New Electric Interlocking Plant for Stockholm Tramways

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With the addition of the Stockholm Tramways' new suburban line to Ängby and the new maintenance depot at the Alvik tram station, this station has attained an imposing size in respect of traffic. The tramcars or tramcars with trailers at Alvik per day of traffic is about 900 and in rush hours the number amounts to about 90.

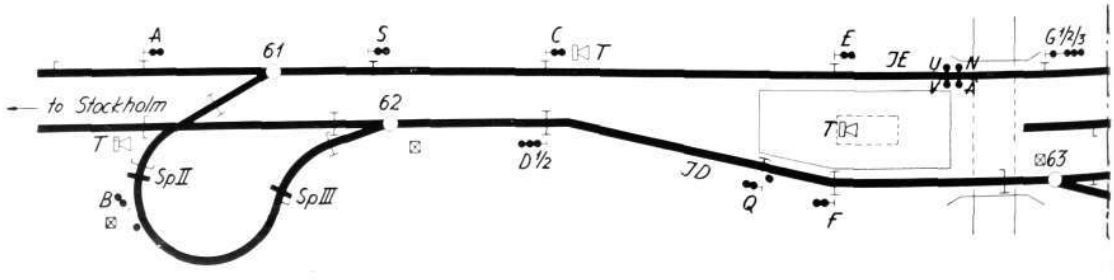
L M Ericssons Signal AB supplied in 1945 for this station an interlocking plant, the technical construction and operation of which is described in the following article.

During the month of October 1945 a new signal plant was taken into service on the Stockholm Tramways. The plant is located at Alvik, which is the junction station for the western suburban lines: the Nockeby line, the Ulvsunda line and the Ängby line. Close to the station is the Company's new tramcar depot, the Bromma Hall, and also a return loop used by some tramcar sets to and from the depot area. At certain times of the day, when car sets drive in and out while the ordinary tramway traffic is proceeding, the traffic is particularly dense and this together with the form of the track area with several level track crossings, a large number of points, right-hand traffic in the depot area (as against left-hand traffic customary for all road traffic in Sweden) etc., provides the reason for a large interlocking plant for the area. The plant now put into service was supplied by Signalbolaget, which company also collaborated in the work of fitting.

A centrally located interlocking machine supervises an area mainly comprising the return loop at Traneberg, Alvik station and station yard, the junction points for the three suburban lines, certain tracks in the depot area and the track area between these places, see track plan, Fig. 1.

Fig. 1 X 7399
Track lay-out of the signal plant at Alvik

- signal cabin
- colour light signal
- pattern light signal
- pedal contact
- telephone
- scotch block
- local switch



The Interlocking Machine

The interlocking machine, an electrical relay interlocking machine, is housed in a separate signal cabin of three stories, erected close to the station, see Fig. 2. In the basement the relay room has been arranged, constructed as an air-raid shelter. The relays, transformers, rectifiers, cable leads and the greater part of the fuses of the plant have been installed here. The relays

Fig. 2 X 6136
Exterior view of the signal cabin at Alvik
in the background the entrance track to the Bromma Hall

are arranged on a relay shelf with built-in wire conduits, see Fig. 3. The cables are led from a separate cable space below the detachable floor up to the cable boxes placed on the lower part of the relay shelf. The relay room has no heating arrangements as the heat loss in the electric apparatus is quite sufficient to maintain adequate temperature on the premises. From the relay room the electric junction lines are carried in wire conduits through the middle floor, which comprises a room for the signal maintenance men and a small boiler-room, up to the control room on the top floor. At the side looking out on the tracks this top room is built out with glass walls to provide a good view over the station track area.

In the control room the interlocking machine, of press-button type, is set up on a desk at which the operator sits, see Fig. 4. The interlocking machine is provided with press-buttons for operating the signals and points, block lamps for the tram routes and tumbler switches by means of which connecting over to local operation can be made for certain of the points, Fig. 5. Press-buttons for emergency release of blocked tram routes and points are provided with

