

DTMF TELEPHONE INSTRUMENT (DESK TYPE 2 WIRE 12 WAY)

1. Brief Introduction

Desk type, 12 way, 2 wire, DTMF Telephone instrument is an electronic extended version of magneto telephone having additional feature of 4 X 3 push button matrix. It can also be used as an intercom between the subscribers. It is selective calling equipment used for operation on overhead, cable, microwave or optic fiber cable.

It is used where the numbers of points to be connected are 4 to 11. It is also used as an intercom wherever 4 to 11 parties are required to be connected for communication. In Railways it is used for point to point communication between station master & cabin ASM of a yard/ Level crossing gate, cabin ASM & Station master/Level crossing gate, Level crossing gate & cabin station master, Level crossing gate & Level crossing gate, cabin ASM & Cabin ASM etc

This handbook contains brief introduction, various parts and their function, installation practices, testing and maintenance of 2 wire 12 way DTMF telephone instrument according to RDSO Specification No. IRS: TC 80 – 2000.

1.1 Advantages over Magneto Telephone

Desk type, 12 way, 2 wire, DTMF Telephone instrument replaces magneto telephones with following advantages:

S. No	Description	DTMF Telephone	Magneto Telephone
1.	Ringling Signal	Standard DTMF tones in VF band.	High voltage, low frequency AC signal
2.	Calling Facility	Each telephone has its own code and can be called selectively from any other telephone	No selective calling facility.
3.	Transmission media	Any media through which signal can transmit such as 2 wire over head line, Underground cable, Optical fiber cable, Microwave channel etc.	2 wire over head line or Underground cable

4.	Selective calling	Any of the 12 telephones connected in parallel can be selectively called.	No selective calling facility.
5.	Distance coverage	Distance having attenuation up to 25 dB.	Lower distance since speech amplifier is not used.
6.	Speech quality	Clear and louder speech since speech amplifier is used.	Low speech since speech amplifier is not used.
7.	Ring & ringing confirmation	Ringling by Piezo buzzer and ring back tone is available as confirmatory signal.	No ring back tone.
8.	Circuitry	Solid state electronic circuits	Electromechanical circuits.
9.	Call indicators	All telephone has audiovisual indications and an LED keeps glowing until handset is lifted.	Only ringing facilities

2. Parts & their Functions

2 wire 12 way DTMF telephone is consisting of the following parts/components.

- a) Body of the telephone
- b) Transmitter and Receiver
- c) Cordage
- d) Push button dial
- e) Visual LED indication
- f) Power ON LED indication
- g) Cradle switch mechanism
- h) Rosette
- i) Piezo electric buzzer
- j) Code/Tone generator
- k) Decoder
- l) Wiring and PCB
- m) Induction coil/Transformer
- n) DC blocking capacitor

2.1 Body of the telephone

The body of the telephone instrument is made of acrylonitrile butadiene styrene (ABS) plastic material. The colour of the ABS material used for making the body of the telephone is light and in no case it is black.

2.2 Transmitter & Receiver

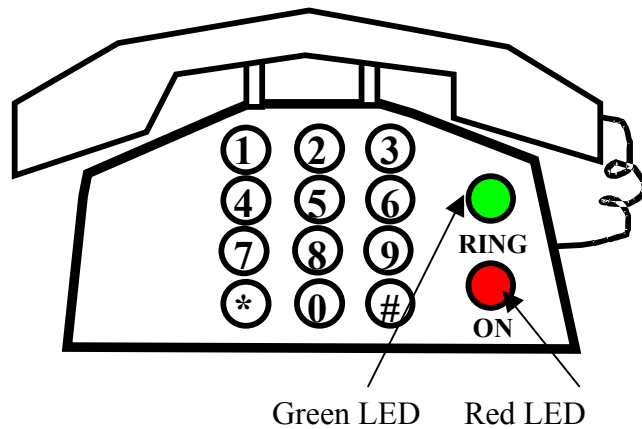
Electro dynamic transducers are used to perform functions of transmitter and receiver. Transmitter converts speech in to electric signal & receiver converts electric signal into audio signal.

2.3 Cordage

For connecting handset with the telephone instrument and telephone instrument with the line.

2.4 Push button dial

Standard push button dial of 4 X 3 matrix with digits from 0 to 9, * (Star), & # (Hash) is provided on the top cover of the body. When the push button is pressed, a standard DTMF code/tone is generated by code/tone generator.



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2.5 Visual LED indication

A green LED for calling attention is provided on the right side of top cover of the body. When the press button is pressed for calling, LED of the called party is glow. 'Ring' is printed below this green LED.

