



 **Evo[®]**  **ACM**

Product Manual

Evo ACM Series Controllers

T2 | T5 | PT5 | PT9 | UTC



 **Portable**

 **TRAFFIC
GROUP
SIGNALS**

Contents

INTRODUCTION

The Evo ACM Series from Traffic Group Signals	3
---	---

SYSTEM OVERVIEW - EVO ACM SIGNALS

Design Features	4
-----------------	---

EVO® ACM SYSTEM

Specification	5
---------------	---

EVO® ACM CONFIGURATION AND CUSTOMISATION

Build your Micro	6
------------------	---

EVO® ACM CONTROLLERS

Evo ACM Controllers	7
---------------------	---

INTRODUCTION - T2 CONTROLLER

Evo T2 Panel Layout	8
---------------------	---

INSTALLATION

Setting up the Signal Heads	9
-----------------------------	---

PREPARING FOR OPERATION - T2 CONTROLLER

Preparing for Operation	10
Setting a Signal Controller (Vehicle and/or Pedestrian)	11-12
Setting a Signal Controller (Pedestrian)	12
Setting the Master Controller	12-14
Starting Operation	14
Radio Channels	15
Transmitting Power	16

OPERATION - T2

Making Adjustments	17
Operation Modes	18
Communication Failures	18
Calling 'Hold All Red'	19
Checking Battery Levels	20
Resetting the System	20
Decommissioning the System	21
Incidents during Operation	21
Error Indications	22
Trouble Shooting	22
Error Indications - Text Display	23

INTRODUCTION - PT5 CONTROLLER

Evo PT5 Panel Layout	24-25
----------------------	-------

INSTALLATION - PT5

Setting up the Signal Heads	26
-----------------------------	----

PREPARING FOR OPERATION - PT5

Preparing for Operation	27
Setting Signal Controllers (Vehicle and/or Pedestrian)	28-29
Setting the Master Controller	29-32
Setting the Master Controller - Starting Operation	33
Pedestrian only Installations	34
Linking Phases	34
Radio Channels	35
Transmitting Power	36

OPERATION - PT5

Making Adjustments	37
Operation Modes	38
Communication Failures	39
Calling 'Hold All Red'	40
Checking Battery Levels	41
Resetting the System	41
Decommissioning the System	42-43
Incidents during Operation	42
Error Indications	44
Error Indications - Text Display	45

END OF LIFE - DISPOSAL INSTRUCTIONS (EOL)

Evo T2 Controller	46
Evo T5, PT5, PT4+ Controllers	47

SAFETY INFORMATION

Operation and Maintenance Information	48-49
---------------------------------------	-------

SAFETY PRECAUTIONS

Warranty	51
Disclaimer	52

DECLARATION OF CONFORMITY

	53
--	----

APPENDIX 1: T2 AS MASTER CONTROLLER

Phase Set Up Samples	54
Example 1: Basic Shuttle Working	55
Example 2: Two Head Shuttle Working	56
Example 3: Crossroad	57

APPENDIX 2: T5 AS MASTER CONTROLLER

Phase Set Up Samples	58
Example 1: Basic Shuttle Working	59
Example 2: Standalone Pedestrian crossing	60
Example 3: Standalone Pedestrian crossing with Two Vehicle Heads per Approach	61
Example 4: Shuttle Working Plus Pedestrian Crossing	62
Example 5: Combined Carriageway Plus Pedestrian Crossings	63
Example 6: Two-way Crossroad Plus Pedestrian Crossings	64
Example 7: Four-way Crossroad Plus Pedestrian Crossings	65
Example 8: Five-way Staggered Junction Plus Pedestrian crossing	66
Example 9: Fast Carriageway with Side Road	67

CONTACT INFORMATION

	68
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As of 2021, Traffic Group Signals have taken the decision to replace 'Slave' with 'Signal' within our terminology, which is now reflected across all controllers and supporting literature.

Introduction

The Evo® ACM Series from Traffic Group Signals

The Evo ACM Series from Traffic Group Signals builds upon the highly successful Evo range of controllers, which has been a staple of the traffic management industry since its launch by Pike Signals in 2013.

With advancements in radar, communications and development technologies, Traffic Group Signals are pleased to offer a modernised product range designed to meet today's traffic control demands, available from new, on hire or as an upgrade to existing fleet.

Now with Active Channel Management, or ACM, the radio communications between signals is incredibly robust, allowing the Micro to be deployed in environments where alternative products have failed. With the RF spectrum filling up fast, ACM enables the enhanced series to switch over to the clearest available radio channel, preventing communications from becoming lost due to interference. Furthermore, the new recovery mode with the will help restore communications should ever a conflict occur.

The enhancement also includes the ground-breaking AutoGreen® Technology, a patented method of optimising vehicle flow at road works that has been proven to improve journey times by over 50% (compared with traditional VA mode). AutoGreen® is the result of years of research and development, understanding driver behaviour at work sites and adapting the technology over a series of live trials. Not only does this technology enhance the efficiency of traffic control, it also prevents the shuttle lane from becoming blocked, a common issue with conventional portable signals.

For multiphase works, our new Smart VA function prevents over-extension of green times to reduce vehicle waiting times.

The Evo ACM Series is manufactured at our Pike Works facility in Birmingham, UK.

Important

This system should be installed and operated only by fully trained and experienced personnel. The junction layout examples given in this document are for guidance only. Always consult your supervisor if you are in any doubt about correct procedures or if you are concerned about safety. Equipment must only be repaired by Traffic Group Signals Ltd.

Caution

Risk of explosion if battery is replaced by an incorrect type.

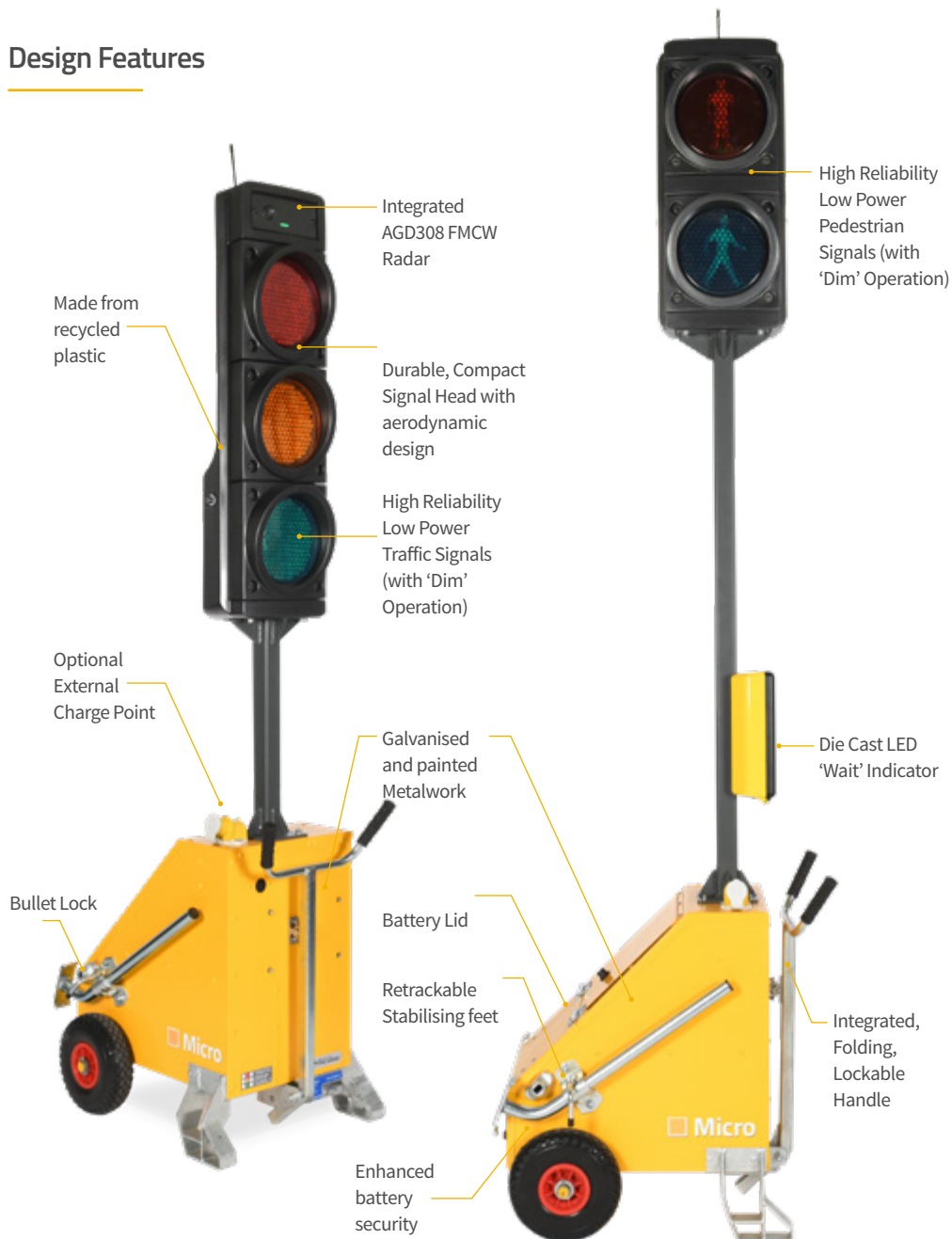
Dispose of used batteries according to the instructions.

Further important details about battery disconnection, handling and disposal can be found in the Operator's guide for the signal unit within which the controller is installed.

Evo ACM Series traffic signals are protected by one or more of the following granted patents; GB2534294, GB2554529 and GB2535320. Other patents and IP protection may apply.

System Overview - Evo ACM Signals

Design Features



Evo® ACM System



Specification

Base Unit	Micro or RadioMaster (PT9 and UTC only)
Function	T2, T5, PT5, PT9 and UTC Controller Options
Battery Power Technology	2 off Deep Cycle VRLA Batteries (12V 105Ah)
Battery Charger (not as standard)	15A in-built charger 110V supply (Option)
System Operation Time	Up to 7 days
System Phases	Up to 9 Traffic Phases (18 heads) & 8 Pedestrian Phases (16 heads)
Vehicular Signal Aspects	3 Aspect, Low Power LED, RAG + Integrated Radar
Pedestrian Signal Aspect	2 Aspect, Low Power LED, Red/Green Man + LED Wait
Radar frequency of operation	24.150 to 24.250 GHz
Radar Power	<100mW eirp
458 MHz Radio frequency of operation	458.525 to 458.925 MHz : Power < 27 dBm e.r.p
869 MHz Radio frequency of operation	869.40 to 869.65 MHz : Power < 27 dBm e.r.p
Handle	Integrated, Folding
Detection	AGD308 FMCW Smart Radar Approved to TOPAS 2504
System Function	TOPAS 2502, 2537, 2538
System Range	5 to 500m subject to line of sight variations.
Weight	<122 Kgs including batteries
Security	Fully integrated design with locking battery tray
External Charge Point	Integrated 110V 16A 4H (for battery charger option)

Evo® ACM Configuration and Customisation

Build your Evo ACM

1 Choose a **Signal Head**



2 Select a **Controller** from the page opposite >

3 **#whatsyourcolour?**
Evo ACM can be painted to any RAL K7 colour!



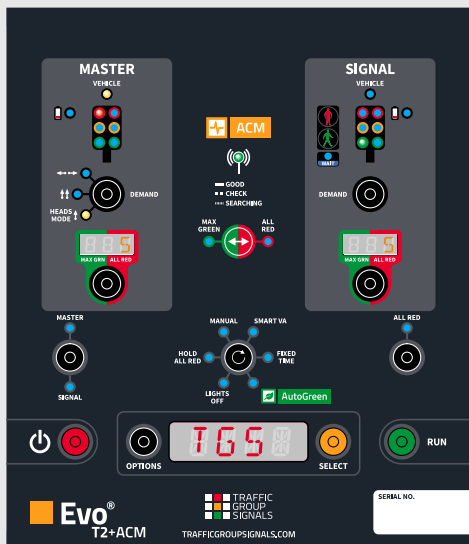
4 Add **Accessories** including...
Charger, Trailers etc.



