MODEL SIGNAL ENGINEERING
Part of WIZARD MODELS LIMITED
PO BOX 70 BARTON upon HUMBER DN18 5XY
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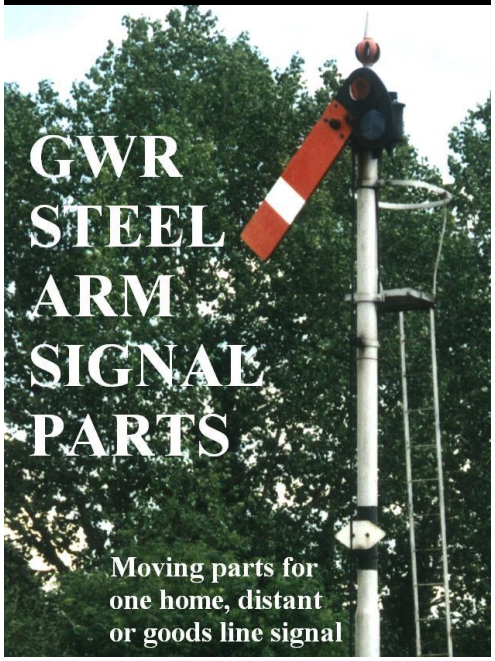
SCALE	CODE	
4 mm	S0015/1	



This is not a complete kit. You will also need a post, lamp, finial, ladder and wire.

This design of signal arm dates from around 1930 as a replacement for the extant wooden arm on a square wooden post style. It was used for new installations (on tubular steel posts) and renewals (often on new steel posts, but sometimes on the original wooden ones) until the end of the GWR period, and by the Western Region of British Rail(ways). Many examples are still in use today, and new ones are still being installed where replacement by colour lights is inappropriate.

Identification of components on fret:
1. 4' home arm 2. 4' distant arm
3. 3' home arm 4. Spectacle plate
5. Balance levers (2)
6. Single balance lever/crank brackets (2)
7. Balance weights (4)
8. Multiple balance lever/crank bracket
9. Signal wire pulley wheels (3)
10. Signal wire cranks (4)
11. Lamp bracket 12. Lamp bracket support
13. Rule 55 track circuit plate
14. Lampman's safety hoop
15. Lampman's platform
16. Platform handrail
17. Ladder bracing struts (4)
18. Back blinder spindle
19. Back blinder 20. Goods line ring

Not all parts will be used on any given signal.

ASSEMBLY INSTRUCTIONS

The test signals were built using 50W normal and low temperature soldering irons, 188°, 145° and 70° solders and liquid fluxes, minidrill and slitting disc, various files, pliers, drills etc, and small scissors for cutting out the fret. Left- and right-hand mean as viewed from the front of the signal. Burnish both sides of the fret before removing any parts. It helps to tin some of the smaller parts before removal. Grip the etched parts in smooth pliers when filing off tags to avoid bending them. Due to the number of prototype applications of these arms, these notes can only be general. Good prototype photographs will help assembly.

The Signal Arm:

Use 188° solder for this section.

As supplied, the arm blades represent the later style with a turned edge for reinforcement. If you wish to model the earlier corrugated style, solder lengths of 0.31mm brass wire to the top and bottom of the front face.

Open out the centre holes in your chosen 4ft home (1), 4ft distant (2) or 3ft goods (3) blade and in the spectacle plate (4) to 0.80mm (no.68). The hole near the edge of the blade and its counterpart in (4) should be opened out to be a loose fit on 0.31mm brass wire. For a 4ft arm, the top spectacle needs broaching out to the edge of the full-relief frame. The etched diameter is correct as supplied for a 3ft arm. Solder the blade on top of the spectacle plate, using stainless steel needles (or anything else that won't take solder) to align the holes. For a goods line arm, solder the ring (20) to the front face of the blade, about 1mm in from the left-hand end.

Solder the arm assembly to a 30 x 0.8mm brass rod spindle. To keep things square, drill a 0.80mm hole in a wood block, insert the spindle then drop the arm on to it face down. When soldering, do not press the arm at one end, or it will tilt. Remove the excess front spindle and file it almost flush with the motion plate. Leave the excess rear material for now as a painting handle.