2.6 Power ON LED indication

A red LED for indication of availability of power is provided below the green LED. 'ON' is printed below this red LED. Power ON indication glows all the time as long as battery is connected to the telephone instrument irrespective of whether handset is on hook or off hook.

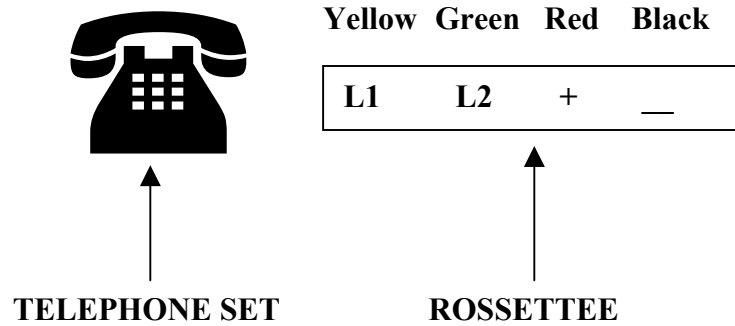
2.7 Cradle switch mechanism

- i) The handset when resting on the cradle of completely assembled telephone shall push the plunger(s) down to the limits of travel.
- ii) The plunger(s) are free and not stick.
- iii) The plunger(s) lifting spring is tensioned to give a positive action.

- iv) Handset of the telephone when ON hook or OFF hook is operates the cradle switch mechanism, which is checked electrically.

2.8 Rosettee

Telephone rosettee is made of ABS. Suitable rubber grommets are provided on the wire entry holes. Four way terminal strip is provided inside the telephone rosettee. All incoming and outgoing wires of terminal strip are terminated on screw terminals. The terminals of 4-way terminal strip inside the rosettee are marked for +ve, -ve, and L1, L2. Connections of telephone instrument strips and telephone cord are showing below.



2.9 Piezo electric buzzer

Electric piezo buzzer operating at suitable voltage generated internally by the circuitry is provided. Buzzer of proper size is firmly fixed in the buzzer housing provided inside the telephone body. Suitable holes or grills are available in the telephone body for audibility of sound from piezo electric buzzer. The volume level is adjustable by strapping, provided on the PCB in three steps (Low, Medium & High).

2.10 Code / Tone Generator

Standard DTMF code/tone generator is provided to produce DTMF tone. By pressing a single button, the code/tone generator produces standard DTMF signals in the matrix form as shown below:

1	2	3	
4	5	6	
7	8	9	Low frequency
*	0	#	
			High frequency

0 (zero) _____ for 10
* (star) _____ for 11
(hash) _____ for general code for master telephone

It is possible to assign any code to a telephone in decimal system using ‘DIP’ switches or by strapping.

2.11 Decoder

Standard DTMF decoder is provided. On receipt of valid code/tone, it decodes and piezo electric buzzer & green LED are activated when the handset of the telephone is ON or OFF cradle.

2.12 Wiring and PCB

The wiring is normally by means of colored PVC insulated multi strand flexible wire of good quality. A single PCB card directly mounted on the base plate of the telephone body is used. Glass epoxy PCB of minimum 1.6mm thickness is used. The PCB is coated with epoxy base anti fungal varnish to provide protection against dust, humidity, fungal infection and mechanical abuses.

All the connections are terminated on the screw type terminals/buck strips mounted on PCB.

2.13 Induction coil/transformer

Cold rolled grain oriented silicon steel or ferrite material is used for core so as to obtain required electrical properties. The complete windings are protected by proper insulation to avoid ingress of moisture.

2.14 DC blocking capacitor

1.5 to 2.2 micro farad capacitor of operating voltage 400 volt minimum is provided for blocking DC voltage on line. Capacitor is made of metallised polyester.

2.15 Electrical Circuit

Electrical circuit of the instrument is such as segregate the ringing and speech circuit. It is provided with good matching between line and instrument with minimum side tone.

3. Working

The system is works on voice communication and signalling on two wire omnibus circuit tapped at different places for point to point & multi point communication.

As a system, the telephone is used in master & slave configuration. There are 1 master and 10 slave telephones. Any subscriber can be designated as master and others as slaves.

A general call button, which is the 12th button, is provided in the master telephone to call all slave points at a time. On pressing this button, a general ring will go to the all slave points simultaneously.

General ring can be used by the master for imparting certain important instructions simultaneously or for conference purposes with all parties.

Digit 1 of the matrix is normally used as calling code for the master telephone and remaining telephones are assigned other distinct calling digits.