Evo® ACM Controller Overview

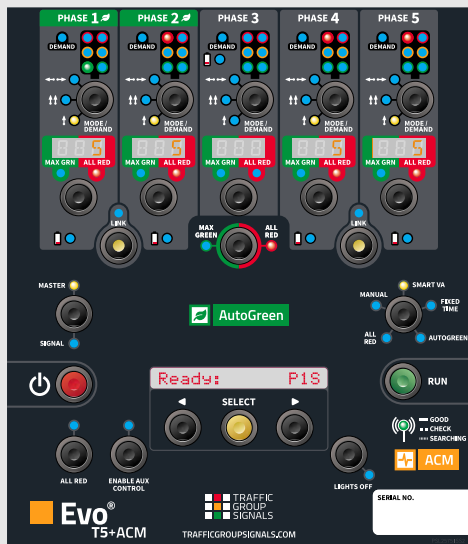
Evo ACM T2

The Evo T2 controller can operate as a master for two vehicle phases; as a vehicle signal controller to an Evo T5, or as either a vehicle or a pedestrian signal controller to an Evo PT5.



Evo ACM T5

The Evo T5 controller has all of the controls and capabilities of the Evo PT5, except for the pedestrian crossing functions.



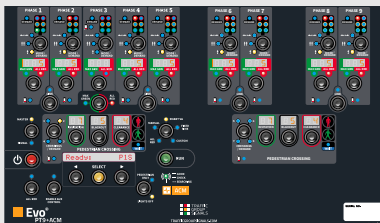
Evo ACM PT5

The main controller in the Evo range, this model can control up to five vehicle phases plus up to four pedestrian crossings.

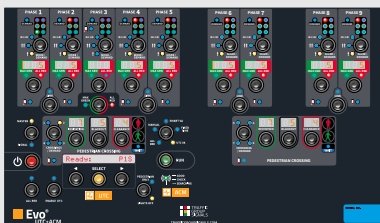


Evo ACM PT9 and Evo ACM UTC

The Evo ACM PT9 and Evo UTC ACM are headless units designed for the most complex jobs, and can control up to nine vehicle phases plus up to eight pedestrian crossings.



The Evo ACM UTC can be connected to the Highway Authority UTC network using our patented wireless solution. **Available to hire only.**



New Technology and Features

The following sections describe the new technologies introduced into the Evo ACM Product range.

Active Channel Management (ACM®)

The radio spectrum is filling up fast, meaning portable traffic signals must communicate with each other in an increasingly congested environment.



ACM

Active Channel Management, or ACM®, delivers reliable radio performance for portable and temporary traffic signals operating in challenging environments.

Traditional portable traffic signals operate using fixed channel radio communications between signals. The channel is selected by the operative at point of deployment, and manually entered into each signal in the set up. The choice of channel is often left to guesswork by the operative, or through using scanning functionality in the signal controller. The channel selection cannot be easily changed during operation.

ACM® constantly monitors all radio channels, both for signal quality and occupancy. ACM can automatically select and seamlessly change channels whenever necessary, as well as recover from temporary loss of communications. This agility avoids the system being affected by interference or causing interference to other equipment.

Enhanced Diagnostic Information



The operative can access diagnostic information, provided by ACM®, about the performance of the radio link to each signal through the controller front panel, helping to identify and resolve any radio communications issues.

Adaptive Channel Hopping



If there is some deterioration or occasional interference ACM® can quickly make a channel change to an available radio channel with a better signal quality. This occurs seamlessly as the Master signal can proactively inform all other signals in advance of the channel change.

Greater Resilience



ACM® generally maintains communications continuity with high reliability and minimal disruption. It learns which channels have the best signal quality and which to avoid. ACM also avoids causing interference by listening to all channels, including its own to determine whether the channel is in use by any other equipment¹.

In the vast majority of cases, any temporary loss of communications is tolerated and does not interfere with normal operation of the signals. Although ACM may choose to proactively change to a better channel, especially if it occurs more frequently.

¹ ACM incorporates the following standards: Dynamic Frequency Selection (DFS), Adaptive Frequency Agility (AFA) and Listen before Talk (LBT).

New Technology and Features

Active Channel Management (ACM®)

Automatic Channel Selection

ACM® selects the best channel at start-up or when recovering after a sudden or persistent loss of communications. This is based on an assessment of the best of the available channels.

The system will change channel whenever a more optimal channel is identified or in the rare event that communications loss with a Signal is persistent.

Only Signals configured with the same Group ID as the Master can connect with each other. The Master ensures that each Signal that connects matches one of the configured phases and that all are successfully connected before continuing. Usually this occurs on the first attempt. If not, the process is repeated with another channel until a successful connection is established.

What are the benefits of ACM®?

- ACM automatically selects the best available radio channel across all connected signals in the system without operator intervention.
- Only Signals configured with the same Group ID as the Master connect.
- ACM is adaptive, learning which channels have the best signal quality and which to avoid.
- ACM is resilient, maintaining communications continuity with high reliability and minimal disruption.
- ACM proactively changes channels seamlessly whenever necessary without impacting signal operation and without need of an operative to be present.
- ACM recovers from sudden or persistent loss of communications by reactively changing channel.
- ACM provides the user with detailed information about the performance of the radio link to each signal, helping identify and resolve any communications issues.

Power Saving Mode

Some power saving in the controller is achieved by blanking the front panel during operation when no buttons have been pressed for more than 10 minutes. Only the ACM Comms LED remains illuminated to indicate that the controller is powered, connected, and operating. Any Low or Empty Battery indicators will also be shown.

Any button press will re-activate the front panel out of the power saving mode but otherwise has no effect.

New Technology and Features

Multi-Phase Smart VA

The Evo ACM signal range has Smart VA function for multi-phase operation which is a considerable improvement for traffic management over traditional portable signals.

Smart VA for Evo ACM works by preventing over-extension of green times.

Over-Extension of green times



The Advanced FMCW radar releases the extension for a green phase when the traffic has thinned out. That is, it closes the phase when it is no longer efficient to keep it open for very low approaching vehicle numbers. This is just one of the operations of the full AutoGreen function. Keeping a green phase on for longer than is optimal is called 'over-extension' and is a key source of inefficiency for older portable signals.

Smart VA mode provides safety and efficiency improvements for 2-way deployments however we strongly recommend opting for AutoGreen operation owing to the enhanced technology features.

Smart VA operation is not a substitute for difficult portable multi-phase applications but a more complete optimisation of the traditional form of VA operation which is closer to VA performance on permanent signals which are based on loop detectors and an inter-green matrix.

AutoGreen®



AutoGreen

AutoGreen® is an advanced form of Vehicle Actuation (VA) which dynamically adjusts signal control to create a safer, greener, more efficient, and less stressful roadworks environment. It is designed for 2-way, shuttle-working sites.

AutoGreen® achieves this through in-built artificial intelligence, which optimises signal performance according to prevailing traffic conditions, allowing the signal to incrementally adapt to an everchanging traffic environment.

Our extensive research into trends in driver behaviour at roadworks has enabled us to engineer AutoGreen® to enhance traffic flow and eliminate the need for manual intervention. It dynamically adapts to traffic flow and site topology.

By shortening cycle times when possible and otherwise prioritising efficient traffic flow during peak times, it reduces driver frustration, keeps queuing to a minimum, lowers emissions and reduces exposure for on-site operatives. One of the key features of AutoGreen is its ability to prevent the shuttle lane from becoming blocked.

Now it is possible to include a pedestrian phase.

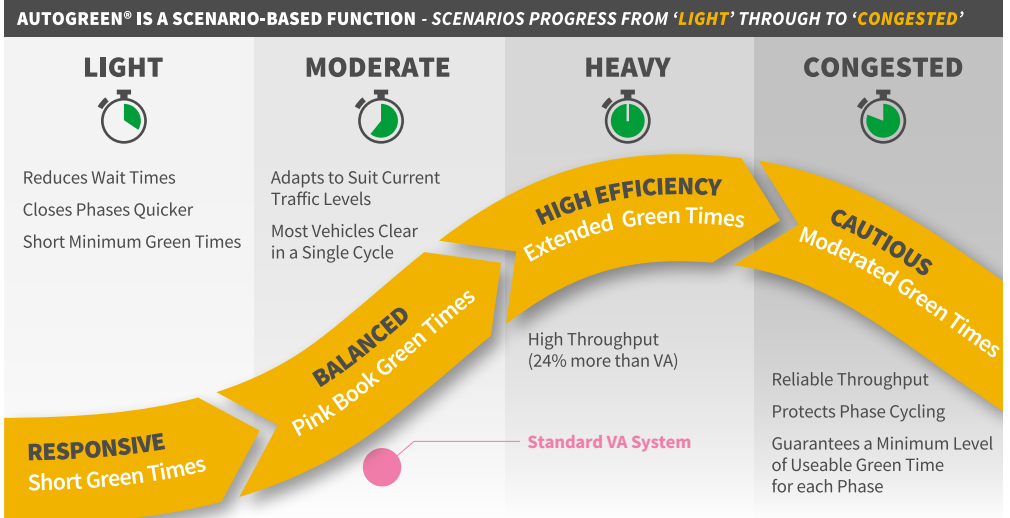
Traffic is typically managed at street works through a combination of Vehicle Actuation (VA) technology, and manual control. VA works well for low complexity sites. However, it can be inefficient in higher traffic volumes and fails to respond when congestion occurs. Manual control offers flexibility in high-volume sites but can be costly, unsafe, inconsistent, and difficult to deliver.

Traditional VA systems for portable signals use simple Doppler radars as the detection input for the signals. The radars used on the AutoGreen system are specially designed, low-power, FMCW radars which are capable of separately tracking each approaching vehicle with their associated range and speed. This data rich detection is used to optimise the operation of the signals.

New Technology and Features

AutoGreen®

As illustrated below, **AutoGreen®** automatically adjusts the operation of the signals according to the prevailing traffic conditions, using a sophisticated scenario-based software algorithm. AutoGreen is designed to protect the cycle and minimise the causes of congestion when traffic is heavy. Any congestion is automatically detected and recovery actions are deployed, all without operator intervention.



What are the benefits of AutoGreen®?

AutoGreen® maintains the cycle, shorting cycle times when possible, otherwise prioritising efficient traffic flow during peak times, thus keeping queues to a minimum.

- The system adjusts in response to traffic variations throughout the day and to unexpected peaks in demand whenever these occur.
- Avoids the causes of congestion and recovers from congestion when it occurs unexpectedly.
- Removes the need for Manual Control on those sites where traffic density is suitable for AutoGreen control.
- Reduces driver frustration and protects onsite operatives from abuse.
- There are no user settings required other than red time for each phase.
- Green times vary automatically and can extend above and below 'Pink Book' times where appropriate.
- Adjustments cover much more than just green time and are based on extensive trials and observation of realworld performance.
- Unaffected by adverse weather conditions or proximity to high tension power lines.

For a standard 2-phase system on a 50m length of roadworks AutoGreen can improve journey times by up to 50% compared to traditional VA based systems based on the 'Pink Book' recommendations.

Please also see 'AutoGreen®' in the Operating Modes section on page 39.

Introduction - ACM T2 Controller

The Evo ACM T2 Controller is our entry level 2-way controller, offering basic Master and Signal capabilities.

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 20).

Vehicle signal head mimics

During operation, these indicators show the signals currently being given at the head(s) for this phase (left side = single head; right side = dual head).

HEADS MODE / DEMAND

When setting up (as master), determines the signal head configuration, e.g. single or dual head or off (see page 13).

During operation, can be used to place a demand on this phase.

MASTER CONTROLLER / SIGNAL CONTROLLER

Determines the role of this controller (see page 11). *Signal was previously referred to as SLAVE on Evo controllers.*

POWER

Press and release to switch on, press and hold for two seconds to switch off (see page 11).

VEHICLE

This indicator shows when the microwave vehicle detector recognises an approaching vehicle (see page 11).

COMMS

Flashes green to indicate active links with signal heads (see page 22).

ALL RED / MAX GREEN selector

Press to change between adjusting the MAX GREEN and the ALL RED timings on all active phases (see page 13).

Pedestrian signal head mimic

The Evo T2 can operate as a pedestrian signal controller when controlled by an Evo PT5. In such cases, this mimic shows the current status of the pedestrian signals.

DEMAND

During operation, can be used to place a demand on this phase.

Combined MAXIMUM GREEN and ALL RED phase timer

In master mode, this button and 3-digit readout are used to set the red and green timings for this phase (see page 13).

CALL ALL RED

Press to hold all signals at red (see page 21).

