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अनुदेशक के आद्यक्षर
Instructor Initial :

Single Section Digital Axle Counters - CEL-710P

(RDSO / SPN / 177 / 2012 – Ver. 3)

INTRODUCTION:

CEL-710P phase reversal type Digital axle counter field unit / counting device is the track side electronic assembly that energize the axle detectors for 'Detecting the Passing of Wheels', 'Determining the Direction of Movement' and 'Keeping the Counting of Wheels'. It transmits the 'count' and 'health' information to the other end unit at regular intervals. Based on the information detected, track side unit determines 'status' of track section at each end of axle counter section (Entry End & Exit End) whether 'clear' or 'occupied'

EQUIPMENTS:

Indoor Equipments:

1. Reset Box
2. VPR, PPR relays
3. Power supply

Outdoor Equipments:

1. Trackside Evaluator
2. Web mounted axle detectors. (TX/RX coils)
3. VR, PR relays
4. Surge Voltage Protection Device (SVPD)
5. Line Verification Box (LV) - for station track sections only

WORKING PRINCIPLE

a) This system consists of a '**ENTRY END UNIT'**, '**EXIT END UNIT'** housed in location boxes adjacent to the track with associated web mounted axle detectors (TX/RX coils)

b) The axle detectors TX1 coil & TX2 coil are fed with a frequency of 21 KHz & 23 KHz respectively at ENTRY end. Then at EXIT end, TX3 coil & TX4 coil are also fed with 21 KHz & 23 KHz frequencies respectively.

c) TX coils are fixed on the outer side of the rail and RX coils are fixed on the inner side of the rail.

d) The system is based on phase reversal technology, wherein the TX & RX signals will be 'OUT OF PHASE' under 'No wheel' condition & will be 'IN PHASE' during 'Presence of a Wheel'.

e) The system senses wheels above 400 mm dia, by which only train wheels are detected & trolley wheels are ignored. Motor trolley wheels are aslo not counted & will not lead to error condition.

f) **'ENTRY END UNIT'** and '**EXIT END UNIT'** will communicate and exchange information on the health statues and wheel counts through FSK Modem over ½ quad cable at regular intervells. Based on the information detected, track side unit determines 'status' of track section at each end of axle counter unit (entry end & exit end) whether 'clear' or 'occupied'.

g) VR & PR relays are provided in the relay box along with the unit in the location box at each end. VR relay status (pick up - section clear /drop-section occupied) is available at 'both ends' of the system.

h) When VR is in energized condition system will give 'CLEAR' indication and when VR is in de-energized condition system will give 'OCCUPIED' indication

i) Each unit is connected to the station-reset box with ½ quad cable for providing the information(system status) on the reset box through FSK mode communication. Another signal cable is run between the system & relay Room / reset box for transmitting reset supply voltage and for picking up of repeater relays VPR, PPR.

SYSTEM DESCRIPTION:

- With the help of this axle counter make we can monitor track section max up to 20 km
- The block section, track sections in station can be monitored by this system.
- The system is designed to work with different rail profiles (90 pound, 52 Kg, 60 Kg rails) & is suitable for axle detection for train speed from 0 to 250 Km/h.
- The system can work in RE/Non RE areas satisfactorily.
- The system can work between -10°C to +70°C.
- 24 VDC supply from battery charger suitable for 'Digital Axle Counter' which is backed up by 80 AH / 120 AH capacity batteries is fed to the system through 2-core, 25 Sq mm. aluminum cable.

EQUIPMENT DESCRIPTION

- Equipment consists of evaluator unit (SSDAC) at each end. 'Entry end' and 'Exit end'.
- One relay box (VR, PR) is also provided with these units at each end.
- Evaluator unit at each end consists of 8 cards as shown below

Card No	SSDAC (DACF 710P) 'ENTRY END' CARD NAMES
Card 1:	Signal Conditioning Card – 1
Card 2:	Signal Conditioning Card - 2
Card 3:	Micro Controller Logic Board – 1
Card 4:	Micro Controller Logic Board – 2
Card 5:	Event Logger Card.
Card 6:	Modem Card.
Card 7:	Relay Driver Card.
Card 8:	DC-DC Converter Card.