Setting of ringing codes for individual subscriber can be done by setting the strips or Dip switches.

The telephone is protected from surge voltages by MOVR based surge protection system.

The receiver of the telephone instrument is protected from acoustic shocks by providing two rectifiers in

parallel and with opposite polarity across the receiver.

The current consumption at 12 volt DC is not more than:

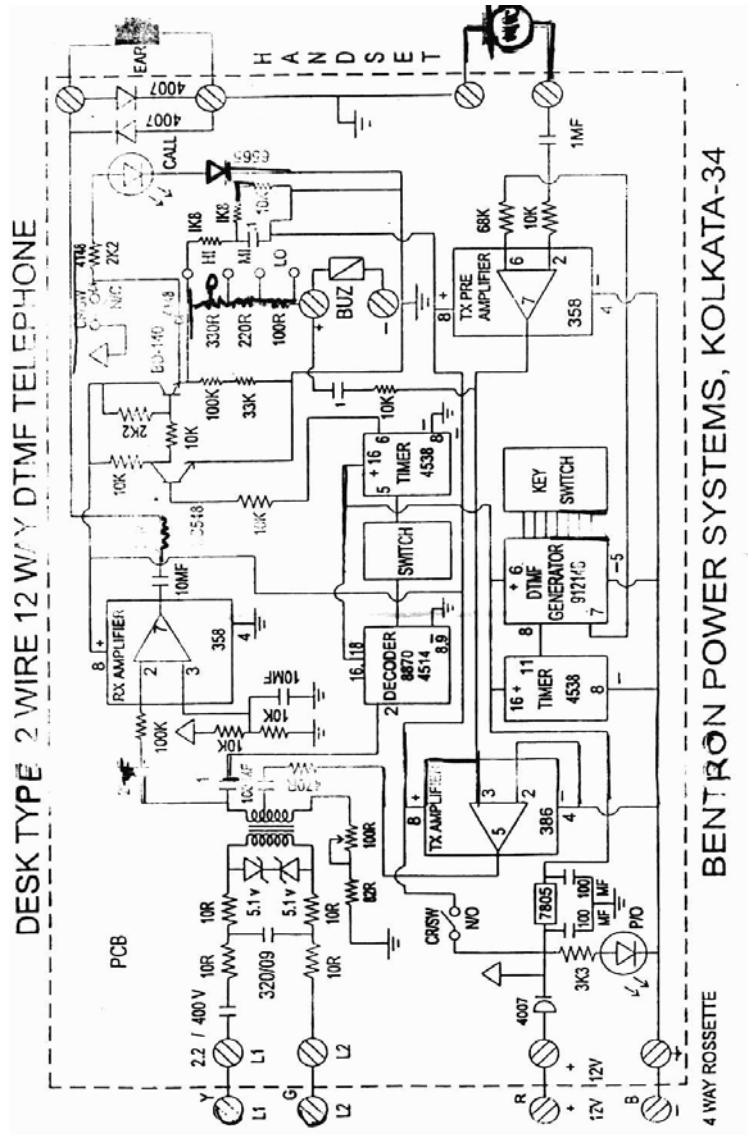
- 20 mA in idle condition.
- 100 mA during ringing period
- 50 mA during conversation

3.1 Operation

- The calling subscriber will lift the handset and press the code of required subscriber.
- DTMF signal will generate from the instrument of calling subscriber according to code of called subscriber.
- On receipt of valid code/tone, decoder of called subscriber decodes and piezo electric buzzer & green LED are activated. Function of decoder, buzzer & LED are not depending up on the position of handset of the telephone.

- Ring back tone will feed to the caller, indicating that called telephone has been rung.
- The duration of the ringing to call telephone is normally be 4 to 5 seconds. It is possible to send the signalling code even when two or more parties are in conversation. The signalling code is transmitted within 500 mili second. Even when the button is kept pressed for more than this duration.
- LED of called subscriber's telephone will glow alongwith the ringing of the buzzer.
- When called subscriber lift handset of the telephone, LED will lit OFF.
- Now conversation will start.
- If third party is required to be brought into conversation, press the code of that subscriber.
- Now the third subscriber will get ring and can join the conversation by lifting the handset.

A typical diagram of Bentron make 2wire, 12 way, DTMF telephone instrument is given on page no. 14 for reference.



4. Inspection & Testing

4.1 Visual Inspection

The instrument is visually inspected to ensure that the moulding is free from cracks & other imperfections and that all the components are fitted properly.