Operation mode

As master, selects the main operation mode for the system as a whole (see page 14).

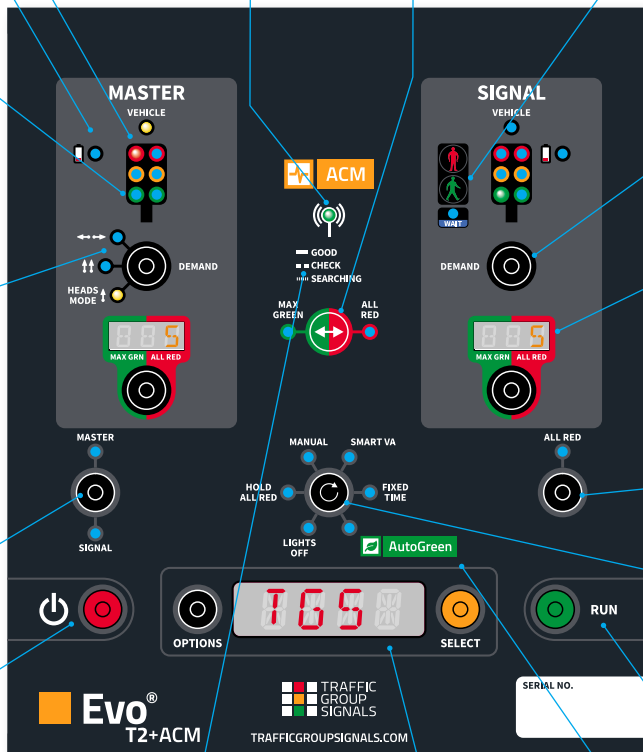
Now with Smart VA

RUN

Press to begin (master or signal controller) operation (see page 12).

AUTOGREEN TECHNOLOGY

For 2-way operation only. A proven technology for reducing congestion and improving efficiency at roadworks.



Indicates that the controller supports 17 different radio channels and improved comms reliability (see page 16).

Text display section

Shows setup details, timings and error codes. The OPTIONS and SELECT buttons allow you to change settings (see page 11).

Evo ACM T2

The Evo T2 controller can operate as a master for two vehicle phases; as a vehicle signal controller to an Evo T5, or as either a vehicle or a pedestrian signal controller to an Evo PT5.

Installation - ACM T2 Controller

Setting up the Signal Heads

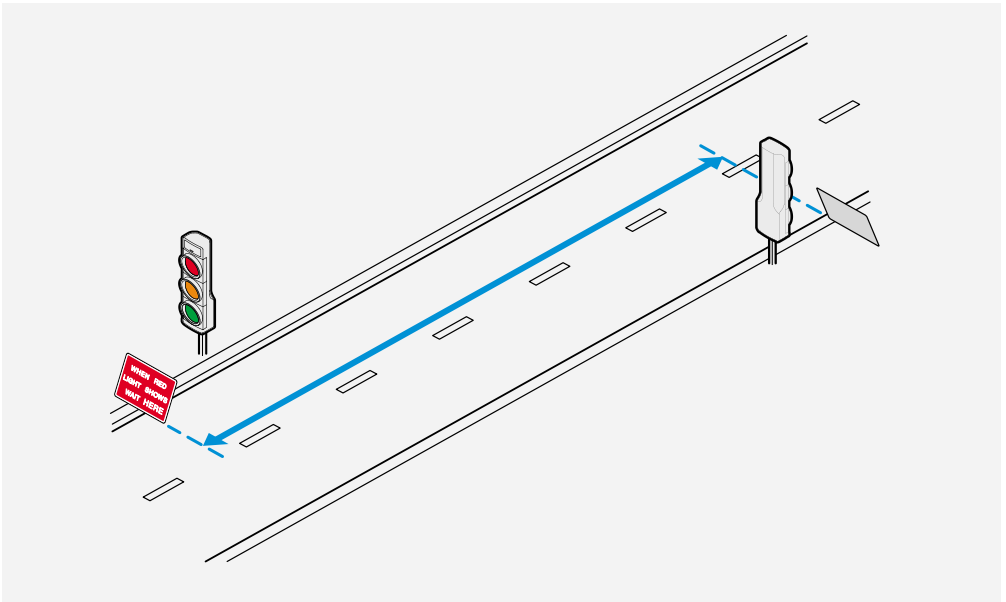
- 1 Set up the signals with the appropriate traffic management scheme for the prevailing roadwork site conditions.

Recommended references

The latest issues of:

- 'The use of vehicle actuated portable traffic signals' (the 'Pink Book')
- 'Safety at street works and road works' (the 'Red Book')
- 'Traffic signs regulations and general directions' (TSRGD)
- Traffic Signs Manual - Chapter 8

- 2 Measure the distance between the **WAIT HERE** signs.



- 3 Follow the system setup procedure beginning on page 10.

Please see Appendix 1, starting on page 54 for example signal head layouts.

Preparing for Operation - ACM T2 Controller

Preparing for Operation

This chapter covers the actions required when setting up an Evo ACM system involving the Evo ACM T2. The main stages are:

- Setting all vehicle Signal Controllers - **page 9**
- Setting all pedestrian Signal Controllers - **page 12**
- Set up the Master Controller - **page 12**

NOTES

- An Evo ACM T2 controller can operate as a vehicle and/or pedestrian **Signal Controller** within any Evo ACM installation.
- An Evo ACM T2 controller can operate as a **Master Controller** for a basic two phase vehicle-only installation (in combination with Evo ACM T2, Evo ACM T5 or Evo ACM PT5 controllers acting as signal controllers).
- Older XL2 and Evo Multi signal controllers are not compatible with Evo ACM equipment.
- Every Evo ACM controller can automatically sense which type of signal heads (vehicle and/or pedestrian) and will restrict/allow certain adjustments accordingly. For instance, if an Evo ACM T2 controller has only a vehicle signal head attached, then no pedestrian signal controller options will be offered.

- * If a tactile indicator on a pedestrian panel is not sensed by the controller during startup, the display will first show **TCTM**. Press **SELECT** to acknowledge.



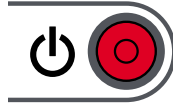
ACM Channel Hopping

With Active Channel Management you are no longer required to select a radio channel. Active Channel Management actively searches for the clearest radio channel for your signals to operate on. Furthermore, ACM will continuously monitor the radio network, automatically changing channels in order to avoid conflicting with other services. This enables Evo ACM signals to work nearby other temporary signal installations and other radio service users without experiencing communications issues, improving overall system reliability.

Preparing for Operation - ACM T2 Controller

Setting a Signal Controller (Vehicle and/or Pedestrian)

- 1** Press **POWER** to switch on.



The text display will briefly show **T65** and then and then the last Group ID used, e.g. **GP10****



- 2** Press **OPTION** to change the Group ID followed by **SELECT** to confirm.



The Group ID must be the same for all signal units.

Note: The Group ID is a new feature and refers to a collection or group of signals being used in the set up. Group ID's run from 1 - 64, we would advise setting unique groups per set-up and avoid Group ID 1 to avoid conflict with other operators.

- 3** If the controller is in Signal Controller mode, the text display will show the previously used designation, such as **P 2D**.

NEXT

- If the previous mode is appropriate, press **SELECT** and go to step **6**.
- If you need to make changes, go to step **4**.
- If you need to change from Master Controller to Signal Controller mode, press **MASTER/SIGNAL** until the **SIGNAL** indicator is lit. Then go to step **4**.



MASTER



SIGNAL

...Setting a Signal Controller - Vehicle

- 4** Press **OPTIONS** to scroll through the various vehicle signal controller designations: e.g. **P 1S**, **P 1D**, **P 2S**, **P 2D**... See below for an explanation of the designations.

As you scroll through the first four head designations for the phases, the mimic displays will show red, amber and green on either the left side or the right side, to highlight the Single or Dual head designations.



Mimic showing that this will be the primary head



Mimic showing that this will be the secondary head

- 5** When the required phase setting is displayed, press **SELECT** to fix it. The text display will show: **RDY**



- 6** Press **RUN**. This controller is now ready to begin working with the master controller. The text display will show that it's waiting for the master controller: **WAIT**



NEXT

- Repeat this procedure for all vehicle signal controllers.
- Set all pedestrian signal controllers - see next page
- Set up and run the master controller - see page 12.

Preparing for Operation - ACM T2 Controller

Setting a Signal Controller (Vehicle and/or Pedestrian)

Vehicle signal controller designations on the text display

The text display uses the following abbreviations to represent the vehicle head modes:

P 1S, P 2S, P 3S to P 9S - this will either be the Single head for the phase (where only one head is used) or otherwise the primary head of a dual head arrangement.

P 1D, P 2D, P 3D to P 9D - this will be the secondary head of a Dual head arrangement.

Note: **P 1S** is reserved for the signal head that is wired to the master controller, unless being used as a remote. i.e. no head fitted, or if the master controller is a Ped.

Pedestrian signal controller designations on the text display

The text display uses the following abbreviations to represent the various pedestrian signal heads:

X 1A, X 2A, X 3A to X 8A - this will be the primary pedestrian signal head in a pair.

X 1B, X 2B, X 3B to X 8B - this will be the secondary pedestrian signal head in a pair.

Note: **X 1A** is reserved for a pedestrian master controller (if the master controller is wired to a pedestrian head). **IMPORTANT:** Each pedestrian crossing must be served by a **matched pair** of pedestrian signal heads.

Setting a Signal Controller - Pedestrian

4 Press **OPTIONS** to scroll through the various signal controller pedestrian signal head designations: i.e. **X 1A, X 1B, X 2A...** See below for an explanation of the designations.

5 When the required phase setting is displayed, press **SELECT** to fix it. The text display will show: **RDY**



6 Press **RUN**. This controller is now ready to begin working with the master controller. The text display will show that it's waiting for the master controller: **WAIT**



Next

- Repeat this procedure for all pedestrian signal controllers.
- Set all vehicle signal controllers - see previous page
- Set up and run the master controller

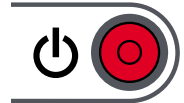
Setting the Master Controller

This section covers the following for the master controller:

- Switching on - below.
- Setting vehicle phases - opposite.
- Starting operation - page 14.

Setting the Master Controller - Switching on

1 Press **POWER** to switch on.



The text display will briefly show **T6S** and then the last group used.

Note: We recommend you select a radio channel other than 01 or 02 as these are most likely to suffer congestion.



Preparing for Operation - ACM T2 Controller

Setting the Master Controller (cont.)

Press **OPTIONS** to change the Group ID so that it is the **same ID as the signal units**. If you wish to change the Group ID, you will need to update the group ID on all the connected signal units.

- 2** Press **SELECT** to fix the chosen Group ID.



- 3** If the controller is in Master mode, the text display will show the previously used settings on the various panel indicators and the text display will show: **RDY**

Next

- If the previous setup is appropriate, press **SELECT** and go to page 14.
- If you need to alter settings, go to step **4**.
- If you need to change from signal controller to master controller mode, press **MASTER/SIGNAL** until the **MASTER** indicator is lit. Then continue with settings.



Note: An Evo ACM T2 controller can operate as a Master controller for a basic two phase vehicle-only installation (in combination with Evo ACM T2, Evo ACM T5 or Evo ACM PT5 controllers acting as signal controllers.)

* If a tactile indicator on a pedestrian panel is not sensed by the controller during startup, the display will first show **TCTN**. Press **SELECT** to acknowledge.



- 4** Repeatedly press **HEADS MODE/DEMAND** until the required setting is illuminated (this one button configures both phases):

↑ selects one approach, one head per approach,

↑↑ selects one approach, two heads per approach,

↔ selects two approaches, one head per approach (aka: two opposed heads).



Note: When the ↔ option is lit, a further press of **HEADS MODE/DEMAND** will disable the phase (press again to choose the required setting).

- 5** Set the All Red time:

Ensure that the **ALL RED** indicator is flashing. If it is not, press the **MAX GRN ALL RED** button located in the centre of the panel.



Using the measurement taken earlier (between the **WAIT HERE** signs) and the table shown below, repeatedly press the phase timing button until the appropriate time is shown on the 3-digit readout.



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

0m	50m	100m	150m	200m	250m	300m
5 seconds	10 seconds	15 seconds	20 seconds	25 seconds	30 seconds	

Preparing for Operation - ACM T2 Controller

Setting the Master Controller (cont.)

