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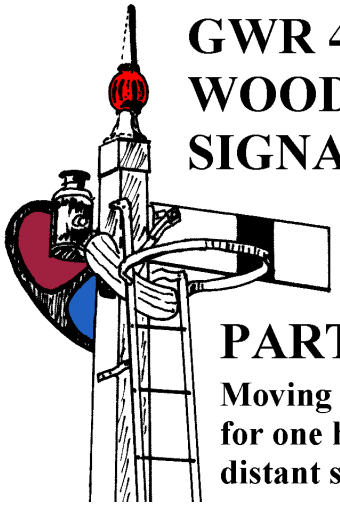
SCALE	CODE	
4 mm	S0014/1	



GWR 4ft WOODEN SIGNAL

PARTS

Moving parts for one home or distant signal

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

Four foot wooden arms were introduced by the GWR in 1887, and used for new installations and renewals until the advent of steel arms in 1930. They are suitable for wooden posts and dolls up to 26ft tall. The occasional lattice or concrete post was also found. Signals above 26ft used a 5ft arm, and this is the subject of a separate pack. The wooden arm is now thought to be extinct on Network Rail as the GWR and BR(WR) replaced many with steel arms, and eventually replaced the whole signal with the tubular steel post type.

Identification of components on fret:

1. Home arm 2. Distant arm
3. Motion plate 4. Back plate
5. Spectacle plate 6. Balance levers (2)
7. Single balance lever/crank brackets (2)
8. Balance weights (4)
9. Multiple balance lever/crank bracket
10. Signal wire pulley wheels (3)
11. Signal wire cranks (4)
12. Lamp bracket 13. Lamp bracket support
14. Rule 55 track circuit plate
15. Lampman's safety hoop
16. Lampman's platform
17. Platform handrail
18. Ladder bracing struts (4)
19. Back blinder spindle
20. Back blinder 21. Goods line ring

Not all parts will be used on any given signal. The goods line ring (21) was not found on 4ft arms, but is included as a useful spare part.

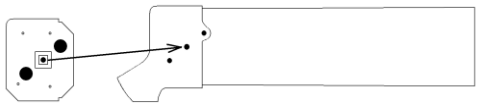
ASSEMBLY INSTRUCTIONS

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.

Open out the centre holes in the home (1) or distant (2) arm and those in the motion (3) and back (4) plates to 0.80mm (no.68). Open out the lower holes in the arm and motion plate (3) to be a loose fit on 0.31mm brass wire. Solder (3) on top of the half-etched portion of arm (1) or (2), using stainless steel needles (or anything else that won't take solder) to align the holes. Now turn the arm assembly over, and solder (4) onto it, orienting the parts as shown, and using needles for alignment:



Now switch to 145° solder.

Turn the arm assembly over again, and solder the spigot of spectacle plate (5) into the corresponding slot on (3). 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, avoid tilting the arm. 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: *being cast in whitemetal, the 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!*

Prototype signals 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 that of the arm centre-line above rail level, so the post cutting length in the second column includes an allowance of 3.5mm and 4mm at the top and bottom of the post respectively. Non-standard cutting heights can thus be calculated from the table - make allowance for any signal not mounted on the ground. Also, if not mounting the signal on a baseplate, and for bracket signal dolls, remember to add sufficient length for your chosen fixing method. Note that a platform starter is typically 16ft high, and that posts 18ft and above were fitted with a lampman's platform.

Height (ft/ins)	Post cutting length (mm)	Post to ladder distance (mm)
12.0	55.5	10.0
14.0	63.5	11.0
16.0	71.5	12.0
18.0	79.5	14.5
20.0	87.5	15.5
22.0	95.5	16.5
24.0	103.5	17.5
26.0	111.5	18.5

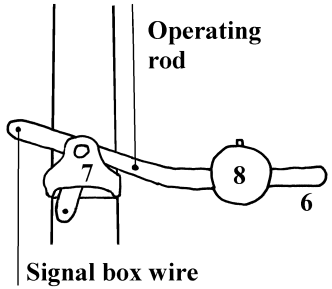
Cut the post/doll to length, removing the excess from the bottom of the casting. Fill in any cast notch, remove any flash and mould lines, file off any cast detail and square the post ends. File along the length of the post rather than across it, so any file marks look like timber grain. Straighten the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