Card No	SSDAC (DACF 710P) 'EXIT END' CARD NAMES
Card 1:	Signal Conditioning Card – 1
Card 2:	Signal Conditioning Card - 2
Card 3:	Micro Controller Logic Board – 1
Card 4:	Micro Controller Logic Board – 2
Card 5:	Event Logger Card.
Card 6:	Modem Card.
Card 7:	Relay Driver Card.
Card 8:	DC-DC Converter Card.

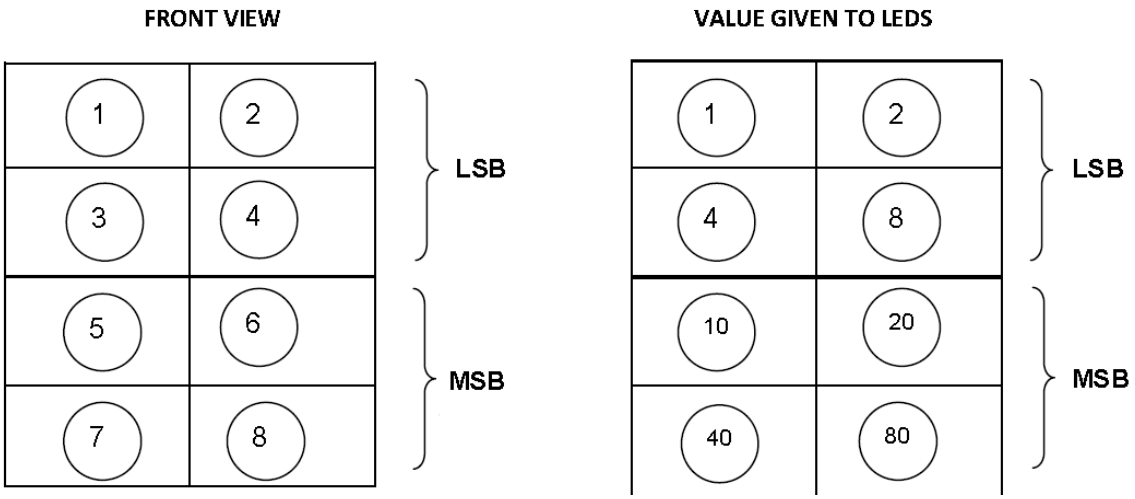
Signal Conditioning Card (Card 1 & 2):

The Signal Conditioning Card-1 (SCC-1) generates 21 KHz carrier signals, which is transmitted to TX1 coil. The Signal Conditioning Card-2 (SCC-2) generates 23 KHz carrier signals, which is transmitted to TX2 coil. The respective Rx coils receive these signals. When the train wheel passes over the axle detectors, the Rx signal undergoes phase modulation. The SCC cards receives the modulated signal and demodulates it, after demodulation they will generate valid wheel pulse, this valid pulse is transmitted to both Micro-controller Logic Boards.

Micro-controller Logic Board/ Card (Card 3 & 4):

The Micro-controller Logic Board (MLB) is the heart of the system. These cards implement the wheel detection, train direction checking and wheel counting functions. In addition it receives the remote wheel count and computes the status of the section whether clear or occupied. It also checks various supervisory signal levels like supervision of Tx/Rx coils, presence of various cards, communication link failure etc. These cards communicate and cross check with each other during wheel count.

Each card is having a block of 8 LED indications for reading the error display. These 2 set of independent LED indicators views the system status. The errors occurring in the system during the operation of the SSDAC are encoded through LED indications present on the front panel of the MLB cards by giving specific value to each LED.



The example for reading an error from the above LED's is as follows: -

LED's 1 & 3 of LSB glow and LED's 5 & 6 of MSB glow and other LED's entire are OFF. By adding LSB + MSB LED's values, (1+4) + (10+20) = 35. The error no. is 35 i.e. Negative Count Errors. (Take the help of error list). Ref for this calculation: - (OEM manual)

Modem Card (Card 6):

The Salient features of the card include: -

a) Multiplexes the two serial ports coming from MLB1 & MLB2.

b) AMD7911 FSK modem chip

c) V.21 mode of operation with ½ quard

d) 300 bit rate of transmission

e) Originator (Entry unit) and Answerer (Exit unit) for V21 selected.

f) AGC - Auto Gain Setting

The modem card transmits and receives the digital packet information form one counting unit to the other.