The Post or Doll:

Warning: *a whitemetal post or doll is easily melted or distorted. Handle it carefully, and ensure you have picked up the low-temperature (70°) iron before making any joints! Tubular posts are made from 2mm diameter brass tube.*

Tubular posts were made in two parts, the post and the butt. They usually came in one of a range of standard heights, chosen to give adequate sighting, as shown in the first column of the table below. The height given is the height of the arm centre-line above rail level, so the post cutting length given in the second column includes an allowance of 4mm and 5mm at the top and bottom of the post respectively. Non-standard cutting heights can thus be calculated from the table - allow for any signal not mounted on the ground. Note that a platform starter is typically 16ft high, and that posts above 18ft were fitted with a lampman's platform. The equivalent figures are also given for square wooden posts; here, signals 18ft tall did have a lampman's platform.

Height (ft/ins)	Tubular post cutting length (mm)	Square post cutting length (mm)	Post to ladder distance (mm)
16.0	73.0	71.5	12.0
17.0	77.0	75.5	12.5
18.0	81.0	79.5	13.0*
19.0	85.0	83.5	15.0
20.0	89.0	87.5	15.5
21.0	93.0	91.5	16.0
22.0	97.0	95.5	16.5
23.0	101.0	99.5	17.0
24.0	105.0	103.5	17.5
25.0	109.0	107.5	18.0
26.0	113.0	111.5	18.5

*- 14.5mm for wooden posts

Cut the post/doll to length. For a square post, remove the excess from the bottom of the casting, fill in any cast notch, remove any flash and mould lines, file off any cast detail and square the post ends. File along the length of the post rather than across it, so any file marks look like timber grain. Straighten the post using gentle finger pressure if it has become distorted.

Solder a 1/16" bearing tube to the post at right angles 4mm (tubular) or 3.5mm (square) below the post top – again, a hole drilled in a wooden block will keep things square, and avoid tilting the post when soldering. Use the minidrill and slitting disc to trim the bearing so it projects around 1mm (tubular) or 0.5mm (square) beyond the front and rear post faces.

The butt on all GW tubular post signals was 12ft tall above the rail, regardless of post height. A 2.5mm brass tube should therefore be cut to a length of 52mm. Solder the post tube inside the butt tube, with 1mm of the post projecting out of the bottom of the butt, then file the characteristic bevel to the butt top.

Prepare a baseplate from scrap brass sheet, around 60 x 15mm. Scribe a longitudinal centre line, then drill a 2.0mm/no.47 (tubular) or 1.0mm/no.61 (square) hole on the line around 15mm from one end.

For a tubular post, solder (145°) the post/butt assembly to the baseplate through the hole. For a square post, solder (70°) the post to the baseplate, using a 1.0mm wire peg as a reinforcement. In both cases, ensure squareness in all three planes. It helps to fit the arm to the bearing temporarily, to ensure the bearing is parallel to the baseplate centre line.

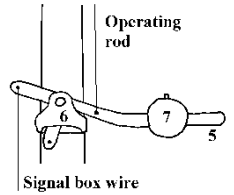
Use the minidrill and slitting disc to cut a groove in the baseplate to take the bottom end of the ladder. This should be perpendicular to the centre line, at the distance from the rear of the post given in the third column of the table above.

For a bracket signal, attach the doll to the bracket according to instructions supplied with the bracket.

The Balance Weight and Post Fittings:

[The cranked arm on (5) is usually only found on bracket dolls, but provides a convenient method of providing arm motion stops on a straight post signal. If unhappy with this compromise, remove the cranked arm, and provide wire stops mounted on the post.]

Use 145° solder for this section unless otherwise stated. There are many different balance lever configurations, so check with photographs.



For a single balance lever, open out the central hole in a balance lever (5) to 0.50mm (no.76). Do the same to the holes in a bracket (6). Open out the other holes in the balance lever to 0.40mm (no.78). Solder weights (7) to either side of the lever to increase the thickness as desired. Fold up the bracket (6), with the half-etched lines on the **inside** of the bends and tin the rear. Solder one of the etched washers to the end of a 26swg nickel silver axle, having first opened out the washer hole to 0.50mm (no.76) and before removing the washer from the fret. Pass the axle through the holes in (6), trapping the balance lever so that with the open jaw upwards, the crank is pointing down through the slot, and the weight is to the right.

Drill a 0.50mm (no.76) hole right through the appropriate faces of the post or doll, 10mm above the bottom end (or higher if your prototype requires it, particularly if an operating wire crank is to be added). Push the axle through the post and solder (145° or 70°) in place at the other side. Ensure the lever still moves freely - if not, remelt the joint, and push the wire out slightly. Run a bead of 145° or 70° solder along the top edge of (6) to secure it to the post. Trim the axle so it is

flush with the post. For multiple balance levers, as might be found on a home/distant or bracket signal, proceed as above, using bracket (8) instead of (6).

