly. Our project is aimed at this and we have achieved remote control action.

Much improvement can be made in this regard. They include on screen Display (OSD), Stereophonic audio output, control of the actuator through the satellite receiver, scrambling and descrambling and so on.

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