6 Set the Maximum Green time

Ensure that the **MAX GRN** indicator is flashing. If it is not, press the **MAX GRN ALL RED** button located in the centre of the panel.

Using the measurement taken earlier (between the **WAIT HERE** signs) and the table shown below, repeatedly press the button until the appropriate time is shown on the 3-digit readout.



7 Repeat steps 5 and 6 for the other phase and then:

Starting Operation

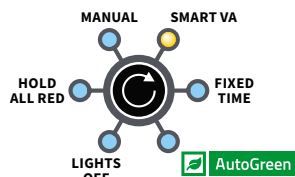
Once the following stages are complete:

- All heads, signs and cones placed in appropriate locations,
- Signal controller(s) set,
- Master controller set,

...then you should be ready to start operation using the master controller.

To start operation

a On the master controller, press the blue button to choose the appropriate operation mode. For normal operation, this should be set to **SMART VA** or **AUTOGREEN** (for 2-way operation).



b Press **RUN**.

The various signal heads of the installation will now start up in an orderly manner:

- The master controller phase will show amber and then go to red.
- The signal controller phase will wait for the longest all red time to run and then change to green.
- Normal operation will then commence according to the setting of the blue mode button.



The phase mimics will show what each of the signal heads are currently displaying.



Operation - ACM T2 Controller

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 a particular approach, consider making careful adjustments to alleviate the problem.

Timing adjustments can be made to either 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 in small steps.

- 1 Ensure that the **ALL RED** indicator is flashing. If it is not, press the **MAX GRN** **ALL RED** button located in the centre of the panel.
- 2 Press the phase timing button for the phase that needs to be adjusted to increase the ALL RED time.
- 3 Allow several full vehicle cycles to occur and observe the changes to traffic behaviour.
- 4 Repeat if necessary.



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 in small steps.

- 1 Ensure that the **MAX GRN** indicator is flashing. If it is not, press the **MAX GRN ALL RED** button located in the centre of the panel.
- 2 Press the phase timing button for the phase that needs to be adjusted to increase the MAX GRN time.
- 3 Allow several full vehicle cycles to occur and observe the changes to traffic behaviour.
- 4 Repeat if necessary.



Operation - ACM T2 Controller

Operation Modes

The blue mode switch determines how the system operates.

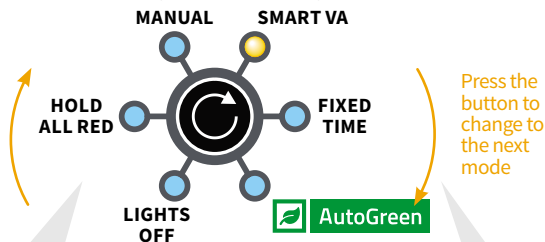
MANUAL

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.

SMART VEHICLE ACTUATION (SMART VA)

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



HOLD ALL RED

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

LIGHTS OFF

The system continues to operate, however, all signals are extinguished until this mode is changed.

AUTOGREEN

AutoGreen is designed for 2-way shuttle working and is the most efficient mode of operation for these sites.

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.

Communication Failures

The Evo ACM system continually monitors itself to check for failures so that it can take appropriate action:

Auto Recovery

The response to any 'Cat 1' fault condition is immediate Lights Out in accordance with TOPAS specifications.

To minimise call-outs, the system performs an automatic restart after a recovery period.

In the event of a comms incident, The text display on the master controller will show the following:

COMR

The controller will wait for ten minutes and will then go through an automated restart procedure:

- The master phase will show amber and then go to red.
- The signal controller phase will wait for the longest all red time to run and then change to green.
- Normal operation will then commence according to the setting of the blue mode button.

The recovery period is initially 15 seconds, but any repeat within 10 minutes will cause this period to ramp up from 15 seconds to 1 minute then to 2, 5, 10 and finally 30 minutes.

Note: During the thirty minute recovery period, it is possible for an operator to manually restart the whole system by pressing the **RUN** button.

Operation - ACM T2 Controller

Serious Communications Failures

Following a serious or sustained loss of communication, the master controller text display will show the following:

CONF

All signals will be instructed to remain off (or at red, if **HOLD ALL RED** or **MANUAL** modes are running). The whole system will require corrective action by the operator and a manual restart.

Calling 'Hold All Red'

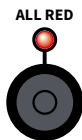
The system allows the 'hold all red' mode to be invoked either from the Evo ACM master controller or from any of the remote signal controllers. This is a useful feature for:

- 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.

Calling 'manual hold all red' from a signal ACM T2 controller

To call 'manual hold all red' from a signal ACM T2

- 1 On a remote signal controller, press **CALL ALL RED**. The adjacent red indicator will illuminate.
 - All signal heads will be returned to red and will stay at red until the state is overridden.
 - The text display on the master controller will show **RED**.



To resume operation

- 1 On the master controller, press **CALL ALL RED**. The adjacent red indicator will extinguish.



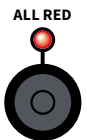
Calling 'hold all red' from the master controller

To call 'hold all red from the master

- 1 On the master controller, press **CALL ALL RED**.

The adjacent red indicator will illuminate and operation will be affected according to the current mode:

 - When running **MANUAL**:
 - Any signals currently at green will wait for a minimum of 12 seconds and then return to red.
 - The **CALL ALL RED** indicator will extinguish and the controller will continue running in Manual mode with all signals at red until a **DEMAND** button is pressed.
 - When running **VEHICLE**, **FIXED TIME** or **HOLD ALL RED**:
 - The text display will show **RED**.
 - Any signals currently at green will wait for a minimum of 12 seconds and then return to red.
 - To resume operation: press **CALL ALL RED**.



Operation - EACM T2 Controller

Checking Battery Charge Levels

When the system is operating you can quickly check the exact battery charge levels for the master and all signal controllers, from the master text display.

To check battery charge levels

- 1 During normal operation, on the master controller, press the **SELECT** button.

The text display will show... ➡



➡ ... while the left hand time display will show the charge level (in Volts) for the master (local) controller's battery.

- 2 Press the **OPTIONS** button to advance to the next display:

This is the current radio channel ➡



- 3 Press the **OPTIONS** button to advance to the next display.

The text display will show... ➡



➡ ... while the left hand time display will show the charge level (in Volts) for the first signal controller's battery.

If another signal controller is connected, press the **OPTIONS** button again to view its battery charge level.

- 4 When you have finished checking battery levels, press the **SELECT** button to return to the normal display.

Note: You can use this procedure to check a signal controller battery charge level from the signal controller itself, but it will not be able to report on any other units. The signal controller unit will report itself as 'LOCL' and the voltage level will be shown in the left hand time display as shown above.

Resetting the System

Certain failures within the Evo 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 master controller indicators to trace the problem, page 3 provides descriptions.
- 2 If the problem is traced to one or more signal heads, visit each affected head and check the signal controller(s). Depending on the fault:

- If possible, rectify the problem and reset the signal controller(s).
- Try performing a radio frequency scan to determine whether a different channel would provide better operation. See "Using the scan option" on page 15.

or

- Replace the signal head(s)/controller(s) and follow the set up instructions shown previously to select the correct phase number(s).

Note: If any signal controller unit is replaced, the master controller must be powered off and then on again to force it to look for all new signal controllers.

- 3 When all affected heads have been reset, on the master controller press the **RUN** button to restart operation. Monitor the system operation until you are sure that it is working correctly.

Operation - ACM T2 Controller

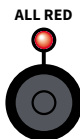
Decommissioning the System

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

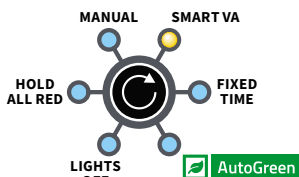
To decommission the system

- 1 Ensure that the shuttle lanes are cleared of obstructions (with the exception of the signals heads, cones and related warning signs).

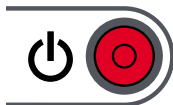
- 2 Press the **CALL ALL RED** button to bring any aspects that are currently on green to red.



- 3 Change the blue mode selector on the master controller to extinguish all signals.



- 4 In turn, go to all approaches, power off each signal controller (press and hold their **POWER** buttons) and face the signal heads away from the traffic.



- 5 If necessary, press and hold the **POWER** button on the master controller to switch it off.

- 6 Remove the signal heads from the carriageways.

Incidents during operation

In accordance with Highways Agency specifications, the Evo master 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 vehicle signal failures

- If ALL red vehicle signals fail on an approach, then 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. The green times for all phases will be reduced to 12 seconds.

- If more than one approach has a total red signal failure, all the signal heads will immediately return to **ALL RED** for 50 seconds, after which all signals will extinguish and the controller will stop operation.

On the master controller, the text display will show **E 84** and the mimic indicators representing the failed red signals will flash. See **Resetting the system** on page 20.

Green vehicle signal conflicts

When the operation mode is either Vehicle or Fixed Time:

- If opposing phases show green signals simultaneously at any time, then the signals on all approaches will immediately return to **ALL RED** for 50 seconds, after which all signals will extinguish and the controller will stop operation.

On the master controller, the text display will show **E 89** and the mimic indicators representing the failed green signals will flash. See **Resetting the system** on page 20.

When the operation mode is either Hold All Red or Manual:

- If opposing phases show green signals simultaneously at any time, then all signals immediately change to red (no amber signal) and will remain at red.

On the master controller, the text display will show **E 89** and the mimic indicators representing the failed green signals will flash. See **Resetting the system** on page 20.

Operation - ACM T2 Controller

Error Indications

The Evo ACM 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 main (or only) signal head for a phase, the right three indicators represent the second of a dual head arrangement (if used). The **VEHICLE** indicator shows when a vehicle is detected by the microwave vehicle detector (on either signal head).



Battery indicators (for each phase)

Note: See also page 20 for details about checking exact charge levels.

During startup, if the voltage of any controller battery is below 11.5V, the text display will show **BFXx** (where **xx** is the affected controller) and the master will refuse to operate.

During operation, when there are roughly two hours of operational time remaining within a remote signal head battery, the battery indicator will flash and the text display will show **LBAT**.



When the battery becomes too low for operation, the signal head will go to red for the **MAX RED** time and then switch off, the controller with the low battery will then power down. The corresponding indicator on the Evo master controller will remain on and the text display will show **BFXx**, where **xx** is the signal controller number.

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 signal head will provide further details.

Comms indicator

In normal operation the **COMMS** indicator will show a flashing green light:



Master controller

Flashing green	System running correctly.
Off	Loss of communication.
On	Fault state.

Signal controller

Flashing green	System running correctly.
Off	Loss of communication.

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 20.

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 20.

The Comms indicator is not flashing

There is a communication error. See **Error indications** above.

The text display is displaying a code

See page 47 for a list of all display codes.

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.

Operation - ACM T2 Controller

Error Indications - Text display - Evo ACM T2

The text 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:

BF	Insufficient battery voltage to continue.	CONF	Communications failure.	E 81	The red man pedestrian aspect failed to turn on or off.
BFXX	Critical battery voltage on signal controller xx.	CONF R	Communication recovery in progress.	E 82	The amber vehicle aspect failed to turn on or off.
CE01	Insufficient battery voltage.	CONF F	Configuring.	E 83	The green vehicle aspect failed to turn on or off.
CE02	Duplicate serial number.	E010	Invalid configuration data.	E 84	The red vehicle aspect failed to turn on or off.
CE03	Invalid operational mode.	E012	Incompatible software installed.	E 88	Near and far side.
CE04	Language mismatch.	E013	Controller started following a watchdog reset.	E 89	Green or green man aspect was on unexpectedly.
CE05	Software mismatch.	E020	Local monitor fault (whilst lamp was on).	FP V	FP software version.
CE06	Nearside/farside mismatch.	E021	Local monitor fault (whilst lamp was off).	LAT1	Language and timing information.
CE07	Configuration incompatible with XL2 signal controllers.	E022	Local lamp conflict detected on disused head.	LBAT	Battery voltage becoming too low.
CE08	System does not have common protocol for all signal controllers.	E023	Local lamp conflict detected by CPLD.	LOCL	Local battery voltage.
CE10	Master has unconfigured vehicle head.	E024	Local CPLD watchdog fault.	LRED	Local red call.
CE11	Master has unconfigured pedestrian head.	E025	Local front panel fault.	MB V	Main board software version.
CE12	A signal controller has unconfigured pedestrian head.	E030	Master detected invalid broadcast.	PFXX	Could not find a signal controller for pedestrian phase xx.
CE13	A signal controller has unconfigured vehicle head.	E031	Master detected aspects are not set as requested.	RB V	Radio board software version.
CE14	Remote master operation disallowed.	E032	Master detected invalid response from signal controller.	RDY	Ready.
CE20	No vehicle phases configured.	E040	Master has been notified of CAT1 fault on signal controller.	RRED	Remote red call.
CE21	No pedestrian phases configured.	E041	Master has been notified of invalid broadcast on signal controller.	SP V	SP software version.
CE30	Awaiting confirmation of radio channel.	E 77	The amber or green vehicle aspect failed to turn on or off.	SRCH	Searching.
CE32	Awaiting confirmation of signal controller identity.	E 78	The tactile aspect failed to turn off.	STOP	System has stopped due to CAT1 fault.
CE33	Radio board failed to respond to commands.	E 79	The wait aspect failed to turn on or off.	TCTN	No tactile aspect detected.
CE40	No head detected.	E 80	The green man pedestrian aspect failed to turn on or off.	TCTY	Tactile aspect present.
CE50	Engineers terminal interlocking active.			VFXX	Could not find a signal controller for phase xx.
CE99	Internal error.			WAIT	Waiting for a response from the master.

