COMMITTEE G: Education & Training

E-5 Highway Grade Crossing Gate

Approved November 1982

Symbol:

GATE ARM

GATE ARM
WITH LIGHTS

Description: A mechanical device that forms a physical barrier between the motorist/pedestrian and the approaching train. There are two general types of gate assemblies in common use: the mast-mounted type and the pedestal-mounted type. The assembly consists of a gate arm, gate lights, gate mechanism and counterweights, used in conjunction with flashing-lights.

Purpose and Application: The automatic gate is used to prevent the motorist/pedestrian from entering the crossing immediately after one train has passed if another train is approaching the crossing. This is accomplished by placing a physical barrier (gate arm) between the motorist/pedestrian and the track whenever it is unsafe to traverse the crossing.

Automatic gates are normally used at multiple mainline crossings where train speed is high and both vehicle and train traffic is heavy. Gates may be installed at other locations as required by state, local governmental control agencies and railroads.

General Information: The most commonly used gates are referred to as "short arm" to indicate that the gate arm extends only over the approach lane of highway traffic. This type of gate arm is used to allow an escape route for vehicles which have entered the crossing prior to the gate arms reaching the horizontal position. The control of the gate operation is such that the flashing lights operate sufficiently in advance of the lowering of the gates to enable those vehicles close to the tracks to continue over the crossing without obstruction. Inasmuch as the gates are not the basic warning device, control for their operation provides that they be in the horizontal position only before the train reaches the crossing. When indicating the approach of a train, the light nearest the gate tip is steadily illuminated and the remaining two lights flash alternately in sequence with the primary flashing lights.

When the gates are in the vertical position considerable downward torque is present so that the gate arm will be lowered by gravity when required. In addition to the force of gravity, some mechanisms power-drive down to the 45 degree position. Torque is provided by design of the gate arm supports and counterweights which may be adjusted for different length gate arms. The control circuits are designed so that interruption of the circuit will cause the gate arm to be lowered.

Detailed Operation: The crossing gate mechanism consists of a motor, gear assembly, circuit control contacts, cams connected to the main shaft, a hold-clear assembly, and a control relay. Refer to Figure 1.

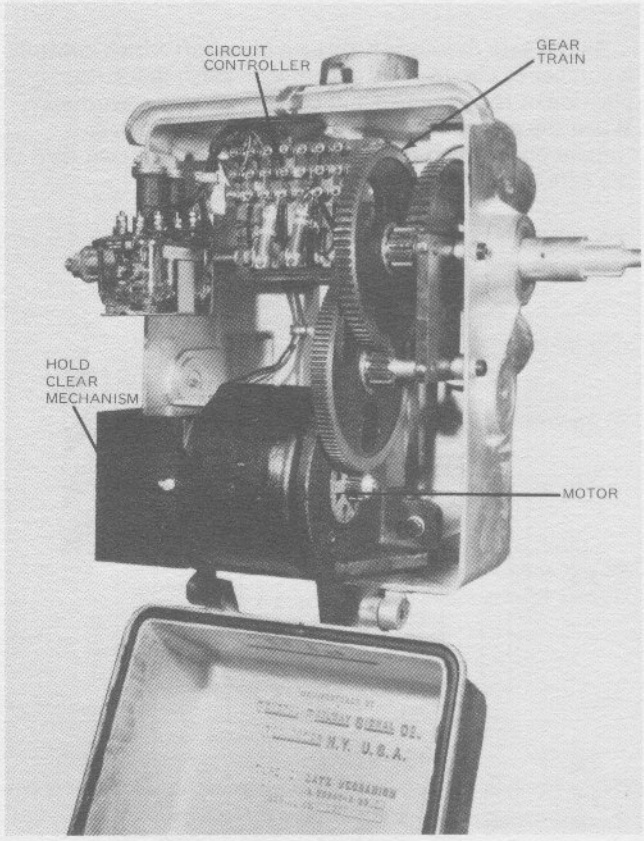
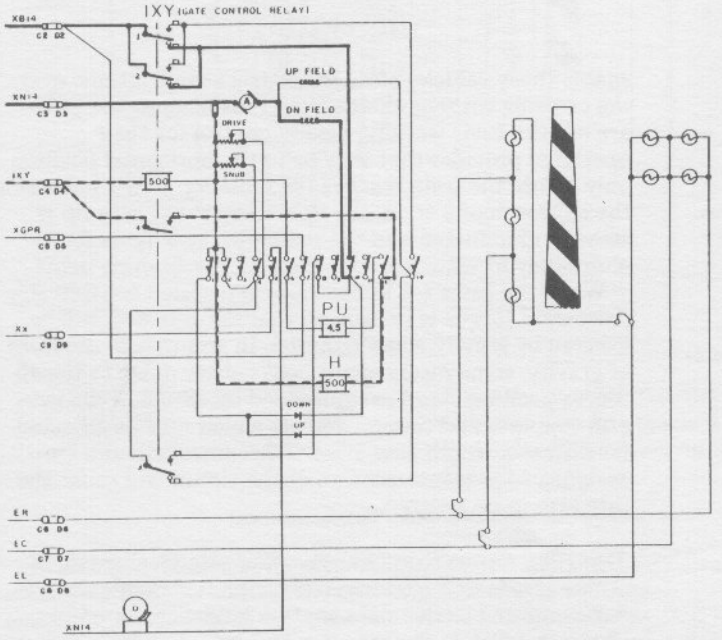