On straight post signals, the signal box operating wire was usually led away from the signal via a vertically-mounted pulley wheel (9). Fold up the second bracket (6) as before, and again trap the wheel inside the bracket using a nickel silver wire axle with a washer soldered to each end. Trim the axle ends and solder the bracket base to the baseplate, in line with the wire hole on the balance lever, and pointing in the direction from which the operating wire approaches the signal (parallel or perpendicular to the track).

Bracket and some straight post signals had a crank arrangement. For this, attach one or more of the cranks (10) inside the second bracket (6) or wider bracket (8), in the same manner as described for the wheel, with the open jaw pointing downwards, and the crank pointing down like an inverted "V". Consider from which direction the operating wire approaches the signal. Drill the correct post/doll faces 0.50mm (no.76), at a height such that the lowest crank hole is just above baseplate/ground level or as shown on your bracket signal photograph. Solder the axle and bracket in place, as described above for the balance lever.

Fold lamp bracket (11), with the half-etched lines on the inside. Solder (188°) support (12) into the half-etched lines so the narrowest part falls underneath the circle. Tin the back and top of the bracket with 145° solder. Solder (145° or 70°) the bracket to the right-hand side of the post, so its top surface is around 2.5mm below the arm bearing centre line. Temporarily fit the arm and offer up the lamp to ensure the lens falls centrally behind the spectacles; adjust the bracket's position if required.

If needed (never on distant signals), solder (145° or 70°) the track circuit plate (13) to the post. On tubular posts, centre it 6mm (18") above the post/butt joint; 52mm (13ft) above the baseplate/ground level on square posts; or around 15mm below the arm bearing centre line on short posts/dolls.

The Platform and Ladder
Use 145° solder for this section unless otherwise stated.

Posts/dolls without a lampman's platform:
On a straight post signal, the ladder is always at the rear, whilst on a doll, the position varies. Remove the end rung from an S009 series ladder. Bend the side stiles over at around 105° just above the new top rung, with the half-etched side on the outside of the bend. Cut the ladder to length, so its bottom end fits in the baseplate groove or can be soldered to fixing wires, and its top end fits around the post, 6mm below the arm bearing centre line. Solder the ladder top and bottom, with the top bend being 3mm from the rear of the post.

Form the safety hoop from strip (14). Wrap it round a 9/32" or 7mm drill; the natural spring of the brass will open it to the correct 7.5mm diameter. Bend the end tags to the ladder width and solder them to the outside of the ladder stiles, just below the top rung. Cut a length of side stile from the waste portion of the ladder to form a lampman's handhold. Very carefully solder (or glue) this to the right-hand ladder/hoop joint, sloping it so it is in line with the ladder, rather than vertical. Trim the top so it projects 4mm above the top rung.

Posts with a lampman's platform:
Position platform (15) to the rear of the post, 15mm below the arm bearing centre line, with the half-etched lines uppermost. Ensure the back edge is touching the post, splaying the tags to give a tight fit. Solder (145° or 70°) it in place.

Warning: the etched handrail (16) is rather delicate. Make sure the holes clear 0.31mm brass wire before removing it from the fret. Once removed, do not attempt to remove the remains of the fret tags until the handrail is strengthened by being fixed to the post.

Fold down the handrail tag so the half-etched line is on the **inside** of the bend. Solder (145° or 70°) the tag to the post with it pointing downwards, so the handrail is 5mm below the arm bearing centre line and when seen from above, the handrail's "square" corner is on the right-hand side of the post. Err on the side of having the handrail too low, rather than too high, otherwise it will be difficult to fit the back-blinder. Solder two 0.31mm brass wire supporting stanchions between the handrail holes and the notches in the platform corners. Remove any excess wire with side cutters. As these will not cut exactly flush, a "bolt-head" is naturally left at each cut.

Cut the side stiles from one end of the ladder, leaving a rung as the topmost edge. Cut the ladder to length, so its bottom end fits in the baseplate groove or can be soldered to fixing wires, and its top end rests against the rear edge of the platform. Solder the ladder top and bottom, with the half-etched side to the rear.

All post heights:
Add one or more pairs of ladder bracing struts (17). Solder them to the ladder (145°) and post (145° or 70°), joggling them to allow for the width difference. Check their height and number with photographs. The ladder end joints should be on the outside of the stiles, and never exactly level with a rung. On a tubular post, bend them around the front of the post to give the appearance of a single continuous strip. Remove any excess strut length and tidy up.

