

# THE ORANGE BOOK

**XL*****Multiphase***<sup>®</sup> operator's guide

PSL1569 issue 1



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# Introduction

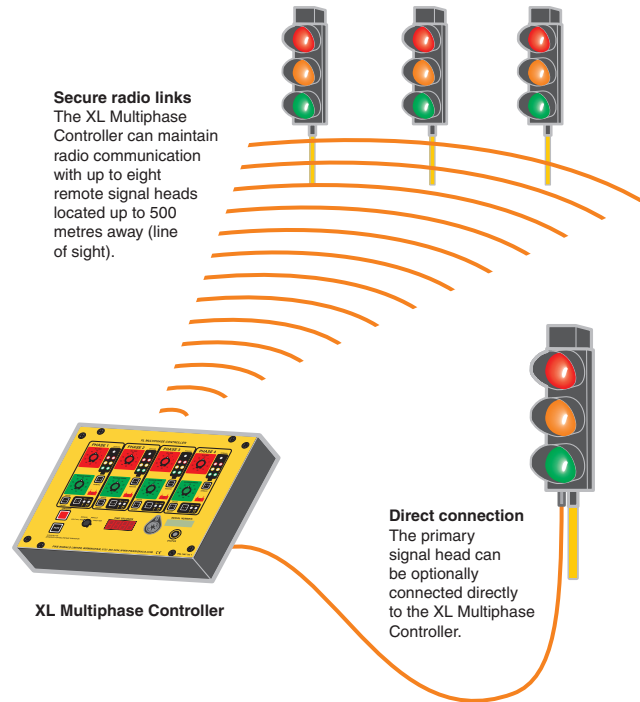
## Welcome

Thank you for choosing the XL Multiphase Controller which allows you to orchestrate up to eight wireless signal heads controlling a maximum of four separate traffic phases.

Using sophisticated radio links and integral failsafe measures, the XL Multiphase system lets you quickly and safely install junction control without the complication of cables.

Although powered by advanced technology within, outwardly the XL Multiphase Controller has a panel with a conventional appearance and logical layout. This allows you to quickly apply settings and then to easily monitor every aspect of the system in operation.

The XL Multiphase Controller is fully type approved to Highways Agency specification TR2502 and is manufactured in the UK in accordance with ISO 9001 Quality Assurance procedures.



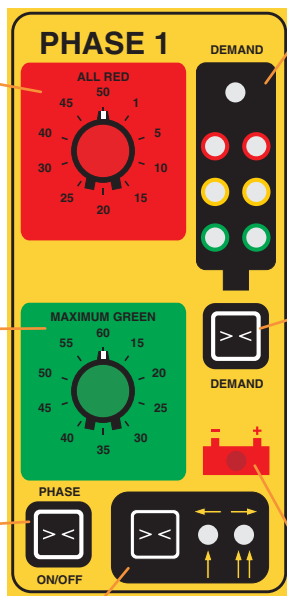
## XL Multiphase panel layout

The control panel of the XL Multiphase Controller is arranged logically for ease of set up and use. General items are located in the lower section of the panel while controls specific to each phase are placed in four identical groups.

**All red dial**  
Sets the time (in seconds) that all signal heads must remain on red before the next phase can begin its amber/green cycle (see page 11).

**Maximum green dial**  
Sets the time (in seconds) that this phase will show green during a normal cycle of operation (see page 11).

**Phase on/off button**  
Use this button to enable or disable this phase within the current set up (see page 11).

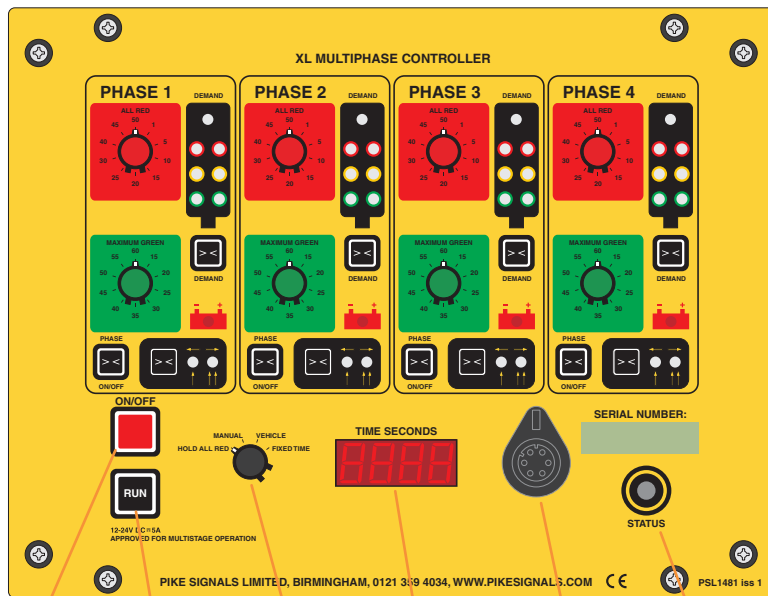


**Phase mode**  
This section determines the number of heads and their function within this phase (see page 11).

**Signal head mimic**  
These indicators show the signals currently being given at the head(s) for this phase (left side = primary head; right side = secondary head). The top (demand) indicator shows when the microwave vehicle detector recognises an approaching vehicle (see page 16).

**Demand button**  
When the mode switch is set to MANUAL, this button simulates the microwave vehicle detector being triggered for that phase. When pressed, the chosen phase will change to green after all others have been set to red (see page 12).

**Low battery indicator**  
Illuminates to warn that one or both of the remote heads on this phase are getting low on battery charge (see page 16).