Solder a 1/16" bearing tube to the post at right angles 3.5mm 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 0.5mm beyond the front and rear post faces. If using a baseplate (scrap brass sheet, around 60 x 15mm), scribe a longitudinal centre line, then drill a 1.0mm (no.61) hole on the line around 15mm from one end. Also drill two 1.0mm ladder foot holes 2mm either side of the centre line, at the distance from the post hole given in the table above. *[For unlisted heights below 18ft, multiply the height in feet by 4, subtract 2, divide by 8, and add 4 to give the drilling distance in mm. For heights above 18ft, multiply the height in feet by 4, subtract 11, divide by 8, and add 7.]* Orient the post and baseplate so the arm bearing is to the left and most of the baseplate is to the rear and solder together using a 1.0mm wire peg through the hole, ensuring squareness in all three planes. 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 (6) 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 (6) to 0.50mm (no.76). Do the same to the holes in a bracket (7). Open out the other holes in the balance lever to 0.40mm (no.78). Solder weights (8) to either side of the lever to increase the thickness as desired. Fold up the bracket (7), with the half-etched lines on the **inside** of the bends. Tin the rear of (7) with both 145° and 70° solders. 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 (7), 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 (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 70° solder along the top edge of (7) 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 (9) instead of (7).

On straight post signals, the signal box operating wire was usually led away from the signal via a vertically-mounted pulley wheel (10). Fold up the second bracket (7) 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 (11) inside the second bracket (7) or wider bracket (9), 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 (12), with the half-etched lines on the inside. Solder (188°) support (13) into the half-etched lines so the narrowest part falls underneath the circle. Tin the back and top of the bracket with both 145° and 70° solders. Solder (70°) the bracket to the right-hand side of the post, so its top surface is 3mm below the arm bearing centre line. If needed (never on distant signals), solder (70°) the track circuit plate (14) to the post. Centre it 52mm (13ft) above the baseplate/ground level, 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.

Post/doll height less than 18ft:
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 holes 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 (15). 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, as shown in the heading drawing. Cut a length of side stile from the waste portion of the ladder to form a lampman's hand-hold. 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.

Post height 18ft or above:
Position platform (16) 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 (70°) it in place. Make sure the holes in handrail (17) clear 0.31mm brass wire. Fold down the tag so the half-etched line is on the **inside** of the bend. Solder (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 in two 0.31mm brass wire supporting stanchions. 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 holes 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 pairs of ladder bracing struts (18). Solder them to the ladder and post (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. 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 (1927 on):

Degrease the post and arm assemblies by washing in warm water and leaving to dry. Spray overall with white car primer, mounting the arm in its bearing to avoid painting the spindle and bearing tube. Detail paint as follows (but check with photographs as there is a lot of variation):

Black: post to just above and including the balance weight assembly; ladder above the level of black on the butt and any bracing struts above this; safety hoop and hand-hold or handrail and platform; lamp and lamp bracket; arm bearing; vertical sides of the finial base; a band on the post 4mm deep above and below the track circuit plate; track circuit plate bolt-heads; arm spectacle plate, motion and back plates; arm rear band/chevron; front chevron on a distant arm.

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).

Silver: lamp lenses front and rear.

For a pre-1927 signal: proceed as above, but all parts listed as yellow were red, and the distant's front chevron was white, not black.

Glaze the spectacles; use red (home) or yellow (distant) in the top aperture, and blue-green in the bottom one. (A pre-1927 distant had red in the top aperture.) 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 for 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 (19) to 0.80mm (no.68). Solder (188°) the spindle to the plain face of back-blinder (20) so the arc on (19) is at the outer edge of (20), and (20) is symmetrical about the axis of (19).

Place the back-blinder assembly onto the arm spindle, against the rear face of the arm bearing. 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 (20) from (19), and push it towards the pivot hole, thus decreasing the radius of swing. File off any part of (19) that now projects outside (20). The back-blinder may no longer cover the lamp's rear lens when rotated. Again, adjust the position of (20) on (19) until it does so, and still swings freely, perhaps removing some material from the bottom edge of (20).

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 brass wire 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. The rod may flex, rather than moving the arm. To prevent this, bend up one or more narrow U-shaped guides from 0.31mm brass wire, and glue them in to pairs of holes drilled in the post's front and left-hand faces, trapping the rod in the bend. Small loco handrail knobs may be used instead, but remember to thread them onto the rod before making the lower bend.

If the weight of the balance lever is insufficient to keep the signal arm on, add one or more 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 and the Severn Valley Railway for allowing access to the real thing.