GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

FRAUSCHER ACS 2000
Multi Section Digital Axle Counter

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Target group:
SSEs/JEs(Signal) & Signal Maintainers

Indian Railways
Centre for Advanced Maintenance Technology

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Introduction
The Frauscher Axle counting system ACS2000 is a microcontroller based modular system. When fully configured, the system comprises the following components/boards:

Trackside equipment
- Wheel sensor RSR180 with moulded cable and protection tube
- Rail claw with clamping bolts
- Rail deflector FRD
- Strain relief clamp SRC
- Track lead junction box TLJB
- Line verification box LVB (for ‘conditional hard reset’ application)

Indoor installation
- Fuse board SIC
- Evaluation board IMC (EB)
- Axle counting board ACB
- Overvoltage protection board BSI
- Board rack BGT
- Axle counting backplane ABP
- Digital input/output board DIOB (optional for transmission mode)
- Reset box RSTBOX (for ‘preparatory or conditional hard reset’ applications)
- Frauscher Reset acknowledgement PCB FRA (for ‘preparatory reset’ application only)
Each wheel sensor to evaluation board IMC requires 4 wires (either 4 wires of Red or Green for one sensor and other 4 wires may be used for 2nd sensor, if any to the same ABP (ST1 connector)).
Mounting instructions for Wheel Sensor RSR 180

- To be mounted at the inside face of the rail (wheel flange side).
- In curves - to be mounted at the inside face of the curve.
- In point areas, the minimum admissible space between rails is 100 mm (inside width between heads of rail).
- Minimum spacing between two wheel sensors on the same rail is two sleeper spaces.
- Minimum spacing between a wheel sensor and the next rail joint or the next rail-weld is 1.5 m to 2.5 m.
- The distance between the centre of the wheel sensor and rail deflectors on either side in the longitudinal rail direction should be at least 350 mm away from the wheel sensor.

Rail claw mounting – Important parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. width of foot of rail</td>
<td>110 mm</td>
</tr>
<tr>
<td>Max. width of foot of rail</td>
<td>155 mm</td>
</tr>
<tr>
<td>Min. height of rail</td>
<td>130 mm</td>
</tr>
<tr>
<td>Max. height of rail</td>
<td>180 mm</td>
</tr>
<tr>
<td>Height (vertical) between the top of the railhead and the top of the sensor (Measurement A, see Figure)</td>
<td>40 to 45 mm</td>
</tr>
<tr>
<td>Depth (horizontal width) between the side of the railhead and the inner face of the sensor (Measurement B, see Figure)</td>
<td>0 to 8 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rail Profile</th>
<th>Claw type</th>
<th>Bolt type</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 Kg</td>
<td>SK140-011</td>
<td>BBK 22</td>
</tr>
<tr>
<td>52 Kg</td>
<td>SK140-012</td>
<td>BBK 17.5</td>
</tr>
<tr>
<td>90 lbs</td>
<td>SK140-013</td>
<td>BBK 22</td>
</tr>
</tbody>
</table>
Important
→ The wheel sensor housing must not touch the head of rail.

**Adjust measurement B by**
- Adding a washer
- Exchanging BBKs (bolts)

**Adjust measurement A**
by loosening/tightening

**Tooothing**

Measurement B: 0...8 mm

Measurement A: 40...45 mm

M10: 15 Nm

M24: ca. 200 Nm

M12: 40 Nm
Maintenance

Measurements on the IMC when the wheel sensor RSR180 is connected . Cycle: < 2 years
Measure voltage at test sockets for Sys1 and/or for Sys2, Specified range: 280 mV to 500 mV DC.
The measured voltage corresponds to the wheel sensor system current across an internal 100 Ohm shunt resistance (100 mV corresponds to 1 mA wheel sensor system current). The voltage must be measured in the unoccupied (Clear) status.

If the difference between the two voltages > 20 mV or 5% (max), then the possible reasons are
• Incorrect wheel sensor mounting
• Wheel sensor RSR180 not mounted centrally between the sleepers
• Metal parts below the wheel sensor RSR180
• A wheel sensor system is defective

V+, GND -- 2 mm test sockets, voltage corresponds to the analogue wheel sensor current via a 100 Ω shunt

Testing of ACB
Cycle: < 2 years

Test (a) Traversing of a counting head connected to the ACB to be tested and counting in and out of at least one axle or
Test (b) Counting in and out of at least one axle, using the testing plate PB200
Testing of Wheel sensor RSR180

**Cycle:** < 2 years

**Test:** Perform visual inspection and mechanical checks of wheel sensor RSR180.

Traverse wheel sensor with a train or Damp (occupy) the wheel sensor using the testing plate PB200. This is done by means of traversing (both system 1 and system 2) of at least one axle, which must be counted in and out correctly by the corresponding ACB as given below:

<table>
<thead>
<tr>
<th></th>
<th>Start position:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The wheel sensor is not occupied</td>
</tr>
<tr>
<td>2</td>
<td>Move (pull) the PB200 constantly in direction of arrow over the first wheel sensor system. <strong>Wheel sensor system 1 occupied</strong></td>
</tr>
<tr>
<td>3</td>
<td>Move (pull) the PB200 constantly in direction of arrow in the middle of both wheel sensor systems. <strong>Wheel sensor system 1 &amp; 2 occupied</strong></td>
</tr>
<tr>
<td>4</td>
<td>Move (pull) the PB200 constantly in direction of arrow over the second wheel sensor system. <strong>Wheel sensor system 2 occupied</strong></td>
</tr>
</tbody>
</table>
Measurements at the overvoltage protection board BSI