**ON/OFF button**  
Press and release to switch on, press and hold for two seconds to switch off (see page 11).

**RUN button**  
Press to begin running the programmed sequences (see page 12).

**Mode switch**  
Selects the main operation mode for the system as a whole (see page 13).

**Timer display**  
Counts the elapsed time (in seconds) within the current phase of operation. When failures occur, this displays troubleshooting codes (see page 16).

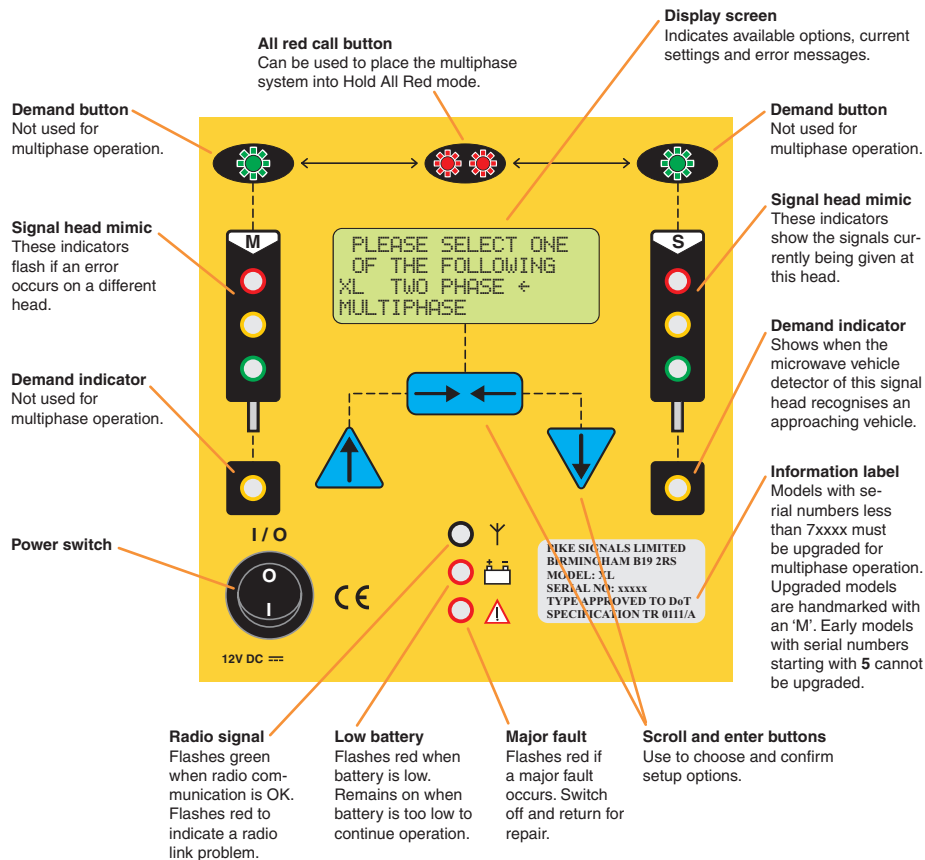
**Expansion connector**  
Reserved for future use.

**Status indicator**  
Displays green or red to indicate the current status of operation (see page 16).

## XL signal head panel layout

The control panel of each XL signal head is located either at the rear of the head or within the head's base unit.

All XL signal heads must be configured before the XL Multiphase Controller begins operation. All configuration is achieved using the three blue buttons and the display screen.



# Installation

The XL Multiphase Controller can control up to four phases of traffic, either all via wireless links or with one phase directly connected by cable and the remainder by wireless. According to the junction layout, the XL Multiphase Controller can be set to control each junction approach as a separate phase or alternatively combine both directions of a road within a single phase.

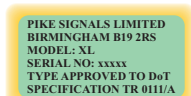
## XL signal heads

### Checking whether a head can be used

There are two ways to determine the suitability of an XL signal head:

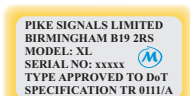
#### Check the serial number

In the lower right corner of the XL signal head control panel is the serial number label. It will take one of three forms:



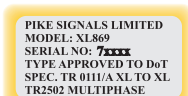
#### Old version

Must be upgraded before it can be used with the XL Multiphase Controller. See note below:



#### Upgraded

Label marked by a handwritten **M** or with a sticker. Can be used with the XL Multiphase Controller.



#### New version

Serial number 7xxxx or above. Can be used with the XL Multiphase Controller.

#### Note

Models that have serial numbers beginning with **5** cannot be upgraded or used with the XL Multiphase Controller.

#### Switch on and check the initial screen

- If this is the initial screen then the XL head **IS** able to operate with the XL Multiphase Controller.
- If this is the initial screen then the XL head **IS NOT** able to operate with the XL Multiphase Controller until it receives an upgrade.



PLEASE SELECT ONE  
OF THE FOLLOWING  
XL TWO PHASE ←  
MULTIPHASE



FOR LAST MODE/SET UP  
TIMES PRESS ENTER →←  
FOR NEW MODE/SET UP  
TIMES PRESS SCROLL ↓

### Upgrading earlier XL signal heads

Most earlier versions of XL heads (except those with 5xxxx serial numbers) can be upgraded to operate with the XL Multiphase Controller. The upgrade work must be carried out by a Pike certified engineer, either on site or at Pike Signals. Contact Pike Signals for details.