Introduction - ACM PT5 Controller

The Evo ACM PT5 Controller is our flagship multiphase controller, offering up to 5-way traffic control and pedestrian capabilities.

The Evo ACM T5 and ACM PT5 controllers are highly compact and yet offer impressive multiphase Master Controller capabilities. Built on the same controller platform, the ACM PT5 has the added addition of Pedestrian Crossing support.

MASTER CONTROLLER/ SIGNAL CONTROLLER

Determines the role of this controller (see page 28). Signal was previously referred to as SLAVE on Evo controllers.

POWER

Press and release to switch on, press and hold for two seconds to switch off (see page 28).

MANUAL ALL RED

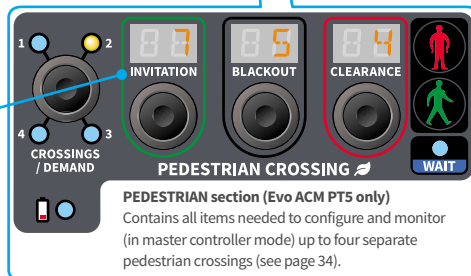
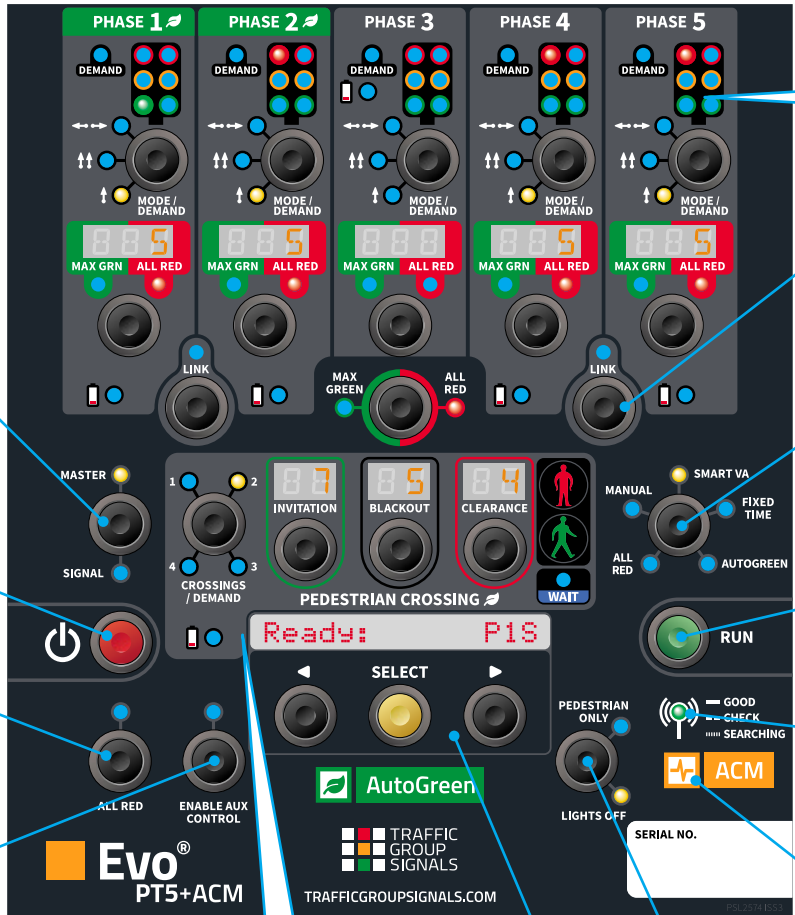
Press to hold all signals at red (see page 40).

ENABLE AUX CONTROL

Press to allow remote control.

INVITATION

Previously referred to as MAX GREEN on Evo ACM PT5 controllers.



TEXT DISPLAY SECTION
Shows setup details, timings and error codes. The arrow and SELECT buttons allow you to change settings (see page 29).

PEDESTRIAN ONLY / LIGHTS OFF
During setup, places Master Controller into dedicated pedestrian mode (see page 36). During operation, places all signal heads into blackout.

Introduction - ACM PT5 Controller

LINK

Combines two phases to allow more signal heads per approach

OPERATION MODE

As Master Controller, selects the main operation mode for the system as a whole (see page 38).

RUN

Press to begin (Master Controller or Signal Controller) operation (see page 29).

COMMS

Flashes green to indicate active links with signal heads (see page 44).



Indicates that the controller supports 17 different radio channels (see page 35).

DEMAND

This indicator shows when the microwave vehicle detector recognises an approaching vehicle (see page 33).

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 44).

ALL RED / MAX GREEN selector

Press to change between adjusting the MAX GREEN and the ALL RED timings on all active phases (see page 31).

For each phase



Signal head mimic

During operation, these indicators show the signals currently being given at the head(s) for this phase (left side = single head; right side = dual head).

Phase MODE / DEMAND

When setting up (as master controller), determines the signal head configuration, e.g. single or dual head or off (see page 33).

During operation, can be used to place a demand on this phase.

Combined MAXIMUM GREEN and ALL RED phase timer

In master controller mode, this button and 3-digit readout are used to set the red and green timings for this phase (see page 31).

When the controller is used as a signal controller, regardless of which phase is set, the Phase 5/signal controller mimics are used to show what the signal controller is doing.

Installation - ACM PT5 Controller

Setting up the Signal Heads

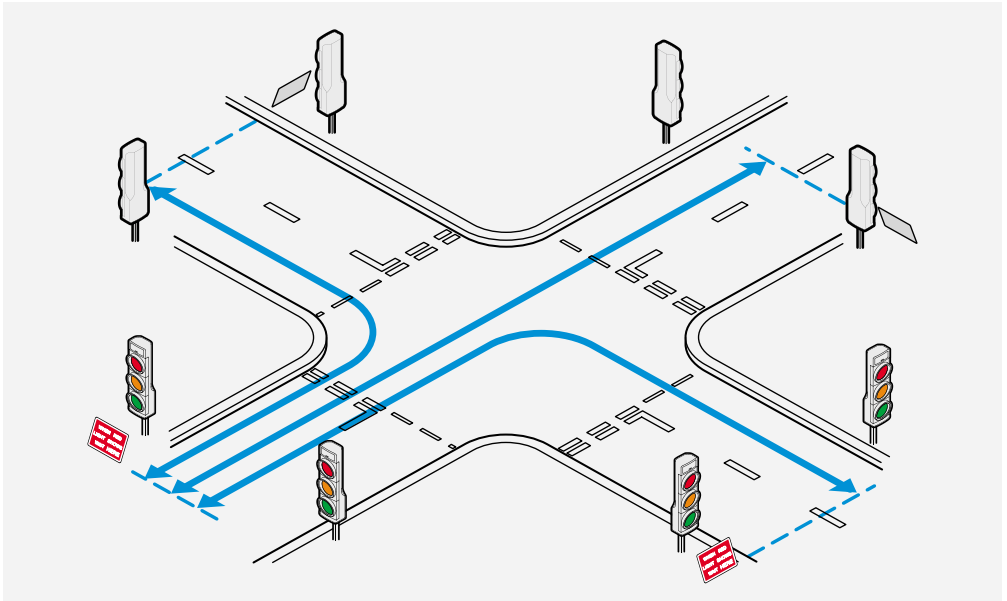
- 1 Set up the signals with the appropriate traffic management scheme for the prevailing roadwork site conditions.

Recommended references

The latest issues of:

- 'The use of vehicle actuated portable traffic signals' (the 'Pink Book')
- 'Safety at street works and road works' (the 'Red Book')
- 'Traffic signs regulations and general directions' (TSRGD)
- Traffic Signs Manual - Chapter 8

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



- 3 Follow the system setup procedure beginning on **page 30**.

Please see Appendix 1, starting on page 54 for example signal head layouts.

Preparing for Operation - ACM PT5 Controller

Preparing for Operation

This chapter covers all of the actions that you need to carry out when setting up an Evo ACM system. The main stages are:

- Setting all vehicle signal controllers - page 28
- Setting all pedestrian signal controllers - page 29
- Set up the master - page 29

NOTES

- If you are setting up a dedicated pedestrian crossing, go to page 34.
- Older XL2 signal controllers can be used as part of an Evo layout for vehicle control, however, if you require pedestrian crossings, then only Evo controllers can be used. Once an XL2 controller is introduced, the system operation will automatically revert to an earlier HA Specification requirement which is limited to four vehicle phases and has no provision for pedestrian facilities.
- Every Evo controller can automatically sense which type of signal heads (vehicle and/or pedestrian) and will restrict/allow certain adjustments accordingly. For instance, if an Evo PT5 controller has only a vehicle signal head attached, then no pedestrian signal controller options will be offered.

- * If a tactile indicator on a pedestrian panel is not sensed by the controller during startup, the display will first show **No Tactile**. Press **SELECT** to acknowledge.

SELECT



ACM Channel Hopping

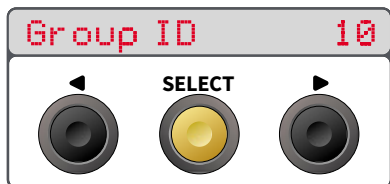
With Active Channel Management you are no longer required to select a radio channel. Active Channel Management actively searches for the clearest radio channel for your signals to operate on. Furthermore, ACM will continuously monitor the radio network, automatically changing channels in order to avoid conflicting with other services. This enables Evo ACM signals to work nearby other temporary signal installations and other radio service users without experiencing communications issues, improving overall system reliability.

Preparing for Operation - ACM PT5 Controller

Setting Signal Controllers (Vehicle and/or Pedestrian)

- 1 Press **POWER** to switch on.

The text display will briefly show **TGS ACM** and then the last group ID used.



- 2 Press ◀ or ▶ to change the Group ID and press **SELECT** to confirm.

SELECT



The Group ID must be the same for all signal units.

Note: The Group ID is a new feature and refers to a collection or group of signals being used in the set up. Group ID's run from 1 - 64, we would advise setting unique groups per set-up and avoid Group ID 1 to avoid conflict with other operators.

- 3 The text display will show the previously used mode, such as **Signal Veh 25**.

SELECT



NEXT

- If the previous mode is appropriate, press **SELECT** and go to step 6.
- If you need to make changes, go to step 4.
- If you need to change from master controller to signal controller mode, press **MASTER/SIGNAL** until the **SIGNAL** indicator is lit. Then go to step 4 opposite.

SELECT



MASTER



Setting a Signal Controller - Vehicle

- 4 Press ◀ or ▶ to scroll through the various vehicle signal controller designations: e.g. **Signal Veh 1S**, **Signal Veh 1D**, **Signal Veh 2S**, **Signal Veh 2D**... See below for an explanation of the designations.

As you scroll through the head designations for the phases, the mimic display for the current phase will show red, amber and green on either the left side or the right side of the mimic, to highlight the **Single** or **Dual** head designations.