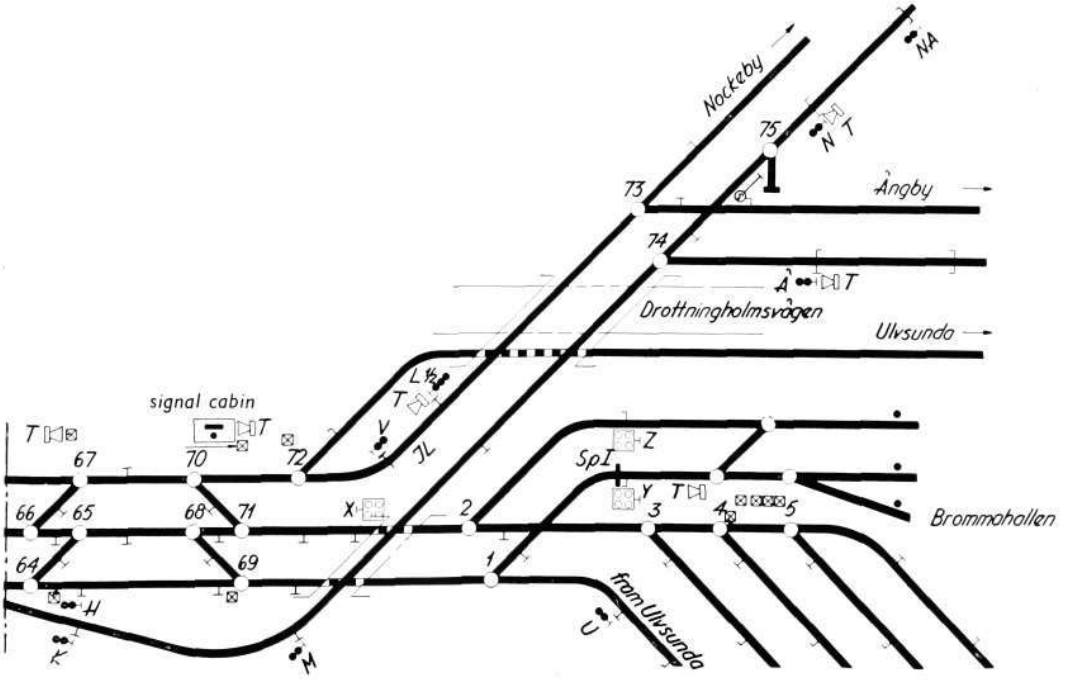


Fig. 3 X 6137

Interior of the relay room

with the plant's relays, transformers, rectifiers and fuses; left, after completion; right, during fitting

seals. In one cupboard of the desk the automatic plugs and fuses for the point machine circuits are stored so that the operator in case of need can reconnect the current without calling for the maintenance man.

Behind the desk, above the interlocking machine, the illuminated track diagram, Fig. 6, is placed on a cupboard. (This gives the signals and points in diagram.) Signal pictures, point positions and state of track circuits are repeated by lamps on the track diagram.

Track Circuits

The track area has been divided into insulated sections, the track circuits. To avoid disturbance from the traction current, which is D.C., the track circuits are fed with A.C. (50 c/s). At several places in the area it has been found necessary to use both rails of a track as return line for the traction current, as this otherwise would cause too great a voltage fall in the rail system. In these cases the track circuit boundaries have been provided with impedance bonds with low resistance for the traction D.C. and high resistance for the track circuit A.C.

Fig. 4 X 6138

Interior of operators' room

The interlocking machine is on the desk. Above this to the right, a portion of the illuminated track diagram.

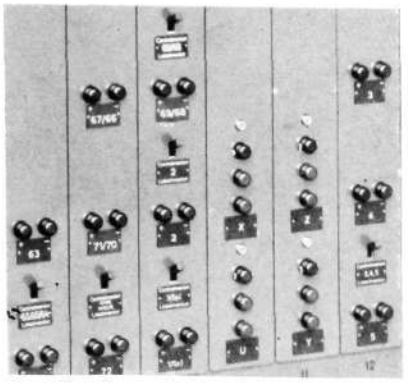


Fig. 5
Picture showing interlocking machine in detail

The main track is divided into track circuits between the signals. In the tramcar depot area the marshalling tracks at entrance are provided with track circuits so located that they indicate when there is room for at least a further three car train on the track concerned. In addition each point or group of points constitutes a track circuit which, when it is occupied by a train, blocks the point or points so that changing of points cannot take place.

As the situation of the track circuits is repeated by way of the track relays in lamps on the track plan, it is possible at any moment to survey the traffic situation in the area covered by signals in the operator's room. The lamp of the track diagram is extinguished when a train is on (shortcircuits) the track circuit.