Relay Driver Card (Card 7):

The Relay Driver card (RD) provides the 24 VDC output required for driving Vital Relay.

The RD card receives the command of clear and clock signals from MLB1 & MLB2 cards and drives the vital relay when section is NOT OCCUPIED. If a train occupies the section, the vital relay is dropped. The vital relay status is read back by the system as per the driving output.

DC-DC Converter (Card 8):

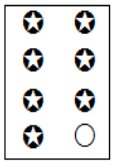
The DC-DC converter card input and outputs are protected for short circuit and input reverse polarity. LED indications and Monitoring sockets are provided for all output voltages.

Module	Item	Nominal Voltage	Required voltage
DC-DC Converter	Input voltage	24 V DC Maximum current drain = 1.2 A	19.2 V to 28.8 V DC.
	Output voltage	+5 V DC @ 2 A	4.75 to 5.25 V DC
		+12 V DC @ 200 mA	11.5 to 12.5 V DC
		+24 V DC @ 300 mA with common ground	23.5 to 24.5 V DC
		+15 V DC @ 100 mA with isolated ground	14.5 to 15.5 V DC

- Foolproof working is ensured in hardware with polarization for avoiding mix up of positioning of boards.
- LED's are provided on individual boards for indication of different stages of the working of the system. 8 LED indicators for count progress / error display are provided on MLB module.
- Whenever the system enters into error mode due to internal or external reasons, the system has to be reset
- For resetting the system under different conditions, interactive & intelligent reset box is provided in the station. Reset unit is provided with LCD to display error codes.
- LCD display of the reset box provide plain English messages of status & error codes making the system highly user friendly during installation, commissioning & maintenance.
- The system accepts co-operative reset with piloting of a train (Preparatory Reset) or direct reset with/without line verification depending upon the field conditions.
- A 48 VDC potential (from the 24 VDC supply) is developed within the reset box for affecting the reset of the system. A voltage window circuit ensures that the reset potential is maintained within the limits of 36 VDC to 52 VDC.

- ERROR NO - 7F REMOTE RESET ERROR

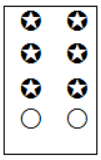
  The error is generated in the local unit when remote unit is resetted.



Error No.	Action required
Error no. 7F is generated in local unit if the remote unit has been resetted.	Apply reset in the local unit or else apply reset in both SSDAC units.

- ERROR NO 3F – SELF RESET ERROR

  The error is generated if the local unit has been resetted.



Error No.	Action required
Error no 3F is generated in the local unit when it is resetted and it is waiting for remote unit to be resetted.	Remote unit is to be resetted or else both SSDAC units are to be resetted.

- OTHER TYPE OF ERRORS:

CONDITION	ERROR NO.	SYSTEM STATUS	ACTION REQUIRED
Entry counts are more than Exit counts	No Error	Vital relays are dropped. System may fail for each train movement.	1. Check Exit end axle detectors and align them properly. 2. Check SCC1 & 2 cards and its output.

- **Independent Resetting procedure when SSDAC is used in Block sections:**

1) a) Insert SM's key, turn right and keep pressed.
   b) Press Reset Button.
   c) Release SM's key and Reset Button.
   d) Turn left, remove SM's key and keep in safe custody.
2) With the above operation from step 1(a) & (b) At both station48 VDC from reset box is extended and connected to the SSDAC through the drop contacts of PPR and VPR relays in Relay room. This 48 VDC actuates the reset circuit in modem card (card 6) of SSDAC unit and generates reset command to the Micro-controllers in MLB1 and MLB2 cards (board 3 & 4).
3) The SSDAC units become reset and counts become zero and self test is carried out in both the units. The SSDAC units attain the preparatory reset state. The preparatory reset LED indication glows on the reset box in SM's room.
4) The counter reading also increments by 1 count through the Preparatory Reset command after a gap of 5 sec approx .The counter reading should be recorded.
5) One pilot train is to be passed in the section to make the system normal. The vital relay picks up at both station

- All these events are stored in Event Logger module of the system. The data therein can be downloaded through RS232 communication port available on the module.
  a) Event logger card has a Rabbit processor and 2 MB flash memory to store packets
  b) The data is initially stored in the buffer and subsequently transferred to flash memory per every two minutes.
  c) Normally 4096 pages of the data can be stored in flash memory.