Mimic showing that this will be the primary head



Mimic showing that this will be the secondary head

- 5 When the required phase setting is displayed, press **SELECT** to fix it. The text display will show: **Ready**

SELECT



- 6 Press **RUN**. This controller is now ready to begin working with the master. will show the signal designation and the Group ID alternately, e.g. **Waiting: P2S** and **Group ID 10**



NEXT

- Repeat this procedure for all vehicle signal controllers.
- Set all pedestrian signal controllers - **see page 30**
- Set up and run the master - **see page 30**

Preparing for Operation - ACM PT5 Controller

Setting a Signal Controller (Vehicle and/or Pedestrian)

VEHICLE signal controller designations on the text display

The text display uses the following abbreviations to represent the vehicle head modes:

Signal Veh 1S, Signal Veh 2S, Signal Veh 3S, etc. - this will either be the Single head for the phase (where only one head is used) or otherwise the primary head of a dual head arrangement.

Signal Veh 1D, Signal Veh 2D, Signal Veh 3D, etc. - this will be the secondary head of a Dual head arrangement.

Note: **Phase 1S** is reserved for the signal head that is wired to the master controller, unless being used as a remote. i.e. no head fitted, or if the master is a Ped.

PEDESTRIAN signal controller designations on the text display

The text display uses the following abbreviations to represent the various pedestrian signal heads:

Signal Ped 1a, Signal Ped 2a, Signal Ped 3a, etc. - this will be the primary pedestrian signal head in a pair.

Signal Ped 1b, Signal Ped 2b, Signal Ped 3b, etc. - this will be the secondary pedestrian signal head in a pair.

Note: **Ped 1A** is reserved for a pedestrian master (if the master controller is wired to a pedestrian head).

IMPORTANT: Each pedestrian crossing must be served by a **matched pair** of pedestrian signal heads.

Setting a Signal Controller - Pedestrian

- 4** Press ◀ or ▶ to scroll through the various signal controller pedestrian signal head designations: e.g. **Signal Ped 1a, Signal Ped 1b, Signal Ped 2a**... See below for an explanation of the designations.

- 5** When the required phase setting is displayed, press **SELECT** to fix it. The text display will show: **Ready**

SELECT



- 6** Press **RUN**. This controller is now ready to begin working with the master. The text display will show that it's waiting for the master: **Waiting: P2S**



Next

- Repeat this procedure for all pedestrian signal controllers.
- Set all vehicle signal controllers - see previous section
- Set up and run the master - opposite

Setting the Master Controller

This section covers the following for the master controller:

- Switching on - below.
- Setting vehicle phases - opposite.
- Setting pedestrian crossings - **page 33**
- Starting operation - **page 34**

Setting the Master Controller - Switching on

- 1** Press **POWER** to switch on.

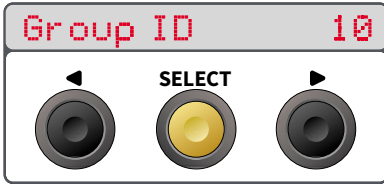
The text display will briefly show **TGS ACM** and then the last group ID used.

Note: The Group ID is a new feature and refers to a collection or group of signals being used in the set up. Group ID's run from 1 - 64, we would advise setting unique groups per set-up and avoid Group ID 1 to avoid conflict with other operators.



Preparing for Operation - ACM PT5 Controller

Setting the Master Controller (cont.)



- 2 To choose a different group ID, press ►.

The group ID set on the Master controller **must** be the same as the group ID set on all the signal controllers within your set up.

Press **SELECT** to fix the chosen group ID.



- 3 The text display will show the previously used mode, such as: **Ready: P1S**

Previous settings will also be shown on the various panel indicators.

Next

- If the previous setup is appropriate, press **SELECT** and go to **page 33**.
- If you need to alter **vehicle** settings, go to step **4** opposite.
- If you need to alter **pedestrian** settings, go to step **4** on **page 34**.
- If you need to change from signal controller to master controller mode, press **MASTER/SIGNAL** until the **MASTER** indicator is lit. Then continue with vehicle and/or pedestrian settings (on **pages 30** and **31**, respectively).



Note: If you are creating a dedicated pedestrian crossing (i.e. a single vehicle phase that serves only the pedestrian crossing), please use the Pedestrian only method of setup shown on page 34.

* If a tactile indicator on a pedestrian panel is not sensed by the controller during startup, the display will first show **No Tactile**. Press **SELECT** to acknowledge.

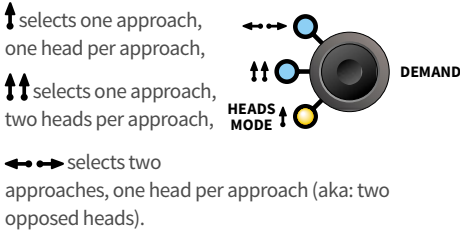


Preparing for Operation - ACM PT5 Controller

Setting the Master Controller (cont.) - Vehicle Phases

For each vehicle phase that you need to use:

- 4** Repeatedly press **MODE/DEMAND** for the phase until the required setting is illuminated:



Note: When the ↔ option is lit, a further press of **MODE/DEMAND** will switch off that phase.

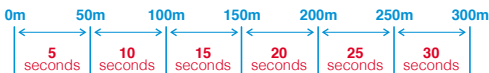
- 5** Set the All Red time:

Ensure that the **ALL RED** indicator is on. If it is not, press the **MAX GRN ALL RED** button located in the centre of the panel.

Using the measurement taken earlier (from this phase's **WAIT HERE** sign furthest away) and the table shown below, repeatedly press the phase timing button until the appropriate time is shown on the 3-digit readout.



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



- 6** Set the Maximum Green time

Ensure that the **MAX GRN** indicator is on. If it is not, press the **MAX GRN ALL RED** button located in the centre of the panel.



Using the measurement taken earlier (from this phase's **WAIT HERE** sign furthest away) and the table shown below, repeatedly press the button until the appropriate time is shown on the 3-digit readout.



- 7** If this and the neighbouring phase need to be linked in order to provide more heads per approach, see page 10 for details.

- 8** Repeat steps **4** to **7** for each active phase and then:

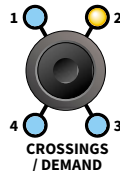
Next

- If you need to alter pedestrian settings, go to **page 29**.
- To start operation, go to **page 33**.

Preparing for Operation - ACM PT5 Controller

Setting the Master Controller (cont.) - Pedestrian Phases

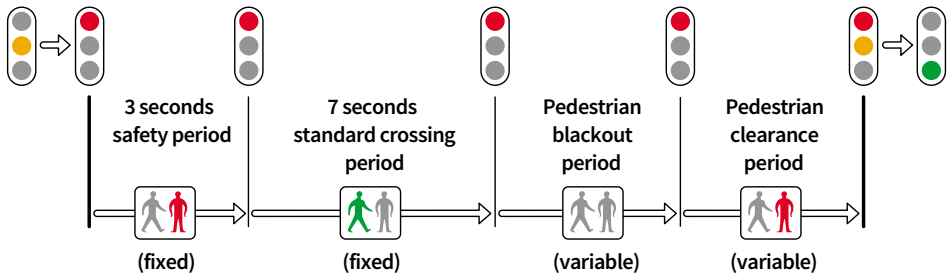
- 4 Where one or more pedestrian crossings are required, on the master controller press **CROSSINGS/DEMAND** until the indicator for the appropriate number of crossings is lit (1-4). When 4 is lit, a further press of **CROSSINGS/DEMAND** will switch off pedestrian mode.



Note: The timings that you choose in this section will apply to all pedestrian crossings associated with this controller.

Note: To create a dedicated pedestrian crossing (i.e. a single vehicle phase serving the pedestrian crossing only), please use the 'Pedestrian only' setup shown on page 34.

- 5 Use the timing buttons within the **PEDESTRIAN CROSSING** section to set the appropriate **BLACKOUT** and **CLEARANCE** times as follows:



Choose a **BLACKOUT** period (in seconds) that is sufficient to allow an able bodied pedestrian to walk the whole of the crossing.



The **CLEARANCE** setting allows you to determine an additional safety factor (4 seconds is the usual setting).



The green crossing time is fixed at seven seconds for almost all installations. However, there are special circumstances where this time may need to be adjusted. The pedestrian **INVITATION** control allows this to be done on Evo control panels that have been suitably adjusted. This feature is not available on standard Evo controllers.



Next

- If you need to alter vehicle settings, go to page 28.
- To start operation, see right

Preparing for Operation - ACM PT5 Controller

Setting the Master Controller (cont.) - Starting Operation

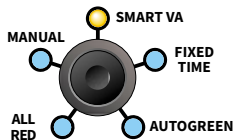
Once the following stages are complete:

- All heads, signs and cones placed in appropriate locations,
- Vehicle signal controllers set,
- Pedestrian signal controllers set (if used),
- Vehicle phase(s) set on the master,
- Pedestrian crossings set (if used) on the master.

...then you should be ready to start operation using the master controller.

To start operation

a On the master controller, press the blue button to choose the appropriate operation mode. For normal operation, this should be set to **VEHICLE**.



b Press **RUN**.

The various signal heads of the installation will now start up in an orderly manner:



- All pedestrian crossings will show red.
- The lowest numbered vehicle phase will show amber and then go to red.
- The next lowest numbered vehicle phase will show amber and then red. This will continue through all enabled vehicle phases until the final one.
- The final vehicle phase will wait for the longest all red time to run and then changes to green.
- Normal operation will commence once the highest numbered vehicle phase has completed its initial cycle.

The vehicle phase and pedestrian mimics will show what each of the signal heads are currently displaying.



Note: When the controller is used as a signal controller, regardless of which phase is set, the Phase 5/Signal controller mimics are used to show Signal controller operation.

The vehicle **DEMAND** and pedestrian **WAIT** mimics will show how requests are being made to the controller by road users and pedestrians, respectively.



Performing a test start

With the standard set up procedure, the system does not come into full operation until you press the **RUN** button. It's at that point you discover whether all the signal controllers are properly responding. In some situations, particularly where the Evo installation is about to replace a large set of fixed signals, it is important to confirm that all units are correctly co-operating before the fixed signals are switched off. By performing a test start, the Evo master will begin running as normal, however, it will inform all heads to not show any signals.

To initiate a test start

- 1** Before starting operation (as described left), press the **PEDESTRIAN ONLY/LIGHTS OFF** button until the **LIGHTS OFF** indicator illuminates.
- 2** Proceed with the usual start up, as described left.



If there are any problems, these will be reported on the master text display.

If everything is OK, although the lights don't sequence and the mimics do not illuminate, you will see the display timer counting through its phases.

- 3** When you are confident that all is OK, either press the **LIGHTS OFF** button to take the system into normal start up signal sequence; or press and hold the **POWER** button to halt the system and switch off (if actual operation will occur later on).

Preparing for Operation - ACM PT5 Controller

Pedestrian only Installations

Where the sole reason for an installation is to form a portable pedestrian crossing, i.e. a single vehicle phase serving only the crossing, you are recommended to use the **PEDESTRIAN ONLY** feature of the Evo controller.

This setting maximises traffic efficiency by resting the vehicle phase at green whenever there are no pedestrian demands (normal vehicle operation is to keep all signals at red during quiet periods).

IMPORTANT: The PEDESTRIAN ONLY option can only be used when all vehicle phases are running the same signals; such as a single road (or dual carriageway) where all signals operate in the same manner. Layouts where opposing traffic streams would cross, such as shuttle working, crossroads, etc. must NOT be used with the PEDESTRIAN ONLY option.

To use Pedestrian only mode

1 Position the vehicle and pedestrian signal heads in accordance with Highways Agency regulations and set the signal controllers on each head in the usual manner, as shown on page 29 and 30.

2 On the master controller, press **PEDESTRIAN ONLY**, the adjacent indicator will illuminate.

3 Enable all of the phases that will be used and set the master controller as shown on the previous four pages, with the following restrictions:

- Use the Phase 1 controls to set details for all phases.
- Use only the  or  modes; it is not possible to use the 'Two opposed heads' mode () in **PEDESTRIAN ONLY** installations.
- It is possible to use the **LINK** buttons to join vehicle phases in **PEDESTRIAN ONLY** mode, however, all linked signal heads **MUST** face in the same direction.



4 Press **RUN** to begin. Operation will start as follows:

- All pedestrian crossings will show red.
- After seven seconds, the vehicle signal heads will go to green.
- Shortly afterwards, a single pedestrian crossing cycle will occur (i.e. vehicles to red, pedestrians to green, etc.).
- The system will now rest at 'vehicles on green' until a pedestrian demand is received.