4.2 Marking

Complete circuit diagram showing the electrical connection of the instrument is fixed or printed in the base of the instrument. The colour code of the wires, value of components and connection to various terminals are clear indicated.

The following informations are clearly embossed/engraved/screen printed at conspicuous places:

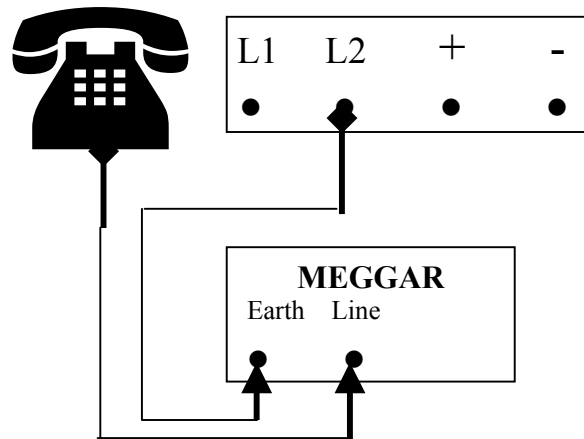
- Name and/or Monogram of manufacturer
- Year of manufacture
- Serial number
- Batch number
- Specification number

4.3 Packing

The instrument is suitably packed so as to avoid any damage or loss during storage and transport.

4.4 Insulation Resistance test

The insulation resistance between the body and all terminals of rosettee connected together shall not less than 50 mega ohm when tested with 500 V DC meggar at ambient temperature.

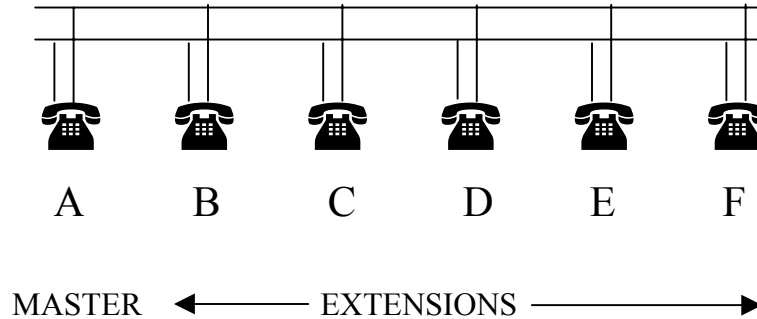


4.5 Insertion Loss

Insertion loss shall not be more than 0.5 dB when handset of the telephone instrument is on hook position and shall not be more than 0.8 dB when handset of the telephone instrument is in lifted position.

5. Installation Practices

12 way, 2 wire DTMF instruments are connected on omnibus circuit tapped at different places for point to point and multi point communication. All extensions are provided in master slave configuration as shown below.



- The instrument shall be provided nearer or in front of the subscriber for easy communication.
- Connect power supply unit to 230 V AC, RED LED will glow which indicate the presence of power supply.
- Check whether DC output is available at the out put terminal. It should 12 volt DC $\{\pm 20\%\}$.

- Connect telephone to power supply unit with proper polarity. Polarity marking is given in telephone rosette box. If AC power is not available, connect any DC source of 12 volt. Power ON LED will glow.
- Connect line L1 & L2 to the respective terminals as marked in rosette box.
- Set the assigned code by a DIP switch inside the telephone.
- Be sure that only one DIP code switch is made ON and all other switches are kept OFF.
- The volume level is also adjustable which can be set by strapping provided on the printed circuit board in three steps i.e. low medium and high.
- Test the self-blow of the telephone instrument.
- Now the telephone is ready for use.

6. Maintenance

Due to having non-moving parts it does not require more maintenance. However, following maintenance work may be carried out during routine visit.

- Each digit of the dialing pad is to be tested to ensure their proper function.
- Cleaning of each digit of dialing pad and terminals of rosettee.
- Cleaning of contact of cradle switch and replacement of faulty cord.
- Cleaning of dust from microphone and receiver.
- Checking of the receive level and set accordingly.
- Checking of buzzer and setting for proper functioning.
- Cleaning of sulphation cobwebs and dust.
- Checking of proper DC supply.
- Checking the noise on line.

7. Do's and Don'ts

Do's

- Use soft brush for cleaning the digits of dialing pad.
- For best result install the unit in a dust free environment.
- Always terminate battery terminals in proper polarity.

Don'ts

- Do not expose the instrument to direct sunlight.
- Do not expose the instrument to extremely humid condition.
- Do not terminate battery supply in opposite polarity.
- Do not drop the unit on the hard surface.
- Do not use any chemical or detergent for clean the instrument.
- Avoid rough handling/treatment.