# Setting up the heads and controller

## 1 Set up all signal heads, cones and signs according to Highways Agency regulations.

### Required reading

- 'The use of vehicle actuated portable traffic signals' (the 'Pink Book') ISBN: 0115507817
- 'Safety at street works and road works' (the 'Maroon Book') ISBN: 0115519580
- 'Traffic signs regulations and general directions' (TSRGD) Chapter 8 ISBN: 0110429427

Attach the supplied antenna to the XL Multiphase Controller and connect a fully charged battery. Ensure that all signal head batteries are fully charged.

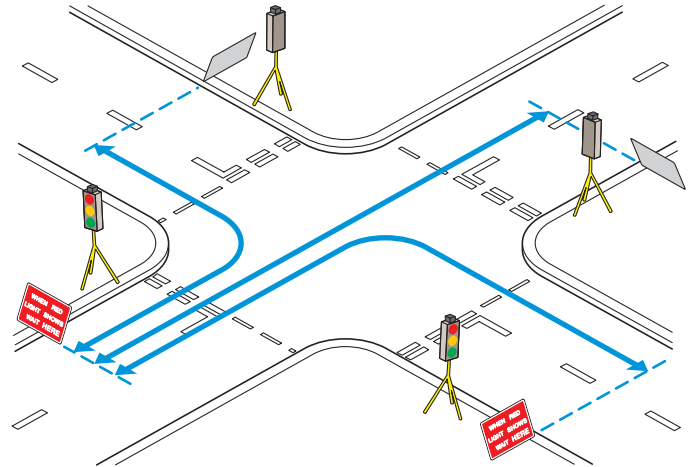
### Notes

The XL Multiphase Controller should be OFF at this stage. The battery should be a 'deep cycle' type of no less than 105Ah capacity.

**If a signal head is directly connected to the XL Multiphase Controller by cable, it will automatically become the primary signal head of phase 1 (PH1+S).**


If a signal head is directly connected to the XL Multiphase Controller, the cable must be less than 5 metres in length and the signal lamps should be LED types.

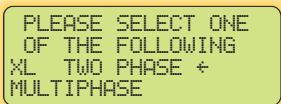


## 2 For each approach, measure the distance from each WAIT HERE sign to the WAIT HERE sign furthest away.





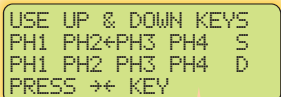


### 3 On each remote XL signal head:

**a**  Switch on the signal head at the control panel.

**b**  Press  to choose (⇄) MULTIPHASE.  
Press  to proceed.

#### Important

If the signal head does not display the above screen, it may not be suitable for use. See page 5.

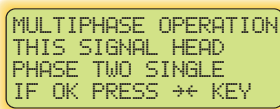



**c**  Press   to choose (⇄) the correct phase number for this head.

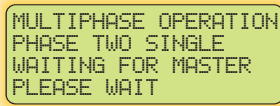
See pages 8 to 10 for phase set up examples.

Press  to proceed.

Use row S for a single or primary signal head.

Use row D for a second signal head in a phase (if used).

**d**  The screen will confirm your settings.  
If correct, press  to proceed.  
If a change is required, use   to make the change, as per step **c**.

**e**  The head is now ready and waiting for control signals from the XL Multiphase Controller. No signal lamps will be lit at this stage.

Repeat for all other signal heads then go to step 4...

...continued on page 11

#### Notes

Ensure that each XL signal head is capable of operating with the XL Multiphase Controller. See page 5 for details about how to check.

**If a signal head is directly connected to the XL Multiphase Controller by cable, it will automatically become the primary signal head of phase 1 (PH1+S).**

Phase set up examples

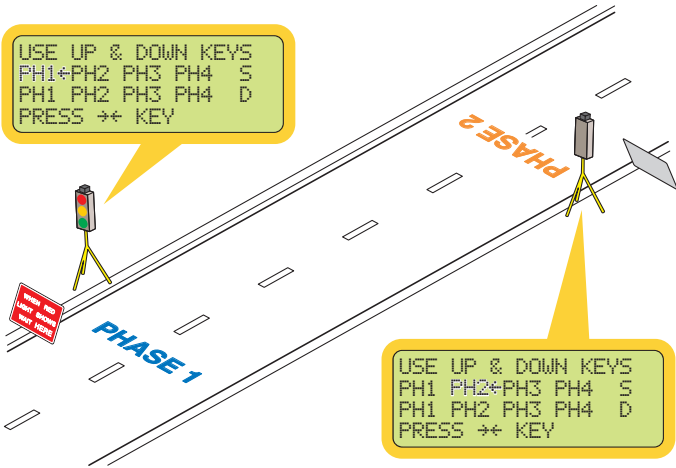
**Example 1:** Carriageway (2 approaches, 2 phases, 2 heads)  
This example shows a carriageway controlled by two single approach phases, each with one signal head.

**Phase modes**

PH PH  
12

One head per approach

USE UP & DOWN KEYS  
PH1+PH2 PH3 PH4 S  
PH1 PH2 PH3 PH4 D  
PRESS ⇐⇨ KEY



USE UP & DOWN KEYS  
PH1 PH2+PH3 PH4 S  
PH1 PH2 PH3 PH4 D  
PRESS ⇐⇨ KEY

**Example 2:** Carriageway (2 approaches, 2 phases, 4 heads)  
This example shows a carriageway controlled by two single approach phases, each with nearside and offside signal heads.