Figure 1 shows the key components of a highway grade crossing gate mechanism.

Approximately 3 seconds after a highway grade crossing warning device has detected an approaching train, the gate control relay (motor control) is de-energized. Contacts of the gate control relay remove energy from the holding coil of the hold-clear assembly and applies energy to the down field and armature of the gate motor. The speed of the motor is controlled by the drive rheostat which is wired in series with the up field. Refer to Figure 2.



CONTROLLER CONTACT DATA

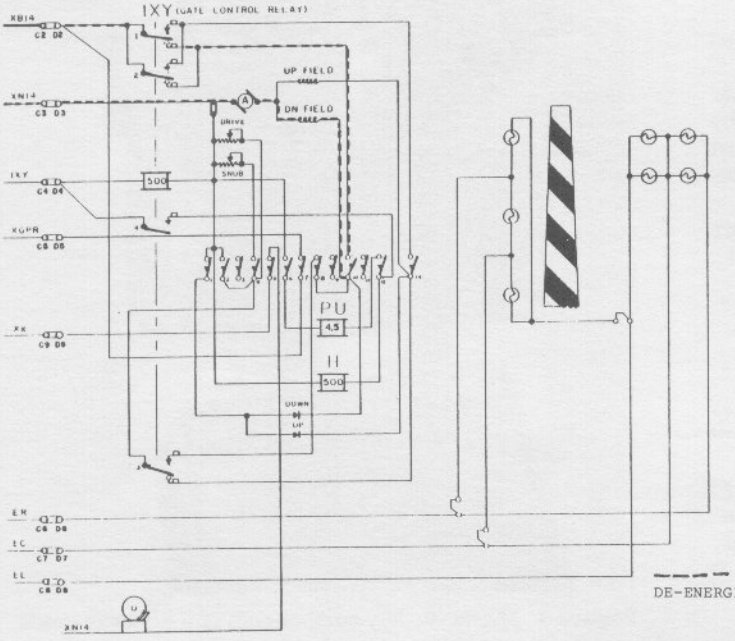
NO.	CONTACT CLOSED
1	45° to 50° 85° to 90°
2	0° to 5°
4	0° to 44°
5	10° to 90°
6	83° to 87°
7	80° to 90°
8	80° to 90°
10	45° to 90°
12	0° to 90° Up 80° to 0° Dn
14	0° to 90° Up 80° to 0° Dn

ENERGIZED CIRCUIT

DE-ENERGIZED CIRCUIT

Figure 2 shows the current flow and circuitry for a gate at the beginning of its descent.

As the gate descends it turns a camshaft which controls a number of circuit control contacts which detect the position of the gate arm and control circuits accordingly. When the arm reaches 45 deg., the camshaft forces a contact open which removes energy from the down field of the gate motor. Refer to Figure 3.



