इ रि से ट
विद्युत सिगनल प्रयोगशाला
प्रयोग नं: ई एस एल - 43

IRISET
ELECTRICAL SIGNALLING LABORATORY
EXPERIMENT NO. : ESL - 43

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

अनुदेशक का अधाक्षर
Instructor Initial :

AUXILIARY WARNING SYSTEM

BRIEFING :

The auxiliary warning system (as per IRS: S-38-70) provides protection against the human error/lapses from the trains driving staff and gives a continuous monitoring of the train during its travel as well
As in its halts conditions. The system can be called as an aid to the drivers.

It is microprocessor based system, transmits track side data to the cab equipment decode them and implement the functions. The Siemens ZUB 100 AWS can handle a maximum of 21 coded informations. It impulses a spread restriction of 15KMPH for signal at Red, 38KMPH for Yellow and 70KMPH for Green and Double Yellow.

AWS basically consists of :

a) Cab equipment (On board)
b) Track side equipment.

The block diagram is placed at end.

1. CAB EQUIPMENT (On board)

It consists of the following units :-

a) Central processing unit. (8085 µp)
b) Brake actuating unit
c) Isolation unit.
d) Indication panel.
e) Target, Nominal and Actual speed indications on driver's indication panel.
f) Engine magnet.
g) Tacho generator. (Speed Sensors)
h) Power supply
i) Frequency generator.
j) Distance evaluation.

k) Switching card, Vigilance card, Brake card, Receiver & Amplifier impulse card etc.

2. TRACKSIDE EQUIPMENT

a) Track magnet 'A' type and 'B' type
b) Opto couplers.

The working of AWS depends upon inductive coupling between track side equipment and cab equipment. The cab, equipment generates 2 frequencies 50 KHz and 100 KHz. The 50 KHz (Supervisory Channel) power the track magnet Oscillators. While 100 KHz acts as data channel which carries the data from track side to CPU. (Central Processing Unit).

The track magnet consists of coils tuned to 50 KHz, 100KHZs, and 7 Oscillators, Inductive coupled Power supply unit Modulator card. The two audio frequencies out of 7 frequencies are switched 'ON' by relevant oscillators when engine magnet passes over it. The active 50KHz frequency detects the presence of track magnet by inductive coupled track magnet coil, power the passive oscillators of track magnet and 100 KHz signal act as carrier frequency to carry the two modulated audio frequencies to the central equipment for further processing. **No power supply is needed for the track magnet.** The central equipment on receiving the track data, demodulate the two audio frequencies which is decoded and implemented. By switching 2 of 7 frequencies 21 unique coded information can be transmitted.

The frequencies transmitted by the oscillators of the track magnets are as follows :-

F1 - 2800 Hz
F2 - 3600 Hz each frequencies are set apart by
F3 - 4400 Hz difference of 800 Hz.
F4 - 5200 Hz
F5 - 6000 Hz field tolerance + 60 Hz to
F6 - 6800 Hz - 55 Hz
F7 - 7600 Hz

UTILISATION 21 CODED INFORMATION :

Sl. No.	Design	Frequency	Utilisation
1.	A1	F3/F4	Signal Off (Green)
2.	A4	F1/F4	Signal Caution (Yellow)
3.	B1	F1/F5	Red permissive (R with A or C or SH)
4.	A5	F1/F2	Red stop absolute (Red)
5.	D2	F2/F6	No change in earlier information
6.	A2	F1/F3	Signal attention (Double yellow)
7.	A3	F4/F5	Signal attention (Double Yellow)
8.	D5	F4/F6	Reduced breaking distance after next signal
9.	D6	F5/F6	Reduced breaking distance after second next Signal

10.	D3	F1/F6	Release of breaking curve
11.	D4	F3/F5	End of AWS Section
12.	B2	F2/F5	L.C gate out of order
13.	B3	F2/F4	Off aspect yellow greater than 400 Mts.
14.	B4	F2/F3	Signal Yellow with route indicator (turn out ahead) - 30 KMPH
15.	D1	F3/F6	Location of goods sighting board or approach of a gate
16.	C1	F1/F7	Restricted speed section 65 KMPH
17.	C2	F2/F7	Restricted speed section 50 KMPH
18.	C3	F3/F7	Restricted speed section 30 KMPH
19.	C4	F4/F7	Restricted Speed section 15 KMPH
20.	C5	F5/F7	Restricted speed section 08 KMPH
21.	C6	F6/F7	End of restricted speed section.

The AWS provides the following features:

1. It gives optical and acoustical warnings to the driver while passing a signal and the driver need to acknowledge while passing a yellow signal within 4 Seconds. When fails to acknowledge, AWS applies emergency brakes and bring the train to dead stop.