The Lamp and Finial:
Use 70° solder or glue for this section.

Remove any casting sprue and mould lines from the lamp and finial. Fix the lamp centrally on the circular part of the bracket, with the slightly larger lens facing forwards. Finally, add the finial to the post top, checking it is square in all three planes.

Painting:

When first introduced, the general tubular post colour was white. In Western Region days, this changed to an aluminium grey. Signals on lines then taken over by other Regions changed back to white – as always, check with photographs! Square posts were always white.

Degrease the post and arm assemblies by washing in warm water and leaving to dry. Spray overall with white or grey car primer as determined above (use white for the arm, regardless of post colour). Mask the ends of the bearing to avoid painting the inside of the tube. Detail paint as follows:

Black: post to just above and including the balance weight assembly (lever outboard of the weights is white); lamp and lamp bracket; arm bearing; vertical sides of the finial base; a band on the post 2mm deep (4mm on square posts) above and below the track circuit plate; track circuit plate bolt-heads; arm spectacle plate; arm rear band/chevron; front chevron on a distant arm. On square posts, also blacken the ladder above the level of black on the butt and any bracing struts above this; safety hoop and handhold or handrail and platform.

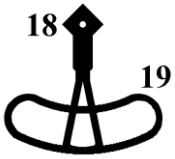
Full-size arm painting templates:

Red (home) or Yellow (distant): front and edges of the arm except the home's white band or distant's black chevron; finial ball (red on a post/doll with both home and distant arms). For an arm fitted with a goods line ring, the white stripe on the front is omitted, and the front, rear and edges of the ring are white.

Silver: lamp lenses front and rear.

Glaze the spectacles; use red (home) or yellow (distant) in the top aperture, and blue-green in the bottom one. The easiest method is to cut a piece of glazing approximately to size so the whole of the aperture is covered, fix it in place using MSE's *GSA* adhesive or gloss varnish, and then trim the edges when set. Coat the front of the glazing with gloss varnish to give a better glass effect.

Fixing the Arm to the Post:



Place the arm spindle into its bearing and ensure it moves freely – clean off any paint that might have crept in. Open out the hole in back-blinder spindle (18) to 0.80mm (no.68). Solder (188°) the spindle to the plain face of back-blinder (19) so the arc on (18) is at the outer edge of (19), and (19) is symmetrical about the axis of (18).

Place the back-blinder assembly onto the arm spindle, up against the rear face of the arm bearing. Unfortunately, this is where any constructional inaccuracies will become apparent, as the back-blinder arc is very close to the platform handrail. If it will not swing freely, unsolder (19) from (18), and push it towards the pivot hole, thus decreasing the radius of swing. File off any part of (18) that now projects outside (19). You may now find that the back-blinder no longer covers the lamp's rear lens when it is rotated. Again, adjust the position of (19) on (18) until it does so, and still swings freely, perhaps removing some material from the bottom edge of (19).

Remove the back-blinder from the spindle and place an oiled paper washer over the spindle end. Replace the back-blinder and solder (145°) it to the spindle, adjusting so it just clears the lamp rear lens with the arm horizontal, and pushing it sufficiently far on to the spindle to remove any fore and aft spindle motion. Remove the excess spindle length with the slitting disc. Wash off any surplus flux, then prime and paint black.

The Operating Rod:

Blacken a 0.31mm operating rod, by either priming and painting black, using a permanent marker pen, or (preferably) a proprietary metal blackening solution. Make a small hook in the top of the rod. Put the hook in the bottom arm hole from the rear of arm. With the arm horizontal, and the balance lever at the bottom of its travel, cut off the surplus rod around 5mm below the balance lever rod hole. Form a 90° bend to the left in the rod at the correct distance, and pass it through the balance lever hole from the right-hand side, forming a hook to retain it. Note that the rod usually passes in front of the track circuit plate, if fitted. Move the balance lever through its travel, and check for adequate motion of the arm. You may find that the rod flexes, rather than moving the arm. To prevent this, thread a couple of the etched brass washers onto the rod to act as guides, and carefully solder them into horizontal channels filed into the post. Make good the paint finish afterwards.

You may find that the weight of the balance lever is insufficient to keep the signal arm on. If so, add one or two SC0041/1 cast weights to the lever.

The signal may now be installed on the layout and connected to your chosen means of operation.

With thanks to the Kidderminster Railway Museum, the Severn Valley Railway and Network Rail for allowing me to measure and photograph the real thing.