Points

Nineteen points are comprised in the plant, these being provided with point machines of Signalbolaget's latest type. The points are normally operated from the signal cabin, where the position of points is repeated on the track diagram. Certain of the points, *e. g.*, the transit points in the station area, are coupled up in pairs and changed by a common operation. Most of the points can also be operated by local switches, placed in the vicinity of those points. Local operation can only take place after the operator in the signal cabin has given permission by throwing a tumbler switch on the interlocking machine. There then lights up a lamp on the local switch.

Included in the motor current circuit for the point machines is a contactor with zero tension release. In case of interruption in current this, by breaking the operating relays, prevents the points when the tension is restored from completing any switching started.

In the track from Nockeby there lie catch points with safety track before the crossing with the track to Ängby and the junction points with track from Ängby, see Fig. 7. The catch points are directed to the safety track when the entry signal from Nockeby *(N)* shows danger. Such points are lacking in the track from Ängby. Instead there is to be made a device for automatic train stop in conjunction with the entry signal from Ängby *(Ä)*. This device is under construction.

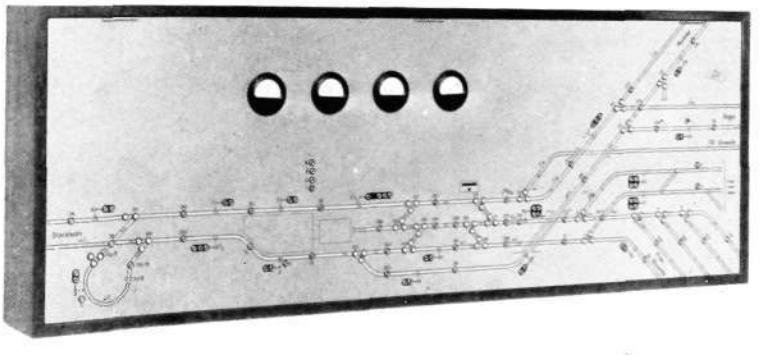


Fig. 6
Illuminated track diagram
On this is reproduced in skeleton the track area with signals and points

Fig. 7 X 6140
Catch points with safety track (left)

where the lines 12 and 11 meet south of Drottningholmsvägen. When complete the points will be covered by gravel

Scotch Blocks

In three places in the area there are located scotch blocks as protection for the main tracks; at the exit from the car depot, at the entrance and exit of the turning loop at Traneberg. The scotch blocks, like the points, are furnished with electric operating devices and are normally operated from the interlocking machine. Two of the blocks are coupled with and operated simultaneously with the respective points in the main track for which they constitute protection. Like the points, the scotch blocks may also be operated manually after permission from the interlocking machine. In the event of fault cranks are used.

Signals

The signals consist of colour light signals and pattern light signals. The colour light signals have a red or green light and one to three green lights to indicate train route. The pattern light signals are of tramway type with four uncoloured lights arranged in a square. The fully automatic signals are purely block signals and cannot be operated from the interlocking machine. The semi-automatic signals act normally as block signals — *e. g.*, the signals A and $D^{1}{}_{2}$ when the turning loop is not used — but may if necessary be operated from the interlocking machine. The manual signals must always be set from the interlocking machine.

For signalling from the trains to the signal cabin there are *pedal contacts* at various spots. When the driver operates one of these by means of the point-iron, a light corresponding to the contact lights up on the track plan and a buzzer signal sounds. There are pedal contacts for trains outwards to the suburbs — for signalling desired train route —, to trains to the turning loop and for trains from the turning loop or from the depot area.

At all important spots in the area telephones are placed. These are connected to a 20-line plug switchboard in the control room. The switchboard has two circuits to the P.B.X. in the Bromma Hall, through which connection with the public telephone network may be obtained. In addition there is in the operator's room a direct extension instrument to the main tramway exchange at Tegnérgatan in Stockholm.

To supply current for the signal plant, two A.C. services of 3×220 V 50 c/s are led in to the signal cabin. One is connected to the low tension network public mains, the other to a large transformer plant in the Bromma Hall. On failure of the one service the signal plant is coupled over to the other by a switch located in the operator's room. Should both services fail it is probable that the interruption is of such an extent that the traction line current is also lacking.

The new signal plant replaces no fewer than eight smaller plants formerly existing in the area, some of them provisional. Four of these were attended during the greater part of the twenty-four hours. As their functions have now been taken over by the new plant, there is gained not only saving in staff but the advantage that the trams can proceed through the area with absolute safety.