2. Whenever over speeding, it applies service/ emergency brakes to control the speed to pre-determined value and brakes are automatically released as and when the speed is controlled to the pre-determined level.

3. If the driver disregard a stop signal, system applies emergency brakes and brings the train to a dead stop; if authorised to pass the system does not allow to exceed a speed of 15 KMPH up to the next stop signal.

4. It does not allow the train to roll back.

5. Temporary/permanent speed restrictions can be easily ensured (provided all trains are equipped with AWS).

6. It can be also used for giving an advance approach warning. In case a Track Magnet is placed at 400m in the rear of distant signal. The train while passing the Track Magnet, the driver gets audible and visual indicator on the drivers panel. Speed indicator displays sectional speed (100 KMPH), the driver should reduce the speed to 100 KMPH, failing which AWS bring the speed to this level. This arrangement is provided in the Shatabdhi Express route between Delhi and Gwalior where the train speed is now 140 KMPH.

TRACK MAGNET TESTING AND INSTALLATIONS

1. Track magnet is installed on right hand side of traffic direction at 231mm. Check that there are no physical damages to the TM before taken to the field for installation.

2. Care should be taken to see the surface edge to the TM is parallel to the rail side and surface is parallel to the rail too.

3. Apply graphite grease on the threaded portions of the clamp to avoid rusting.

4. See that covers and screws are not loose and sealing compounds on screw head/grooves is intact.

5. See that the TM clamp area is free from ballast, metal parts etc and care should be taken to clear the ballast under the clamp of TM so that during train run the same will not touch the ballast.

6. The installation of track magnet shall be done as per the drawing. Ensure various gaps and levels are available.

7. The testing of the track magnet should be done with the track magnet test jig S25432, before track magnet is taken to the site.

TESTING THE HEALTHINESS OF TEST JIG. :

Press test Jig push button and observe the following.

a) The battery indicator needle in the green region.

b) The meters reading 50 KHz and 100 KHz should give a full deflection and shall read 40 divisions.

c) The oscillator level meter should read.

d)

LED FU	Green lit	dip indicator
LED IV	Red off	over current protection
LED EF	Yellow lit	receiver frequency
LED FI-F	Red off	
LED FI-F7	Red off	
LED F-Hz	000 Hz	last 3 digits ON

HOW TO TEST A TRACK MAGNET :

Place the test jig over the track magnet. Set the conditions for green aspect of a signal (f 3 – f 4).

1. **Turn the frequency switch** of **f 3** . **Press the push button** and observe the following :

a) Battery indicator deflects to green region.

b) 50 KHz. Meter deflects 6 to 12 divisions.

c) 100 KHz Meter deflects 20 to 25 divisions.

d) The oscillator Level meter should read above 40 divisions.

e) LED FU Green OFF (Dig indicator)
IH Red LIT (Over Current protection)
EF Yellow LIT (Receiver frequency)
F3 LIT
F4 LIT

Read the frequency in Hertz F3 4400 Hz

Read the frequency in Hertz F4 5200 Hz

KEEP THE TEST JIG OVER THE TM:

Remove the coupler from the TM. Loop the following pins in the coupler sockets and read the frequencies:

Coupler Pins	Frequency in Hz	Nominal frequency in Hz	Variations (in %)
6 - 1	2804	2800	4
6 - 2	5594	3600	6
6 – 3	4391	4400	9
6 – 4	5189	5200	11
6 - 5	5980	6000	20

Place the test jig over B type TM and press the push button. Read the frequencies:-

Type of Frequency	Actual frequency Hz	Normal frequency Hz	Variations in %
F5	5992	6000	0.00071 (8)
F6	6780	6800	0.0031 (20)

Note : The TM (B- type) does not require the OPTO coupler for switching the relevant frequencies, as it gives the fixed frequencies.

Opto coupler card :

This unit act as an inter face between signal and A type track magnet. Depending upon aspect lit, it switches on relevant oscillators in the track magnet. There are 10 types of opto coupler cards are on use depending upon type of signals.

The operating voltages of opto couplers:

1. Main Signals = 12 V AC (8.5 to 20V AC)

2. Auxiliary signals = 110 V AC (85 to 130 AC)

3. The operating current = 20 mA. (Approximately)
   (2ma burden on the primary side of the signal transformer)

Draw the sketch of opto coupler card termination details for **RS SK / AWS / 006 :**

From the wall charts available in the laboratory prepare a detailed drawing for installing opto-coupler and track magnet.

Date: Signature of the Trainee