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अनुदेशक के आद्यक्षर
Instructor Initial :

Multi Section Digital Axle Counters (AzLM) – ELDYNE

(RDSO/SPN/176/2013)

INTRODUCTION

AzLM 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 Central Evaluator' at regular intervals. Based on the information detected, 'Central Evaluator' determines 'status' of track section whether 'Clear' or 'occupied'.

EQUIPMENTS

Indoor Equipments:

1. Axle Counter central Evaluator (ACE)
2. Power Data Coupling Unit (PDCU)
3. Axle counter track section relay (ATSR)
4. Reset Panel
5. Power supply

Outdoor Equipments:

1. Trackside Electronic Units (EAK)
2. Rail Contacts (SK1, SK2).
3. Line Verification Box (LV)
4. Quad cable connection in between outdoor and indoor equipments

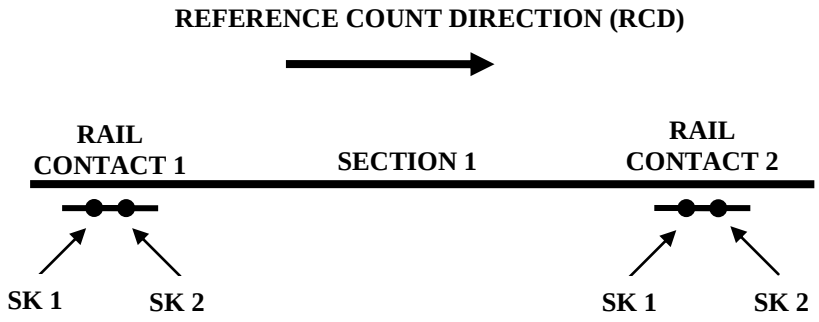
WORKING PRINCIPLE

a) Reference Count Direction (RCD)

To obtain the correct direction of counting, an axle counter reference count direction (RCD) has been defined. The rail contact that is first crossed by an axle in the axle counter reference direction is defined as rail contact 1 (SK1/SK2) and the other rail contact as rail contact 2 (SK1/TX2).

The reference count direction (RCD) must be defined for the track layout independent of the direction of travel. This would normally be the direction of increasing mileage. The use of RCD ensures that the correct order of counting into and out of a section is maintained throughout a series of detection points. Without the RCD the system cannot be correctly configured.

In the figure below, axles are counted as "IN" counts when a train passes Rail Contact1 in the direction of the arrow or a train passes Rail Contact 2 in the opposite direction of the arrow. Axles are counted as "OUT" counts when a train passes Rail Contact 1 in the opposite direction of the arrow or a train passes Rail Contact 2 in the direction of the arrow.



DESCRIPTION

1) **Axle Counter Central Evaluator (ACE):** Axle Counter Central Evaluator is the decision-making unit for multi section digital axle counter. It has the following sub components.
   - **a)** CPU Board: it acts as the brain of AzLM. Two CPU Boards are required for 2 out of 2 systems. These CPU Boards have diagnostic interfaces and an alphanumeric display. For a specific application, the CPU Boards used must be loaded with the 'Site-Specific Software'. Diagnostic interfaces are available on CPU Board to connect it to a PC and check the system status, health messages etc. with the help of diagnostic software.
   - **b)** Power Supply Board: it has DC-DC converters. It works on 24 V DC and generates 5 V DC and 12 V DC required for the electronic circuitry. Two separate Power Supply Boards are required for two CPUs.

c) Serial Board: it receives information from detection points (EAK) through ISDN communication link and provides this information to CPU Boards. One Serial Board can monitor maximum two detection points.

d) Parallel Board: it is responsible for providing section information. This Board takes instruction from CPU Boards and gives section 'Clear / Occupied' output through potential free contact of two miniature relays which are energized by each CPU for each track section. The reset of a section is commanded through the Parallel Board. A Parallel Board has two non-vital outputs that are also configurable through 'Site-Specific Software' for getting different signals, for example, indication of acceptance of reset by the system or a technical defect in a section etc.

2) Power Data Coupling Unit (PDCU): PDCU is the interface between 'outdoor equipment' (EAK) and 'indoor equipment' (ACE). It has a superimposed circuit to use same conductor for 'Power' and 'Data'.

a) One PDCU is used for one (detection point) EAK only.

b) Through this PDCU, 60 V DC power is fed to EAK and data from EAK is sent to serial card. This power to EAK goes through 315 mA fuse which is provided inside the PDCU.

c) One red LED is provided in PDCU, it will glow only when fuse is 'blown off'.

3) Axle Counter Track Section Relay (ATSR): One ATS relay is provided for each track section. It is Q series BRS 930A, EN1 relay. Its rated voltage is 24 V DC. Its contact configuration is 8F/8B. Input of 24 V DC to this relay is fed thorough front contact of two miniature relays of concerned track section.