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DE-ENERGIZED CIRCUIT

Figure 3 shows the control circuits when the gate is at the 45 degree position in its downward travel.

Another contact closes at 44 deg. and places the snub rheostat in parallel with the drive rheostat. This decreases the resistance as seen by the up field of the motor (which is acting as a generator) and slows the rate of gate descent. Refer to Figure 4.

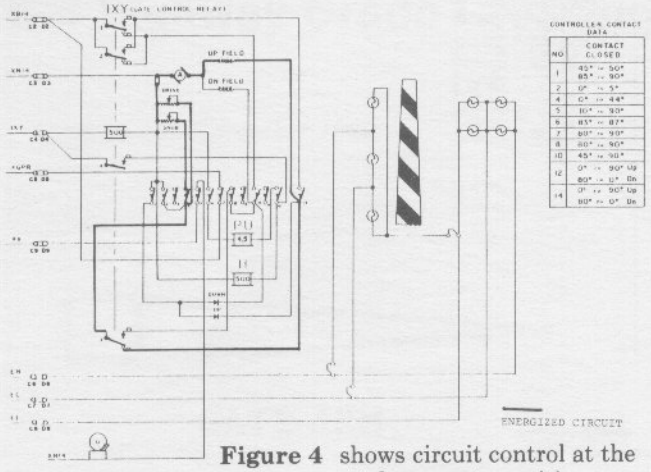

Figure 4 shows circuit control at the 44 degree gate position.

At 5 deg. from the horizontal, a wire shunt is placed in parallel with the drive and snub rheostats, further decreasing the rate of descent as the gate arm settles into the full down position. Refer to Figure 5.

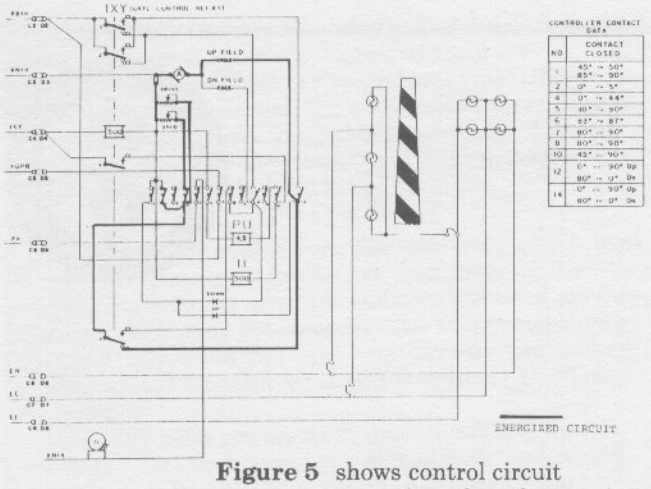

Figure 5 shows control circuit operation when the gate is 5 degrees above the horizontal.

After the train has passed, the gate control relay is re-energized. The gate control relay contacts energize the up field and armature of the motor and the holding coil of the hold-clear mechanism. The holding coil is a high-resistance device and limits current flow to a value below that required to engage the hold-clear assembly. The gate then ascends at the maximum rate. Refer to Figure 6.

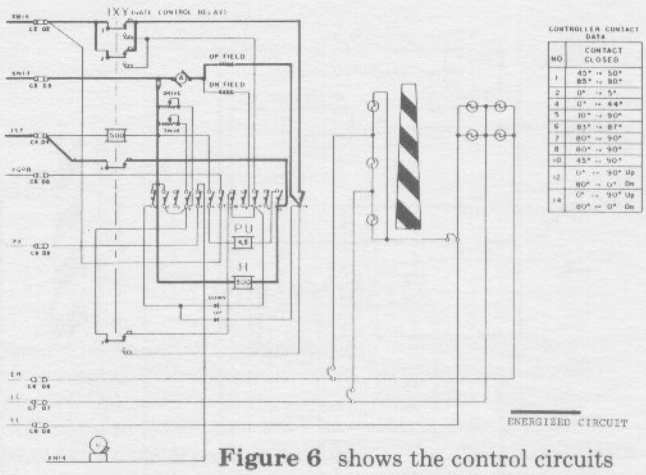

Figure 6 shows the control circuits when the train has passed and the gate is to ascend.