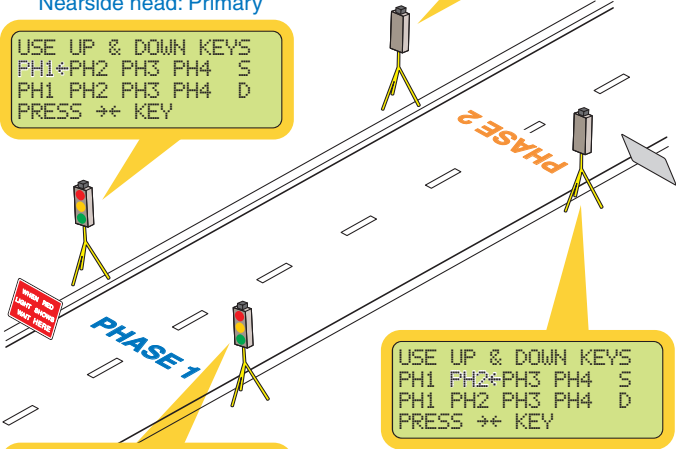
**Phase modes**

PH PH  
12

Two heads per approach

Nearside head: Primary

USE UP & DOWN KEYS  
PH1+PH2 PH3 PH4 S  
PH1 PH2 PH3 PH4 D  
PRESS ⇐⇨ KEY



Offside head: Secondary

USE UP & DOWN KEYS  
PH1 PH2 PH3 PH4 S  
PH1+PH2 PH3 PH4 D  
PRESS ⇐⇨ KEY

Offside head: Secondary

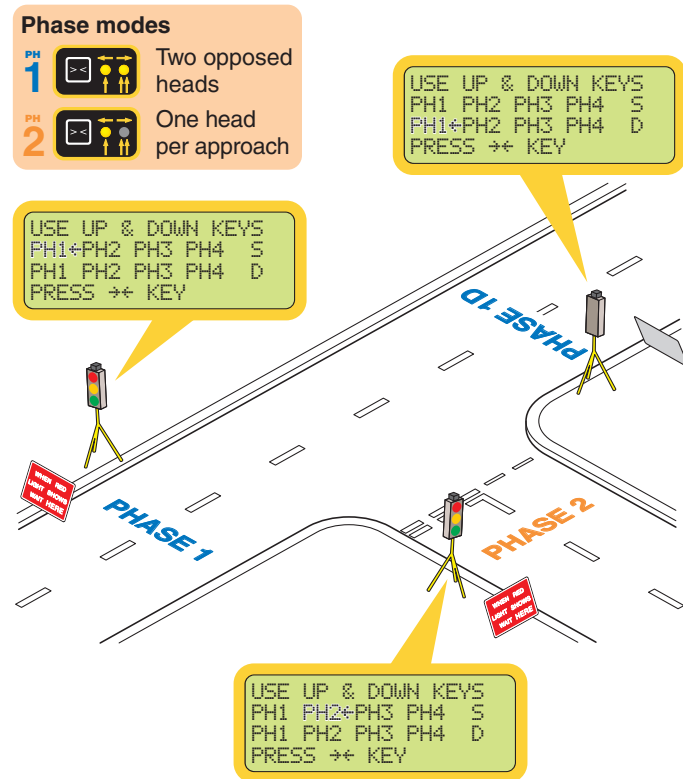
USE UP & DOWN KEYS  
PH1 PH2 PH3 PH4 S  
PH1 PH2+PH3 PH4 D  
PRESS ⇐⇨ KEY

Nearside head: Primary

USE UP & DOWN KEYS  
PH1 PH2+PH3 PH4 S  
PH1 PH2 PH3 PH4 D  
PRESS ⇐⇨ KEY

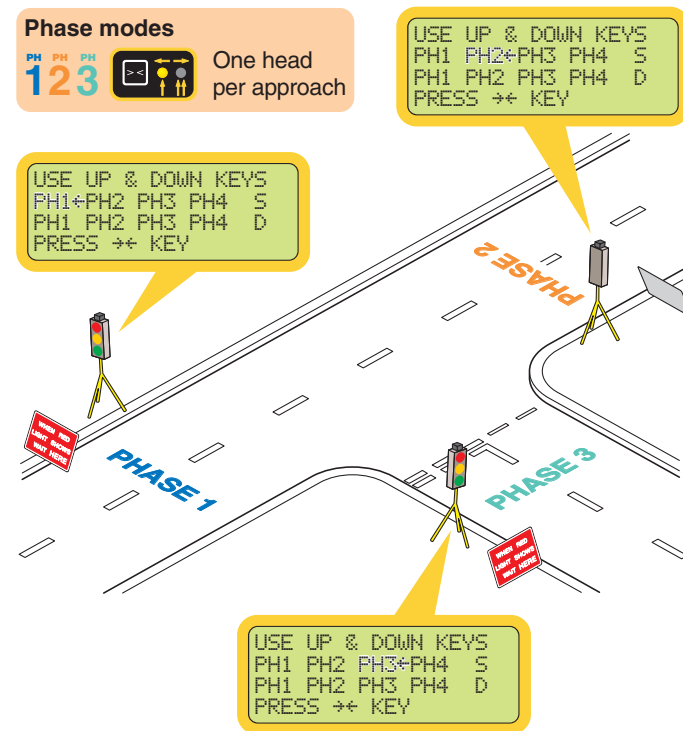
### Example 3: T-junction control (3 approaches, 2 phases)

This example shows two approaches of a main road controlled by one phase with opposed heads. The side road approach is controlled by a single approach phase.