4) Reset Panel: Reset unit is provided for each axle counter track section. All reset units are assembled in one reset panel.

Reset button, reset key, LED indications, counter are provided in each reset unit.

5) Line Verification Box (LV): for co-operative reset this arrangement is provided on outside structure from where concerned axle counter track section can be viewed physically. Resetting of axle counter track section can be actuated only when concerned LV is operated.

6) Trackside Electronic Unit (EAK): The EAKs are provided at every detection point to connect Rail contacts (SK1, SK2). EAK is housed in the Mushroom Cover if installed outside the location box and if it is placed inside the location box it is housed with a dust cover. Distance between SK1, SK2 and EAK depends upon the length of cable connected to coils. (4 m, 5.5 m, 8 m)

a) EAK comprises following

Connection arrangements for input to EAK, connection arrangements for SK1SK2 coils, surge protection, analog board, digital board, earth connection facility.

b) Analog Board: this Board contains potentiometer for each channel SK1, SK2 and also LED indications are given for diagnosis purpose.

With the help of 'MESSAB' potentiometer RX rectified voltage can be adjusted and with the help of 'PEGUE' potentiometer reference voltage can be adjusted.

Functions of this Board are as below

i. Generates transmitter signal (Tx)
ii. Amplifies receiver signal (Rx)
iii. Phase sensitive rectification
iv. Generates analog wheel pulse MESSAB(Rectified DC Voltage)
v. Generates Digital wheel pulse (RADIMP)
vi. Generates stable voltage output

c) Digital Board: this Board communicates with concerned serial Board in ACE.

LED indications are given for diagnosis purpose.

Functions of this Board are as below

i. Counts Digital wheel pulse (RADIMP)
ii. Determines the direction of count
iii. Supervises Rail Contact
iv. Generates telegrams(Codes)
v. Transmits data to ACE using ISDN protocol for evaluation

d) Mother board: it accommodates analog Board and digital Board on the mother board '16 Bit Address setting' for each channel is provided.

e) Power supply: for trackside electronic unit (EAK) is 54 V DC to 72 V DC. The power consumption per EAK is 9 W (approximately). The ripple content of the power supply is recommended to be lower than 24 mV peak to peak. Extreme care should be taken to see that the power source does not have any change over time from mains to battery during mains failure. Care should also be taken to see that power supply does not have any kick beyond upper tolerance value (71.5 V DC) during startup or charging after power failure. Care should also be taken that power supply source is not under / over loaded beyond its specification.

f) Terminations: Power supply input to EAK is at terminals 3 & 13 when super imposition is used (data exchange and power supply). In case if voltage drop is excess then local supply 60 V DC can be given from location box which is nearer to EAK but at that time power shall be in at terminals 1 & 11

g) Earthing: The EAK has to be connected to the separate earth with a copper cable of minimum 25 sq.mm or an iron cable of minimum 50 sq.mm.

7) Rail Contacts (SK1, SK2): TX, RX coils for each channel SK1, SK2 are installed on web portion of rail. With the help of jig concerned holes are marked on web of rail.

An arrangement is provided on 'TX side' to adjust the height of TX coil by moving it up or down.

Positions of SK1, SK2 are decided as per RCD (Reference Count Direction).

8) Quad cable connection in between outdoor and indoor equipments:

For communication with the axle counter central evaluator (ACE), a physical communication link must be needed. The system uses 'Two' wire ANSI T1.601 communication protocol with ISDN modulation. The maximum transmission distance is 13 Km with a good quality communication cable having maximum loop resistance of 56 Ω/ Km and capacitance of 45 nF/ Km. For better reliability the correct pair of star quad cable (diameter 0.9 mm / IRS: TC-30/96) should be used with proper terminations**.**

READINGS & ADJUSTMENTS WITH THE HELP OF TOOL KIT ETU001

1) Tool kit ETU001 includes
   a) Integral cable with connector. (The connector fits to matching connector on EAK)
   b) Dummy wheel. (It simulates wheel presence)
   c) True RMS multi-meter.
   d) Multi function Selector Switch.
   e) Adjustable Torque Wrench
2) The selector switch position 1 shows the value of the output of 1st internal DC-DC Converter (Channel1) in Analog Board. This should be within the range of 22 V DC to 35 V DC.
3) The selector switch position 2 shows the value of output voltage of 2nd internal DC-DC Converter (Channel2) in Analog Board. This should also be within the range of 22 V DC to 35 V DC.
4) The selector switch position 4 shows the rectified Rx voltage (MESSAB1) for SK1. This should be positive without dummy wheel. After placing the dummy wheel between TX1 on Rx1 vertically in the center, the (MESSAB1) voltage should be negative. In ideal condition and for proper adjustment of rail contact, MESSAB1 voltage without dummy wheel should be equal to the MESSAB1 voltage with dummy wheel but having an opposite polarity. The value of MESSAB1 should be within 80 mV to 1000 mV which depends upon rail profile and fixing of TX coil.
5) Turning the MESSAB potentiometer (R2) on analog board, the rectified voltage without dummy wheel must be set to positive maximum.
6) The rectified voltage has to be checked with dummy wheel. If there is a big difference between the positive value and the negative value, the Transmitter head should be adjusted

by pulling up or pushing down.