- **Surge protection**:
  a) External Surge Protection Devices on input, output and power supply lines. It is easy to install.
  b) Surge Voltage Protection device Part No is (SV – 121)
  c) The surge protectors are rated for 24 VDC main supplies and 48 VDC for reset box. The wiring diagram takes for the proper routing of the cables through the surge protectors. The metallic frame of the surge protector should be connected to the main earth rigidly achieved proper earth protection
  d) Class B & C types surge protection must be provided on 230 VAC mains line
- **Earthing:**
  a) Check that metal sheaths of the outdoor cable are connected to earth at both ends.
  b) Screen of axle detector cable should be earthed.
  c) Separate Earth of quad/PIJF telecom cable shall be less than one ohm (1 Ω).
  d) Earthing of SSDAC units, relay box and reset box should be provided firmly through copper strips or other standard copper cable. (Value < 1 Ω)

- **Communication Media - Type of Cable:**
  a) Only OFC or Quad cable is to be used between field units.
  b) No Signalling Cable is to be used in totality/parts.
  c) Proper pair of wires to be used for connectivity, No wires to be paralleled.
  d) Insulation resistance of Quad cable Shall be greater than /equal to 10 MΩ
  e) Loop resistance of designated pair not to exceed 56 Ω/Kms at 20^0 C.

- **Inductor cable length 10 m or 15 m.**

- **Reading:**

S. No	Description	Terminals	Tolerance Range	Actual Readings	
				Station "A"	Station "B"
1	Battery (24V DC)	B24 N24	19.2 to 28.8 V DC		
2	Tx1 Vrms / Freq 21 KHZ)	D1 D2	30 to 40 V AC 20.80 to 21.20 KHZ		
3	Tx2 Vrms / Freq (23 KHZ)	D3 D4	30 to 40 V AC 21.80 to 23.20 KHZ		
4	Rx1 Vrms	D5 D6	275 to 600 mV		
5	Rx2 Vrms	D7 D8	275 to 600 mV		
6	Modem Vrms	C7 C8	>400 mV (approx)		
7	SSC1 (Card1) V DC **Without dummy wheel**	2.2 VDC GND	2.0 to 2.5 V DC		
	SSC1 (Card1) V DC **With dummy wheel**	2.2 VDC GND	0.7 V DC		
8	SSC1 (Card2) V DC **Without dummy wheel**	2.2 VDC GND	2.0 to 2.5 V DC		
	SSC1 (Card2) V DC **With dummy wheel**	2.2 VDC GND	0.7 V DC		
9	**DC-DC Converter V DC**				
	5 V DC	5 VDC GND	4.75 to 5.25 V DC		
	12 V DC	12 VDC GND	11.5 to 12.5 V DC		
	24 V DC	24 VDC GND	23.5 to 24.5 V DC		
	15 V DC (ISO)	15 V (ISO) GND	14.5 to 15.5 V DC		

EXERCISE:

1) Draw layout of CEL 710-P SSDAC as on board

2) Due to 'NEGATIVE COUNT' failure which error code will display on LCD of reset box?

3) On which board address setting for Entry end and Exit end is done?

4) Give the details of dimensions of holes for installation of detectors (information is available in E content site http://10.195.2.19)
   a) _____ Holes to web
   b) Diameter of hole _____mm ,
   c) Distance between centre of adjacent holes _____ mm,
   d) Height of hole
      I. _____90 pound rail,
      II. _____52 Kg rail,
      III. _____ 60 Kg rail,

Date: **Signature of the Trainee**