Voltage measurement:
Between clamps E3 and E4. Specified range 12 V to 28 V DC (with wheel sensor connected).
Between E1 & E4 – Specified range 1.5 V to 3.0 V DC
Between E2 & E4 – Specified range 1.5 to 3.2 V DC

Current measurement:
At wire E3. Specified range 57 mA to 65 mA
Measurements in TLJB when wheel sensor RSR180 is connected
Voltage between wires 3 and 4 - 12 V to 14 V DC.
If voltage is less than 12 V DC, the loop resistance must be tested.
The maximum loop resistance of the cable from the TLJB to the backplane ABP is 250 Ohms

Tools and Measuring instruments
- Steel wire brush and WD40 spray - used to clean the rail surface area for easy fixing of rail claw.
- Torque wrench (range 15 - 60 Nm) - used to fasten the bolts at specified torque.
- Socket spanner SW19 and SW17 & screw drivers.
- Fixed spanner SW36/Friction type ratchet – used to fix rail claw in the rail.
- Steel tape measure (Fibre/wooden tape measure recommended in RE area)
- Plumb bob for level measurement (2 m length).
- Multi-meter: Range 1000 mV DC, precision ± 0.5 %
- Two probes with 2 mm male connectors (for connection of evaluation board with mV meter).
- Testing plate PB200.
### Important parameters

<table>
<thead>
<tr>
<th>Outdoor equipment</th>
<th>Wheel Sensor RSR180</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor equipment</td>
<td>ACS 2000 system consisting of BSI, BGT, ABP, SIC, IMC (EB), ACB &amp; DIOB boards and reset box</td>
</tr>
<tr>
<td>Configurations of axle counting backplanes ABP slots</td>
<td>(i) 1 ACB + 1 SIC + 2/3/4/5/6 evaluation boards IMC &amp; (ii) 1 ACB + 1 SIC + 1 DIOB + 2/3/4/5/6 evaluation boards IMC</td>
</tr>
</tbody>
</table>

| No. of counting heads per ACB | 6 |
| For more than 6 counting heads (Max. upto 12). | 2 ACBs interconnected by null-modem cable |

| Communication between Indoor (ACB) and Outdoor equipment (RSR180) | Four-wire signalling cable (typically star-quad cable) |
| Length of sensor cables between TLJB and RSR180 | 5m (10 m & 15m on special requirement) |
| Input power supply range | +19 V DC to +72 V DC. |
| Maximum cable length from the TLJB to the backplane ABP | Up to 4.4 km (0.90 mm dia. star-quad cable with a loop resistance of 56.6 Ohms /km. |
| Max. No. of wheels counted per track section by the ACB | 8191 |
| Reset Box input Power Supply | +19 V DC to +30 V DC |
## Error codes for troubleshooting

Listed below are some generic error codes that may be displayed on ACB during the functioning of the ACS2000 system:

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Cause &amp; Remedy</th>
</tr>
</thead>
</table>
| +111/+211 or -111/-211 | Partial traversing e.g. during shunting or Very Small wheel.  
  1. Check wheel sensor mounting  
  2. Apply Reset |
| +112/+212 or -112/-212 |  |
| +113/+213 or -113/-213 |  |
| +114/+214 or -114/-214 |  |
| +115/+215 or -115/-215 |  |
| +116/+216 or -116/-216 |  |
| +121/+221 or -121/-221 | Negative axle at the Evaluation Board. Reset applied when track section occupied or presence of at least one wheel in the track section or Very small wheel -Apply Reset |
| +122/+222 or -122/-222 |  |
| +123/+223 or -123/-223 |  |
| +124/+224 or -124/-224 |  |
| +125/+225 or -125/-225 |  |
| +126/+226 or -126/-226 |  |
| **** flashing | Appears after power up -Apply Reset |
| **** steady | If after power up and before reset a wheel was counted in or out -Remove fuse on the fuse board, re-insert and apply Reset |
| ///// | During power up, a wheel sensor system assigned to the track section is occupied.  
  1. Check - If sensor is occupied, Sensor wiring, DIP - switch setting for double usage or Double usage RJ45 patch cable.  
  2. Remove fuse on the fuse board, re-insert and apply Reset |
| - 109/- 209 or +109/+209 | Reset applied from reset box or from PC based reset – After train movement it will clear. |
Do’s & Don’ts

Do
✓ Always carry out adjustment and testing after any work done in the sensor.
✓ Check Nuts and bolts of sensor and rail claw in every maintenance round and tighten if found loose.
✓ Always ensure that Wheel sensor cables for connection between TLJB and RSR-180 are visible and not buried under ballast or mud.
✓ Check the axle counting system fuses at regular interval by checking the LEDs.
✓ Axle counting system Powering Down: Switch OFF individual section by pulling the SIC board out of the rack.
✓ Axle counting system Powering Up: Switch ON the individual section by pushing the SIC board back into the rack.
✓ Check regularly the BSI, BGT and earth connections. Always maintain earth resistance value less than 1 Ohm.

Don’t
X Attempt to use “pre -Reset” input switch on the the ACB.
X Change DIP switch and soldering jumper settings on the axle counting backplane ABP and plugin berg jumper position on the PCB inside the reset box.
X Touch the module components & repair module on your own.
X Remove/modify axle counting system interface wirings or cables without authorization.
X Use blower for cleaning the dust or use vacuum cleaner inside the housing.
X Remove RJ45 cable when axle counting system is ON.

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