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Name	: _____	
अनुक्रमांक		प्राप्त अंक
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पाठ्यक्रम		
Course	: _____	
दिनांक		अनुदेशक का आधाक्षर
Date	: _____	Instructor Initial:

EXPERIMENT No. CT -1

Study of DTMF Headquarter (Controller)'s Equipment

Objective: To study the features and working of the Head quarters equipment used in railway control communication.

Function: The function of this equipment is to provide

- Control telephone facility to the Section Controllers and
- A means for selective calling of any way station along the track

Description: This equipment consists of two parts to meet the above two requirements

- Speech part and
- Signaling part

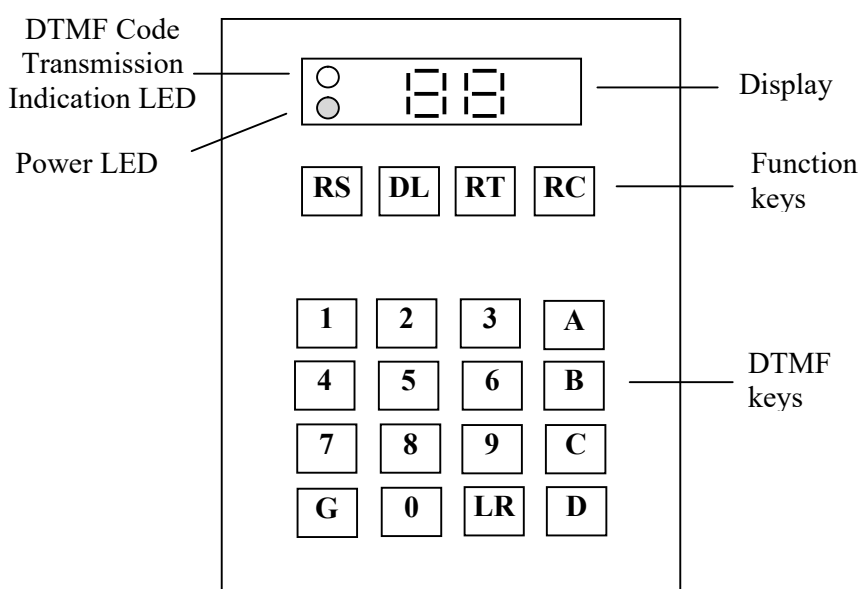
The **speech part** of the equipment consists of two **op-amps** used for trans and receive speech amplification.

The **signaling part** of this equipment is a solid-state digital circuitry using the microcontroller 8749 as CPU. It employs DTMF signaling, for calling way stations. DTMF signaling, in compliance with the ITU-T (previously CCITT) recommendations, uses 8 different tones (or frequencies) which are within the VF range and also harmonically unrelated.

The Technical Features of the Equipment:

- 1) Uses 8749 Microcontroller
- 2) It employs a 4x4 matrix DTMF key board

- 3) There are total 8 tone frequencies
 - (a) 4 row frequencies - **697, 770, 852, 941 Hz** and
 - (b) 4 column frequencies - **1209, 1336, 1477, 1633 Hz**
- 4) Each key or digit on DTMF key board is represented by two tones ie., **one row frequency** and **one column frequency**.
- 5) A 2-digit code is used for each way station. This gives a total of **99** way station codes.
- 6) The transmission duration for each digit-tones is for 200ms and the pause duration between the two digits is 100ms



Front Panel of DTMF Head quarter's Equipment

Key	Function	Description
RS	Reset	System is reset
DL	Delete	Deletes the previous key board entry
RT	Repeat	Retransmits the last entered 2- digit station code
RC	Row / column tones	Row & column tone frequencies are sent to Tx lines for measurement purpose for maintenance
0 to 9	Numeric Keys	Station code Transmission
A,B,C & D	Group code keys	Group code Transmission
G	General call	General call transmission to all stations at time
LR	Long Ring	When kept pressed sends the last called station code repeatedly for every 4. 5 seconds

Table showing the function of keys

Working Features:

- 1) It is designed to assign *two-digit* codes for way stations
- 2) The dual tone transmission for the code digits starts only after pressing the second digit of the way station code
- 3) The second digit of the code should be pressed within 4 sec after pressing the first digit. Otherwise the first digit becomes invalid and goes off the display.
- 4) Code transmission is completed in 500ms
- 5) Entered two- digit code is shown on the 7-segment LED display.
- 6) During code digit transmission an LED on the extreme left of the display flickers indicating code transmission.

Special Features:

- 1) It is a most versatile system suitable for both RE and Non-RE sections
- 2) The controller's equipment as it is designed for 4 wire working. For 2 wire working in non-RE just one 4-wire to 2-wire conversion unit is required additionally
- 3) Calling of way stations is possible in case poor line condition ie., noisy and distorted condition.
- 4) At -25dB of DTMF signal level also the calling of way stations is possible. This is the minimum level for the signal.

Specifications: (of M/s Tummala make Equipment)

1) DTMF Signaling :

Frequency stability	: $\pm 1\%$
Output Level	: 0dB to -7dB

2) Speech :

Trans:

Nominal output level	: 0dB
Level adjustment	: 15dB from max. Level)

Receive:

Input Signal	: Min. -20dB & Max. +12dB
Level adjustment	: 15dB from max. level
AGC range	: -15dB to +10dB

3) Power Supply : 12V DC $\pm 10\%$ @ Current 400mA (max)

NOTE: A 12 V dc power supply unit with charger and a built -in 12V maintenance-free battery is provided with system.

Review Questions

- 1) Mention two main advantages of DTMF signaling.
- 2) What does controller need to dial if he wants to call the **Group- B** stations?
- 3) Is it possible to ring a way station if 00 is allotted as its station code?
- 4) Mention the dual tones assigned to LR key and are the same tones transmitted on the line when LR is pressed?
- 5) Do you think that ringing of the way stations can be possible if an Auto-telephone is used in place of the controller's equipment?