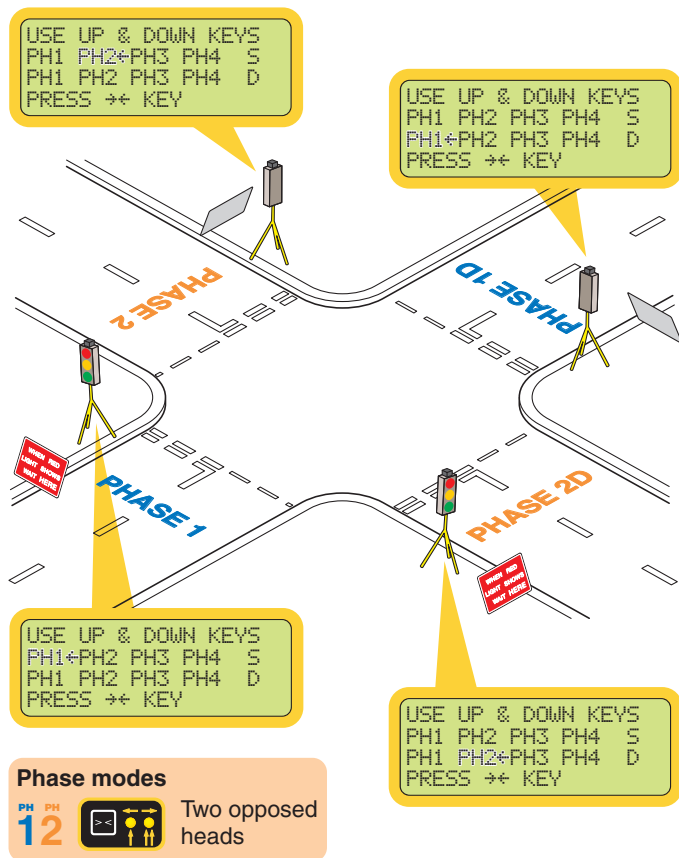
### Example 4: T-junction control (3 approaches, 3 phases)

This example shows two approaches of a main road controlled by two separate single approach phases. The side road approach is controlled by a third single-approach phase.



### Example 5: Crossroad control (4 approaches, 2 phases)

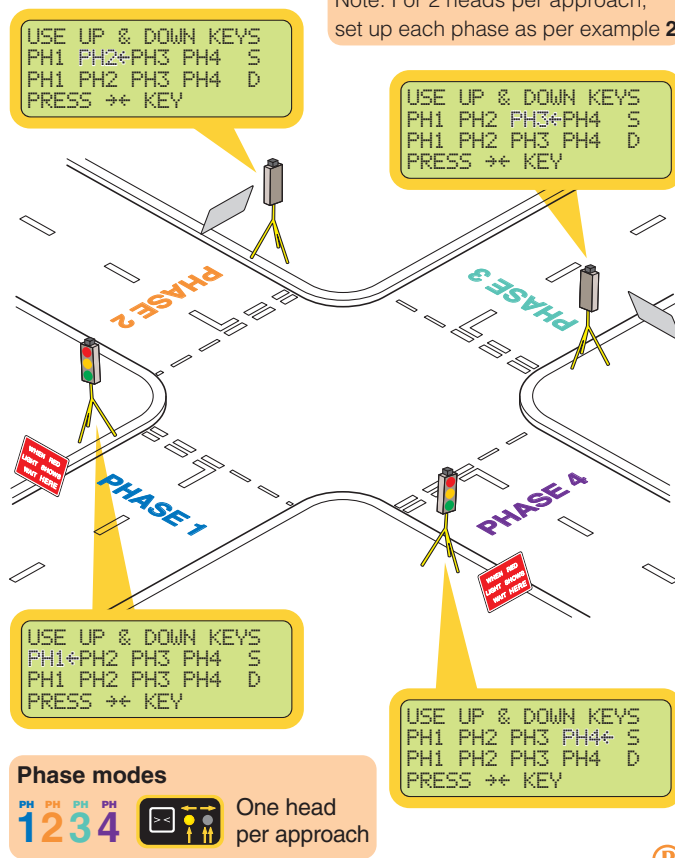
This example shows a crossroad (or staggered junction) controlled by two phases (two opposed heads).



### Example 6: Crossroad control (4 approaches, 4 phases)

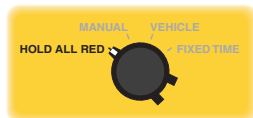
This example shows a crossroad (or staggered junction) controlled by four separate single-approach phases.

Note: For 2 heads per approach, set up each phase as per example 2



## Setting up (continued from page 7)

- 4** On the XL Multiphase Controller, change the mode switch to **HOLD ALL RED**.



- 5** Press the **ON/OFF** button to power on the XL Multiphase Controller.

The controller retains all of the settings from its previous installation.



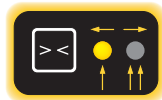
- 6** For each phase that will be used:

- a** Press the **PHASE ON/OFF** button to enable or disable the phase. **Ensure that all unused phases are disabled.**



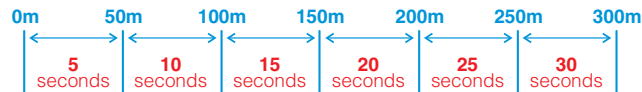
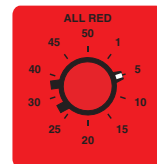
- b** Press the phase mode button to choose the appropriate mode:

- One head per approach
- Two heads per approach
- Two opposed heads



See pages 8 to 10 for phase set up examples.

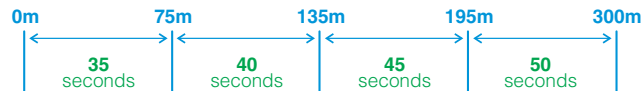
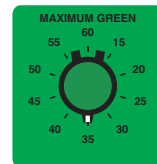
- c** Using the measurement taken earlier (from this phase's WAIT HERE sign to the WAIT HERE sign furthest away), set the appropriate **ALL RED** time:



### Note

On steep gradients, increase the ALL RED time by 5 seconds for the uphill phase(s).