Linking Phases

Evo controllers allow you to optionally join phases 1 and 2 as well as (separately) phases 3 and 4 to suit road layouts.

When phases are linked, all signal heads associated with both of the phases will act together in the same manner. The extra signal heads can be made to work in opposing directions or in the same direction (see examples on pages 60-69).

IMPORTANT: It is possible to use the LINK buttons to join vehicle phases when using PEDESTRIAN ONLY mode, however, all linked signal heads MUST face in the same direction. This ensures that the signal failure modes are handled correctly.

To link phases

1 Switch on the master controller, as shown on page 24.

2 On the master controller, press the **LINK** button that is located just below the two phases that you need to join. The indicator next to the button will illuminate.

3 Choose the required settings for the linked phases, as shown on the previous three pages, using the controls as follows:

- Use the Phase 1 controls to set the Phase 1 + 2 pair.
- Use the Phase 3 controls to set the Phase 3 + 4 pair.



Preparing for Operation - ACM PT5 Controller

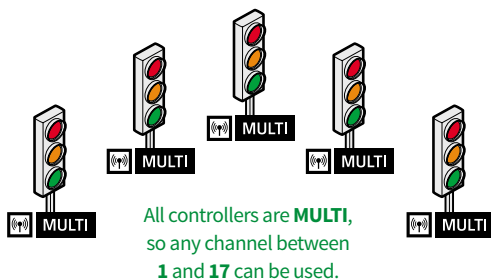
Radio Channels

All Evo ACM controllers that show the **ACM** logo on their front panels offer a greatly increased number of radio communication channels (1 to 17). This compares with the first generation (**Standard**) Evo controllers, which provide channels 1 and 2.

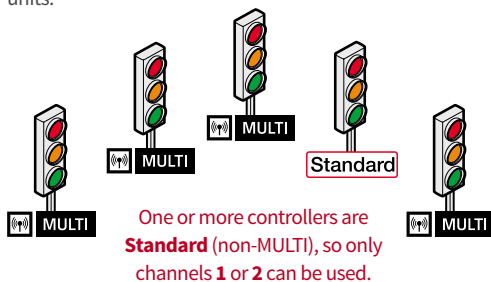


When mixing Multi-channel and standard controllers

If all of your Evo controllers are the **MULTI** type, then you can use any of the available 17 channels:



However, if your installation contains *any* standard Evo controllers (those that do not have the MULTI logo) then you must choose either channel **1** or channel **2** for all units.



If you choose channels **3** to **17** then the standard controller(s) will not be found and the installation will not run.

IMPORTANT: You need to ensure that all controllers within a set are configured to use the same radio channel.

Using the scan option

1 Press **POWER** to switch on. The text display will show **RADIO CHANNEL XX**, where **XX** is the last channel used.

2 Press **▶** to advance to channel 17 and then press once more to show **RADIO CHAM. SCAN**. Press **SELECT**.

Note: The controller must be in Master mode to access the Scan function.

The controller will now scan the radio channels. After roughly 20 seconds, the text display will show the first available clear radio channel that was detected during the scanning process.

3 Press **SELECT** to choose the recommended channel, or manually choose a different channel.

4 Continue with the usual configuration steps. Don't forget to manually select the same radio channel on all of the other Evo controllers within the set.

Discovering the radio channel during operation

When the system is running, you can check which radio channel is being used as follows:

1 During normal operation, on the master controller, press the **SELECT** button. The text display will show the current battery charge.

2 Press the **▶** button to show the radio channel: **RADIO CHANNEL 01**

3 Press the **SELECT** button to return to the normal display (or wait for 12 seconds and the text display will automatically return).

Preparing for Operation - ACM PT5 Controller

Transmitter Power

Evo controllers that show the **MULTI** logo on their front panels provide an option, when they are first switched on, to change the transmitter power:



RADIO TX POWER 3

The standard power level is **3** and for most installations this should not be changed; simply press **SELECT** during startup to choose the standard option.

Reducing transmitter power to avoid interference

Reducing transmitter power *may* be a useful option when two (or more) separate Evo installations are placed near to each other and you begin to experience communication issues.

IMPORTANT: You should always try to solve interference issues by changing the radio channels first before attempting to reduce transmitter power.

If the Evo controllers in set are all **MULTI** units, you have the choice of 17 different channels to switch them all to; if not, you have a choice of 2 channels. See page 35 for details.

If changing radio channels does not solve the problem, then you could consider reducing the TX power in one or more units that are in closest proximity between the affected sets.

Note: When reducing power in a controller, you must ensure that its transmissions are sufficiently strong to still reach its own master; or if it is the master, that it can reach **ALL** of its signal controllers.

It is not necessary to change the TX power level in all Evo units within a set. A change in TX power affects only the transmission of a controller, it has no effect of the reception of signals by that controller.

As a rough guide, the line of sight transmission distances (when there are no external sources of interference) are as follows:

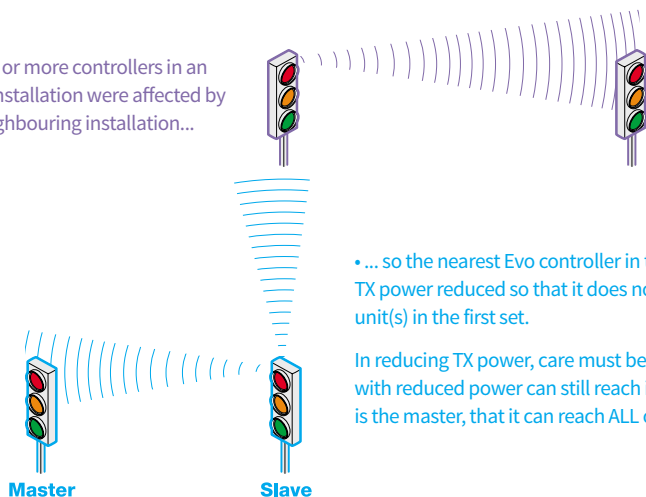
TX power level	Power mode	Approx. TX distance
3 and 2	Standard	300 metres (984 feet)
1 and 0	Low	100 metres (328 feet)

To reduce power on an Evo T2 controller

- 1 Switch on the controller in the usual manner.
- 2 Select the radio channel and press **SELECT**.
The display will now show: **RADIO TX POWER 3**
- 3 Use the ◀ or ▶ buttons to change the TX radio power value and press **SELECT**.
- 4 Continue with your configuration in the usual manner.

Note: If the controller is switched off and back on, the TX power level will be offered at the normal setting of 3.

• One or more controllers in an Evo installation were affected by a neighbouring installation...



• ... so the nearest Evo controller in the second set has its TX power reduced so that it does not reach the closest unit(s) in the first set.

In reducing TX power, care must be taken that the unit with reduced power can still reach its own master (or if it is the master, that it can reach **ALL** of its signal controllers).

Operation - ACM PT5 Controller

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 a particular approach, consider making careful adjustments to alleviate the problem.

Timing adjustments can be made to either 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 in small steps.

- 1 Ensure that the **ALL RED** indicator is flashing. If it is not, press the **MAX GRN** **ALL RED** button located in the centre of the panel.
- 2 Press the phase timing button for the phase that needs to be adjusted to increase the **ALL RED** time.
- 3 Allow several full vehicle cycles to occur and observe the changes to traffic behaviour.
- 4 Repeat if necessary.



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 in small steps.

- 1 Ensure that the **MAX GRN** indicator is flashing. If it is not, press the **MAX GRN ALL RED** button located in the centre of the panel.
- 2 Press the phase timing button for the phase that needs to be adjusted to increase the **MAX GRN** time.
- 3 Allow several full vehicle cycles to occur and observe the changes to traffic behaviour.
- 4 Repeat if necessary.



Operation - ACM PT5 Controller

Operation Modes

The blue mode switch determines how the system operates.

MANUAL

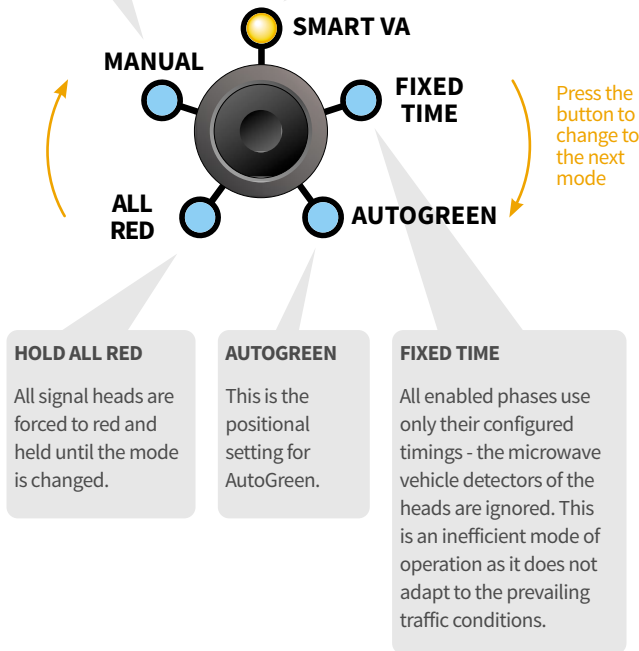
Phases respond to the control panel DEMAND buttons - the microwave vehicle detectors of the heads are ignored. In this mode, the ALL RED time settings for each phase are used, the minimum green time is set at 12 seconds and the maximum green time is determined by the operator's actions.

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.

SMART VEHICLE ACTUATION (VA)

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

Smart VA provides efficiency gains over traditional portable signals by preventing over-extension of green times, thus reducing vehicle wait times and emissions associated with vehicle idling.



Operation - ACM PT5 Controller

Communication Failures

The Evo ACM system continually monitors itself to check for any type of failure so that it can take appropriate action:

After a temporary communications loss

Firstly, all signals will show red for 50 seconds. After that period, all signals will switch off (unless the master controller is running in **HOLD ALL RED** or **MANUAL** modes, in which case all signals will remain at red). The text display on the master controller will show the following:

COMS RECOVERY 123

Once the counter reaches **600** (10 minutes), the system will go through an automated restart procedure:

Vehicle only installations

- The lowest numbered vehicle phase will show amber, then red.
- The next lowest numbered vehicle phase will show amber and then red. This will continue through all enabled vehicle phases until the final one.
- The final vehicle phase will show amber then red and wait for the longest set ALL RED time. The lowest numbered vehicle phase will then change to green.
- Normal operation will commence once the highest numbered vehicle phase has completed its initial cycle.

Vehicle plus pedestrian installations

- All pedestrian signals to red.
- Vehicle signals in turn show amber then red.
- All signals are held at red for the longest set ALL RED time.
- All pedestrian signals go through a normal green cycle and then return to red.
- Normal operation continues with the next vehicle phase.

Note: During the ten minute recovery period, it is possible for an operator to manually restart the whole system.

After a serious communications loss

Following a serious or sustained loss of communication, the master controller text display will show the following:

COMMS FAIL

All signals will be instructed to remain off (or at red, if **HOLD ALL RED** or **MANUAL** modes are running). The whole system will require corrective action by the operator and a manual restart.

Operation - ACM PT5 Controller

Calling 'Hold All Red'

The system allows the 'hold all red' mode to be invoked either from the Evo ACM master controller or from any of the remote signal controllers. 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.

Calling 'manual hold all red' from a signal Evo controller

To call 'manual hold all red' from a signal

- 1 On a remote signal controller, press **ALL RED**.
The adjacent red indicator will illuminate.
 - All signal heads will be returned to red and will stay at red until the state is overridden.
 - The text display on the master controller will show **REMOTE RED CALL**.



To resume operation

- 1 On the master controller, press **ALL RED**.
The adjacent red indicator will extinguish.



Calling 'hold all red' from the master controller

To call 'hold all red from the master

- 1 On the master controller, press **CALL ALL RED**.
The adjacent red indicator will illuminate and operation will be affected according to the current mode:



When running **MANUAL**:

- Any signals currently at green will wait for a minimum of 12 seconds and then return to red.
- The **ALL RED** indicator will extinguish and the controller will continue running in Manual mode with all signals at red until a **DEMAND** button is pressed.