7) Moving the transmitter head upwards increases the negative voltage and decreases the positive voltage and vice versa.
8) After getting the positive and negative voltages within the specified limit the transmitter head has to be tightened properly with the torque wrench set at 25 Nm.
9) For proper adjustment the positive voltage should be greater than negative voltage by a value not less than 30 mV and the difference between positive voltage and negative voltage should not be more than 20% of sum of positive and negative values. This adjustment is for achieving suppression of spoke trolley wheels so that the rectified RX voltage does not go to negative with the specified trolley wheel. It is recommended that the adjustment should be done using a spoke trolley wheel that is normally used in the section. For fine adjustment the potentiometer R2 may be used.
10) The selector switch position 5 shows the value of reference voltage for SK1 (PEGUE1). This can be adjusted by the PEGUE potentiometer R1 on the Analog board and is made equal (or ± 2%) to the value of MESSAB1 as measured without the dummy wheel.
11) Keeping the selector switch at position 7, the SK2 is adjusted by measuring rectified Rx voltage for SK2 (MESSAB2) following the same way as mentioned above. For fine adjustment the potentiometer R4 on the Analog board should be used.
12) The selector switch position 8 shows the reference voltage for SK2 (PEGUE2) and can be adjusted.

Different LED indications for Analog Board and Digital Board are given in the table below

Board	LED	Color	Normal status	Meaning
Analog	H1/1	Red	Off	Wheel is not on SK1
	H1/2	Green	Flashing	MESSAB1 in tolerance
	H2/1	Red	Off	Wheel is not on SK2
	H2/2	Green	Flashing	MESSAB2 in tolerance
	H3/1	Red	Off	H 24 V is not out of tolerance
	H3/2	Green	On	H 5 V OK.
Digital	H1/1	Green	Flashing	Transmitting data
	H1/2	Green	OFF	Self test of CPU 1 is successful
	H2/1	Green	Flashing	Transmitting data
	H2/2	Green	OFF	Self test of CPU 2 is successful

MESSAB: Rectified voltage in accordance with phase change.
PEGUE : Reference / supervision voltage.
RADIMP : Equivalent Digital pluse.
EAK : Elektrischer anschluss kasten(Electronic unit)
SK1/SK2 : Schienen Contact (TX/RX Coils)

READINGS

Selector position in test unit	Description	Tolerance Range	DP 4	DP 2
1	Power Supply Channel 1	22…35 V DC		
2	Power Supply Channel 2	22…35 V DC		
3	**OFF**			
4	Rectified Rx 1 Voltage MESSAB1	+80…..+1000 mV		
	Dummy wheel set on 40 mm	-80…..-1000 mV		
5	Reference Voltage PEGUE1	Adjust		
6	**OFF**			
7	Rectified Rx 2 Voltage MESSAB2	+80..+1000 mV		
	Dummy wheel set on 40 mm	-80…..-1000 mV		
8	Reference Voltage PEGUE2	Adjust		
Terminal 3&13	Power Supply Voltage	54 V…..72 V		
Terminal Sk1 / S1 & S2	Transmitter Freq.Sk1	30..31.25 KHz		
	Transmitter Volt.Sk1	40…….85 V AC		
Terminal Sk2 / S1 & S2	Transmitter Freq.Sk2	27.4….28.6KHz		
	Transmitter Volt.Sk2	40…….85 V AC		
Analog Board Indications	H1-1 Red / H1-2 Green	Observe		
	H2-1 Red / H2-2 Green	Observe		
	H3-1 Red / H3-2 Green	Observe		
Digital Board Indications	H1-1 Green / H1-2 Green	Observe		
	H2-1 Green / H2-2 Green	Observe		

EXERCISE:

1) Draw a functional block diagram of MSDAC (AZLM) from board.

2) Draw a RCD diagram of MSDAC system for 4 detection points with 2 track sections from board.

3) 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) Dia 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.
4) On desktop, generate the report of all information in between time 08.00 to 12.00 of yesterday and write how much time ATS1 was in occupied status

5) Try to reset the system keeping dummy between TX & RX of DP 4, write your observations.

Date: **Signature of the Trainee**