- d** Using the measurement taken earlier (from this phase's WAIT HERE sign to the WAIT HERE sign furthest away), set the appropriate **MAXIMUM GREEN** time:



Repeat for each active phase and then go to step 7 overleaf

## 7 Press the RUN button to begin operation.

It is at this point that the XL Multiphase Controller will begin to communicate with the remote XL signal heads.



If any communication or configuration problems exist, it is now that they will become apparent.

Errors are signalled on the XL Multiphase Controller panel in three main ways:

- Flashing indicators within each phase section of the control panel,
- Error codes shown on the numeric TIME display, and/or
- Flash codes on the STATUS indicator.

Operation will not begin and the signal heads will not be lit until all communication and/or configuration problems are solved.

See pages 14, 15 and 16 for details about error indications and possible remedies.

**When the XL Multiphase Controller is fully confident of the system integrity, the signal heads in each phase/approach will in turn display amber and then red.**

### Important

To preserve battery power, after 20 minutes of normal operation the XL Multiphase Controller panel indicators will switch off. The backlight for the RUN button and also the STATUS indicator will remain on and normal operation will continue. To restore the indicators, press the RUN button.

## 8 You can now switch to VEHICLE activated operation.

**If traffic is tailing back significantly on one approach:**

- a** Change the mode switch to **MANUAL**.



- b** Press the **DEMAND** button for that approach/phase.



- c** Then, as the traffic starts to flow, change the mode switch to **VEHICLE**.



**If traffic is evenly spread among the approaches:**

- a** Change the mode switch straight to **VEHICLE**.



# Operation

## Making adjustments

When the system is running, continue to monitor the build up of traffic on each approach. If regular patterns of significant traffic queues are emerging on particular approaches, consider making careful adjustments to alleviate the problem.

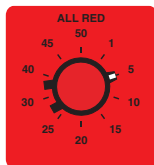
Timing adjustments can be made to a phase at any time. The effects of timing changes will be incorporated during the next full cycle of operation for each phase.

### Note

Introduce timing changes in small steps and one at a time. Observe the results before making any further changes.

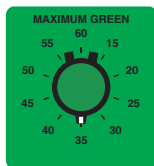
### Slow moving vehicles not clearing the works

If there are large numbers of slow moving vehicles which have difficulty in clearing the works before the signals have changed, increase the **ALL RED** settings for the affected approach(es) by 5 seconds.



### Vehicles taking more than one green period to clear the works

If substantial queues begin to form and vehicles regularly take more than one green period to get through the works, increase the **MAXIMUM GREEN** settings for the affected approach(es) by 5 seconds.



## Operation modes

The mode switch determines how the system operates.

### MANUAL

Phases respond to the control panel DEMAND buttons - the microwave vehicle detectors of the heads are ignored. In this mode, the ALL RED time settings for each phase are used, the minimum green time is set at 12 seconds and the maximum green time is determined by the operator's actions. *Note: It is important to set the correct ALL RED time for each phase in order to prevent green signals being given too soon on opposing phases.*

### VEHICLE

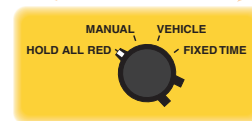
All enabled phases use their configured timings and respond to the microwave vehicle detectors on each signal head. This is the most efficient mode of operation and should be used in most situations unless there are special circumstances.

### HOLD ALL RED

All signal heads are forced to red and held until the mode is changed.

### FIXED TIME

All enabled phases use only their configured timings - the microwave vehicle detectors of the heads are ignored. This is an inefficient mode of operation as it does not adapt to the prevailing traffic conditions.




## Calling 'hold all red' from a signal head


The multiphase system allows the 'hold all red' mode to be invoked from any of the remote signal heads as well as via the main control panel. This is a useful feature for:

- Occasional heavy plant crossings,
- When the works involve temporarily blocking the shuttle lane(s), or
- When traffic needs to be stopped due to an accident or incident within the works area.

### To call 'hold all red' from a remote signal head

- 1 On the remote signal head, press the **all red call** button.
  - All signal heads will be returned to red and will stay at red until the state is overridden.
  - The time display on the XL Multiphase Controller will show **rrc** (remote red call).
  - The display panel on each head will show **ALL RED KEY ACTIVE**.

### To override the 'hold all red' state

- 1 On the XL Multiphase Controller, press the **RUN** button.
  - The system will resume with the mode that was running prior to the 'hold all red'.

## Resetting the system

Certain failures within the XL multiphase system require the operator to cure/acknowledge the failure and reset the system as a whole. In such cases the system may be held within a special condition or remain operating in a reduced mode.

### To reset the system after an error

- 1 Inspect the XL Multiphase Controller panel indicators to trace the problem. Pages 15, 16 and 17 provide descriptions.
- 2 If the problem is traced to one or more signal heads, visit each affected head and check the control panel(s). Depending on the fault:
  - If possible, rectify the problem and reset the signal head(s),  
or
  - Replace the signal head(s) and follow the set up instructions in **step 3** (shown **on page 7**) to select the correct phase number(s).
- 3 When all affected heads have been reset, on the XL Multiphase Controller panel press the **RUN** button to restart operation. Monitor the system operation until you are sure that it is operating correctly.