A circuit control contact closes at 80 deg. which places the drive rheostat in series with the down field which slows the rate of ascent of the gate arm. Refer to Figure 7.

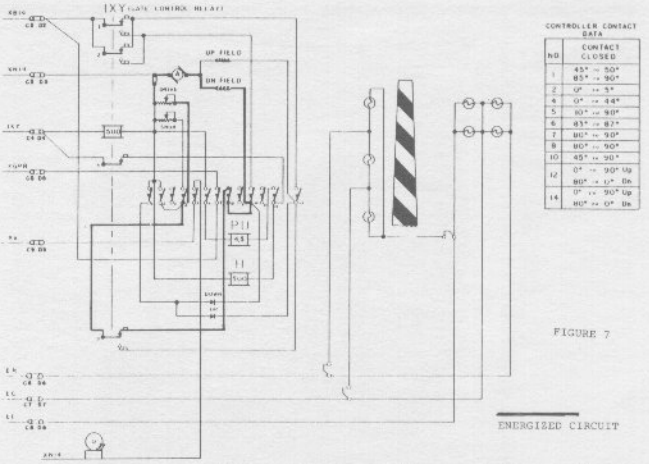

Figure 7 shows the control circuits when the gate reaches the 80 degrees on its upward travel.

When the gate arm reaches 83 degrees the pick-up coil of the hold-clear mechanism is energized and engages the hold-clear assembly. Refer to Figure 8.

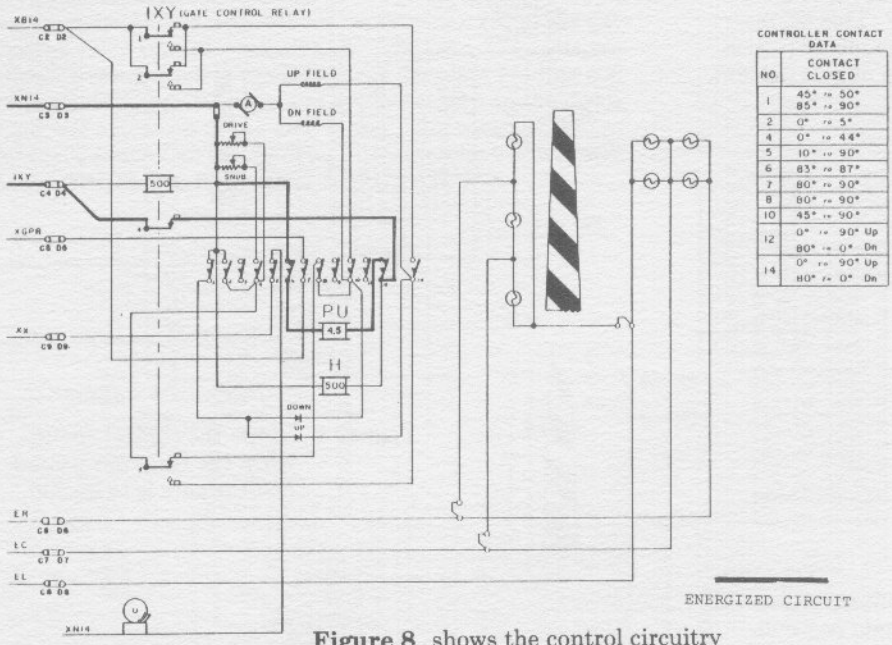

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Figure 8 shows the control circuitry when the gate has reached the 83 degree position on its upward travel.

Because of the direction of rotation when the gate arm is ascending and the ratchet design of the hold-clear assembly, the gate arm continues to ascend unimpeded. At 87 degrees the pick-up coil is de-energized, however the hold-clear assembly remains engaged. The holding coil now has the required current flowing through it to remain energized and hence holds the gate arm full vertical.

Note: This Bulletin is for general information only. For specific applications consult the rules, standards and instructions published by your railroad.

Notes:

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