## Decommissioning the system

When the portable traffic signals are no longer required, please follow this procedure to decommission their use:

- 1 Ensure that the shuttle lanes are cleared of obstructions (with the exception of the signals heads, their cones and related warning signs).
- 2 Change the mode switch of the XL Multiphase Controller to **HOLD ALL RED**.
- 3 In turn, go to each approach and face the signal head away from the traffic.
- 4 When all signal heads have been faced away from traffic, press and hold the **ON/OFF** button on the XL Multiphase Controller until all indicators extinguish.
- 5 Remove the signal heads from the carriageways.
- 6 Carefully remove all cones, then the signs, all in accordance with the recommended procedures given in the guide “Safety at street works and road works” ISBN: 0115519580.

## Incidents during operation

In accordance with Highways Agency specification TR2502, the XL Multiphase Controller and all associated signal heads monitor themselves continually for faults or unexpected incidents during operation. The system as a whole adheres to a defined set of responses for particular failures, as discussed here.

### Red signal failures

If a red signal failure is detected on a signal head:

- The green signals on all other approaches/phases will be suppressed. In other words, as any other phase begins its sequence, the green signal that should immediately follow the red/amber will be blanked. The signal head with the failed red is the only one that will continue to show green during its active cycle. All green times will be reduced to 12 seconds.
- On the XL Multiphase Controller panel, the mimic indicator representing the failed red signal will flash continuously.

If failed red signals are detected on more than one signal head:

- All signals will be immediately blanked and the controller will stop operation.
- On the XL Multiphase Controller panel, the TIME display will show **Stop** and the mimic indicators representing the failed red signals will flash. See **Resetting the system** on page 14.

### Green signal conflicts

If opposing phases show green signals simultaneously at any time:

- All signals will change directly to red (no amber signal) and all will remain at red. See **Resetting the system** on page 14.
- On the XL Multiphase Controller panel, the TIME display will show **Stop** and the mimic indicator representing the signal head that incorrectly presented a green signal will flash.

## Error indications

The XL Multiphase Controller uses its various panel indicators to provide assistance in tracing and solving operational problems.

### Mimic indicators (for each phase)

In normal operation these displays mimic the currently active lamps of each signal head with a steady illumination of the appropriate lamp colour. If a lamp fails or a green conflict is detected, the relevant indicator(s) will flash to highlight the location of the problem. The left three indicators of the mimic represent the primary signal head for a phase, the right three indicators represent the secondary head (if used). The top indicator shows when a vehicle is detected by the microwave vehicle detector (on either signal head).



### Battery indicators (for each phase)

The battery indicator will flash when there is roughly two hours of operational time remaining within a remote signal head battery. When the battery becomes too low for operation, the signal head will switch off and the indicator on the XL Multiphase Controller will remain on. If two heads are used within a phase, the low battery state could signify low power at either or both signal heads - the control panel on each XL signal head will provide further details. When the primary signal head and the XL Multiphase Controller are cable connected, they both use a common battery. The common battery's low power state is signified by a **bAt** message on the TIME display.



### Time display

The four digit display at the bottom of the control panel shows a continual count of the elapsed time for the current signal of the active phase. In error situations, this display is used to provide alphanumeric status codes, as follows:



**Cnn** then **Cnf9** Connection/configuration problem with remote XL signal heads. Heads are either not configured as set up on the XL Multiphase Controller or are not available as expected.

**StoP** Operation has been stopped due to a serious fault. Check the other panel indicators and the signal head displays to locate and remedy the fault.

**bAt** The battery supplying the XL Multiphase Controller is running low - roughly two hours operation or less remaining.

**rrc** The system has entered 'hold all red' mode due to a request from a remote signal head. Press RUN to override.

### Status indicator

In normal operation the status indicator will show a constant green light or other states as follows:

**Constant green** System running correctly.

**Constant red** System unconfigured, not running.

**Flashing green** Attempting to locate a remote head that is registered to be available according to panel settings.

**Flashing red** Setting/state change made at the control panel but not yet transferred to the affected signal head(s).

*Note: Alternate red and green flashes may be seen as attempts are made to send new settings to remote heads.*



## Troubleshooting

### Green mimic indicator flashing

A green conflict has been detected. Reset or replace the corresponding signal head, as necessary. See **Resetting the system** on page 14.

### Red mimic indicator flashing

A red lamp failure has been detected. Check and replace the affected signal lamp or head, as necessary. See **Resetting the system** on page 14.

### The Status indicator is flashing

**Flashing green** Communications - attempting to locate a remote head that is registered to be available according to the panel settings.

**Flashing red** Setting/state change made at the control panel but not yet transferred to the affected signal head(s).

**Flashing red and green** Attempts are being made to transfer new control panel settings to one or more signal heads.

### Battery symbol flashing

The indicated signal head has roughly two hours or less of operation remaining before it must shut down. Check the control panel of the affected signal head and replace its battery.

### Battery symbol on

The indicated signal head has shut down due to insufficient battery power. Change the battery of the affected signal head.

### The mimic lights are not working on the controller

The controller has probably entered power save mode (after 20 minutes of operation). Press the **RUN** button to restore the status illuminations, if required. Operation of the signal heads is not affected by the power save mode.

### XL Multiphase Controller does not respond to ON/OFF button

A fuse may have blown within the controller. See page 18 for details.

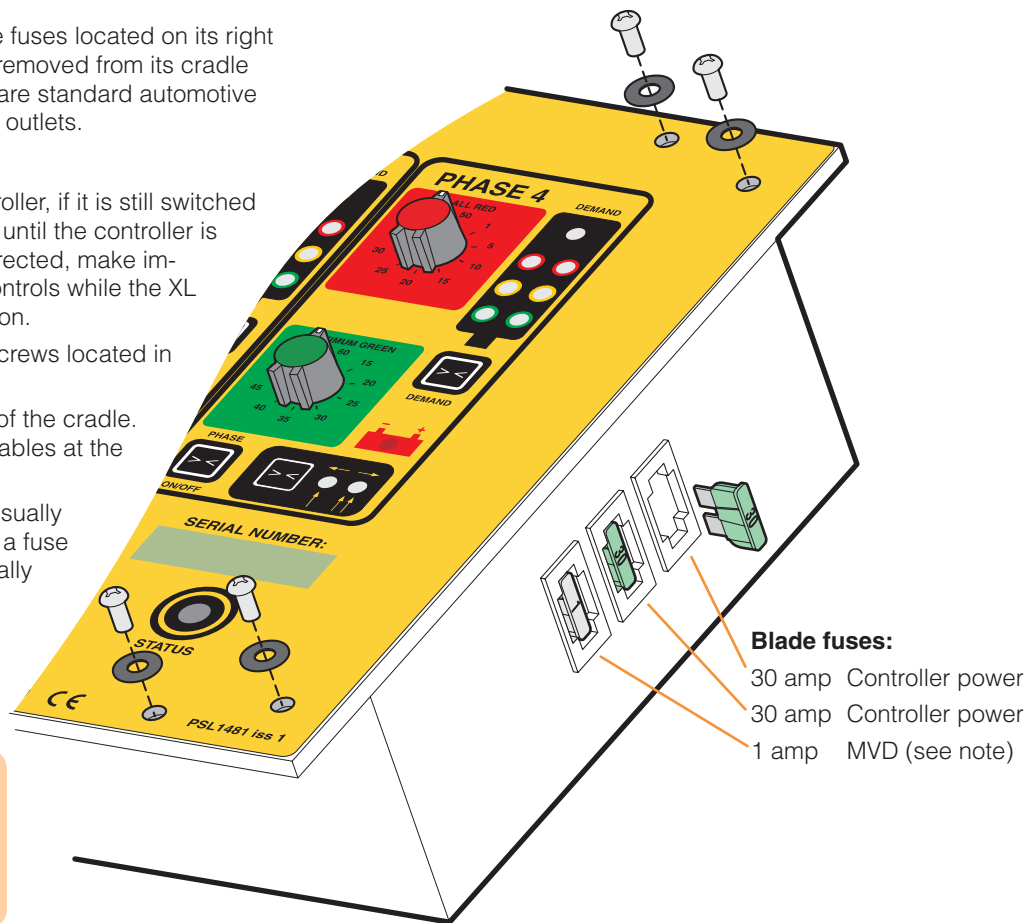
## Fuse replacement

The XL Multiphase Controller has three fuses located on its right hand side. The control panel must be removed from its cradle in order to access the fuses. All fuses are standard automotive blade-types that are available at many outlets.

### To change a fuse

- 1 Switch off the XL Multiphase Controller, if it is still switched on - all slave signals will show red until the controller is reinstated. If traffic needs to be directed, make immediate provision of alternative controls while the XL Multiphase Controller is out of action.
- 2 Remove the eight cross-headed screws located in the corners of the control panel.
- 3 Lift the control panel carefully out of the cradle. Take care not to pull or snag the cables at the rear.
- 4 Pull out each fuse and inspect it visually (and with a meter, if necessary). If a fuse is blown, replace it with an identically rated fuse. Check all three fuses.
- 5 Place the control panel back into its cradle and replace the eight screws.

Note: The 1 amp fuse powers the Microwave Vehicle Detector (MVD) on the signal head connected directly to the XL Multiphase Controller (if used). Check the MVD on the head for indications before checking the fuse.





## Warranty

The XL Multiphase Controller is guaranteed against failure subject to fair wear and tear, correct operation and return to our works carriage paid. We undertake to repair or replace this equipment free of charge providing:

- It has been maintained in good condition and operated with due care, and
- Any failures are directly traceable to faulty material or workmanship.

However, we cannot entertain any claims for labour or other expenditure in connection therewith. Items or components subject to another manufacturer's guarantee are subject to the terms of that guarantee only.

Any warranty given is void if seals on equipment are subsequently found to have been broken without prior permission by Pike Signals Limited.

Any item of equipment repaired by Pike Signals Limited is guaranteed from failure for three months from the date of repair, provided that the item has been subjected to fair usage and regular maintenance.

## Disclaimers

Pike Signals Ltd reserves the right to change or alter product specifications without prior notice. The information contained within this guide is subject to copyright and may not reproduced in part or in full without prior written permission by Pike Signals Ltd. While every effort has been taken to ensure that this guide provides accurate information, no liability shall be accepted for any errors or omissions.

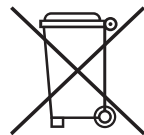
It is a policy of Pike Signals Ltd to seek registered Design and/or Patent Protection for its products.

## Environmental information

### EU directive 2002/95/EC on the Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

It is Pike Signal Limited's desire to meet customer requirements with respect to the RoHS initiative. We are actively working to achieve the important objective of making our products compliant with the EU RoHS directive (and similar initiatives) through efficient product design that reduces unnecessary waste; the use of recyclable materials throughout, and a transfer to lead-free components and solder.

### EU directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)



Pike Signals Limited is focused on developing a compliance program for the European Union ("EU") Directive on Waste Electrical and Electronic Equipment, Directive 2002/96/EC. Under the EU WEEE Directive manufacturers of covered electronic equipment are obligated to take back such products at the end of their useful life.

Pike Signals Limited is committed to meeting or exceeding environmental standards in the production of all products and is engaged in a comprehensive, company-wide effort towards full compliance with the EU WEEE Directive.



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RADIO LINK



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