When running **VEHICLE, FIXED TIME** or **HOLD ALL RED**:

- Any signals currently at green will wait for a minimum of 12 seconds and then return to red.
- The **ALL RED** indicator will then extinguish and the time display will show **LOCAL RED CALL**.
Operation will remain halted with all signals at red until you restart it:
- **To resume operation:** press **ALL RED**.



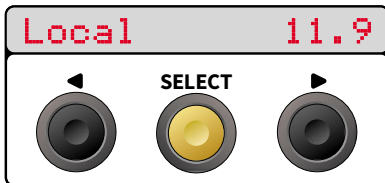
Operation - ACM PT5 Controller

Checking Battery Charge Levels

When the system is operating you can quickly check the exact battery charge levels for the master and all signal controllers, from the master text display.

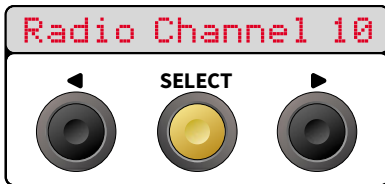
To check battery charge levels

- 1 During normal operation, on the master controller, press the **SELECT** button. The text display will show:



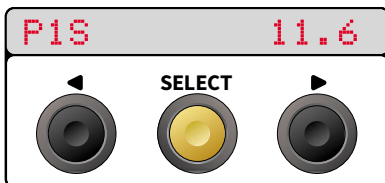
This is the charge level for the master controller's battery.

- 2 Press the ► button to advance to the next display:



This is the current radio channel.

- 3 Press the ► button to advance to the next display:



This is the charge level for the first signal controller's battery.

With each successive press of the ► button, the text display will show the battery charge levels for each of the signal controllers.

- 4 When you have finished checking battery levels, press the **SELECT** button to return to the normal display.

Note: You can use this procedure to check a signal controller battery charge level from the signal controller itself, but it will not be able to report on any other units. The signal controller unit will report itself as '**LOCAL**'.

Resetting the System

Certain failures within the Evo ACM 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 master controller indicators to trace the problem, page 3 provides descriptions.
- 2 If the problem is traced to one or more signal heads, visit each affected head and check the signal controller(s). Depending on the fault:

- If possible, rectify the problem and reset the signal controller(s).
- Try performing a radio frequency scan to determine whether a different channel would provide better operation. See "Using the scan option" on page 35.

or

- Replace the signal head(s)/controller(s) and follow the set up instructions shown on pages 28 and 29 to select the correct phase number(s).

Note: If any signal controller unit is replaced, the master controller must be powered off and then on again to force it to look for all new signal controllers.

- 3 When all affected heads have been reset, on the master controller press the **RUN** button to restart operation. Monitor the system operation until you are sure that it is working correctly.

Operation - ACM PT5 Controller

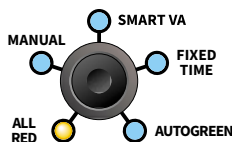
Decommissioning the System

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

To decommission the system

- 1 Ensure that the shuttle lanes are cleared of obstructions (with the exception of the signals heads, cones and related warning signs).

- 2 Change the blue mode selector on the master controller to **HOLD ALL RED**. The master controller will bring any aspects that are currently on green to red using the normal timings.



- 3 Press the **LIGHTS OFF** button to extinguish all signals.



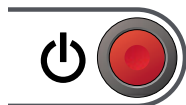
- 4 In turn, go to all approaches, power off each signal controller (press and hold their **POWER** buttons) and face the signal heads away from the traffic.

- 5 If necessary, press and hold the **POWER** button on the master controller to switch it off.

- 6 Remove the signal heads from the carriageways.

Incidents during operation

In accordance with Highways Agency specifications, the Evo master 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 vehicle signal failures

Red vehicle signal failure in Vehicle plus Ped or Ped-only setups:

- If ALL red vehicle signals fail on an approach*, then the signals on all approaches will immediately return to **ALL RED** for 50 seconds, after which all signals will extinguish and the controller will stop operation.

On the master controller, the text display will show **STOPPED** and the mimic indicators representing the failed red signals will flash. See Resetting the system on page 41.

Red vehicle signal failure in Vehicle-only setups

- If ALL red vehicle signals fail on an approach*, then 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. The green times for all phases will be reduced to 12 seconds.
- If more than one approach has a total red signal failure, all the signal heads will immediately return to **ALL RED** for 50 seconds, after which all signals will extinguish and the controller will stop operation.

On the master controller, the text display will show **STOPPED** and the mimic indicators representing the failed red signals will flash. See **Resetting the system** on page 41.

Red pedestrian signal failure:

- If any single red man signal has a failure this is treated as a total approach fail. The signals on all approaches will immediately return to **ALL RED** for 50 seconds, after which all signals will extinguish and the controller will stop operation.

On the master controller, the text display will show **STOPPED** and the mimic indicators representing the failed red signals will flash. See **Resetting the system** on page 41.

Operation - ACM PT5 Controller

Decommissioning the System (cont.)

Green vehicle signal conflicts

When the operation mode is either Vehicle or Fixed Time:

- If opposing phases show green signals simultaneously at any time, then the signals on all approaches will immediately return to **ALL RED** for 50 seconds, after which all signals will extinguish and the controller will stop operation.

On the master controller, the text display will show **STOPPED** and the mimic indicators representing the failed green signals will flash. See **Resetting the system** on page 41.

When the operation mode is either Hold All Red or Manual:

- If opposing phases show green signals simultaneously at any time, then all signals immediately change to red (no amber signal) and will remain at red. See **Resetting the system** on page 41.

** When phase linking is used, the duplication of signal heads facing in the same direction permits a slight relaxation of the above rules. Where 2, 3 or 4 signal heads are facing the same approach, the master controller will maintain normal operation until the last remaining head ceases normal operation, whereupon the above procedures will occur.*

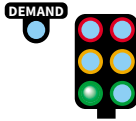
Operation - ACM PT5 Controller

Error Indications

The Evo 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 main (or only) signal head for a phase, the right three indicators represent the second of a dual head arrangement (if used). The **DEMAND** indicator shows when a vehicle is detected by the microwave vehicle detector (on either signal head).



Battery indicators (for each phase)

Note: See also page 41 for details about checking exact charge levels.

During startup, if the voltage of any controller battery is below 11.5V, the text display will show **LOW BATTERY** and the controller will refuse to operate.

During operation, when there are roughly two hours of operational time remaining within a remote signal head battery, the battery indicator will flash and the text display will show **LOW BATTERY**.

When the battery becomes too low for operation, the signal head will go to red for the **MAX RED** time and then switch off, the battery indicator will remain on and the text display will show **BATT FAIL**. The corresponding indicator on the Evo master controller will remain on and the text display will show **BATT FAIL NM**, where **NM** is the signal controller number.



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 signal head will provide further details.

Comms indicator

In normal operation the **COMMS** indicator will show a flashing green light:



Master controller

Flashing green	System running correctly.
Off	Loss of communication.
On	Fault state.

Signal controller

Flashing green	System running correctly.
Off	Loss of communication.

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 41.

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 41.

The Comms indicator is not flashing

There is a communication error. See Error indications above.

The text display is displaying a code

See page 47 for a list of all display codes.

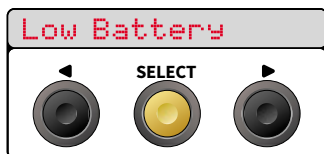
Battery symbol flashing

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.

Operation - ACM PT5 Controller



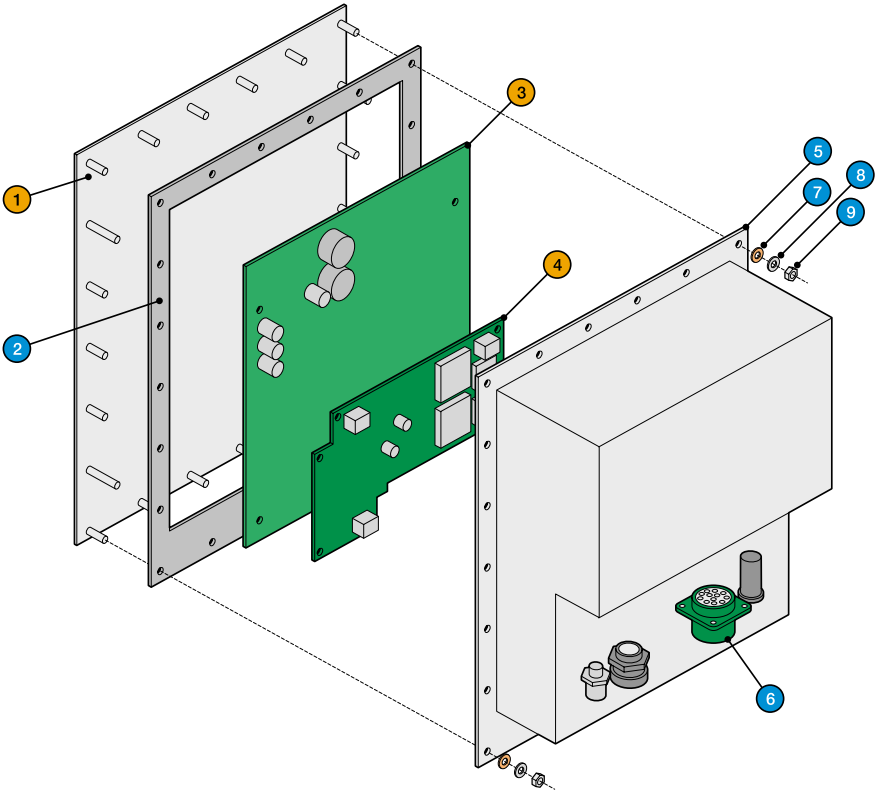
Error Indications - Text display

The text 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:

LOW BATTERY	Battery voltage becoming too low.	CONFIG ERROR 20	No vehicle phases configured.
BATT FAIL	Insufficient battery voltage to continue.	CONFIG ERROR 21	No pedestrian phases configured.
RED FAULT	The red vehicle aspect failed to turn on or off.	CONFIG ERROR 30	Awaiting confirmation of radio channel.
AMBER FAULT	The amber vehicle aspect failed to turn on or off.	CONFIG ERROR 31	Awaiting confirmation of authority mode.
GREEN FAULT	The green vehicle aspect failed to turn on or off.	CONFIG ERROR 32	Awaiting confirmation of signal controller identity.
RED MAN FAULT	The red man pedestrian aspect failed to turn on or off.	CONFIG ERROR 40	No head detected.
GRN MAN FAULT	The green man pedestrian aspect failed to turn on or off.	CONFIG ERROR 50	Engineers terminal interlocking active.
WAIT FAULT	The wait aspect failed to turn on or off.	CONFIG ERROR 99	Internal error.
TACTILE FAULT	The tactile aspect failed to turn off.	VEH FAIL NM	Could not find a signal controller for phase nn.
ERROR 010	Invalid configuration data.	PED FAIL NM	Could not find a signal controller for pedestrian phase nn.
ERROR 011	Failed to communicate with configuration plug.	BATT FAIL NM	Critical battery voltage on signal controller nn.
ERROR 012	Incompatible software installed.	LAMP FAULT	The amber or green vehicle aspect failed to turn on or off.
ERROR 013	Controller started following a watchdog reset.	STOPPED	System has stopped due to CAT1 fault.
COMS RECOVERY MMM	Recovering from comms loss (10 minute period).	GREEN CONFLICT	Green or green man aspect was on unexpectedly.
COMMS FAIL	Sustained communications fault.	ERROR 020	Local monitor fault (whilst lamp was on).
CONFIG ERROR 01	Insufficient battery voltage.	ERROR 021	Local monitor fault (whilst lamp was off).
CONFIG ERROR 02	Duplicate serial number.	ERROR 022	Local lamp conflict detected on disused head.
CONFIG ERROR 03	Invalid operational mode.	ERROR 023	Local lamp conflict detected by CPLD.
CONFIG ERROR 04	Language mismatch.	ERROR 024	Local CPLD watchdog fault.
CONFIG ERROR 05	Software mismatch.	ERROR 025	Local front panel fault.
CONFIG ERROR 06	Nearside/farside mismatch.	ERROR 030	Master detected invalid broadcast.
CONFIG ERROR 07	Configuration incompatible with XL2 signal controllers.	ERROR 031	Master detected aspects are not set as requested.
CONFIG ERROR 10	Master has unconfigured vehicle head.	ERROR 032	Master detected invalid response from signal controller.
CONFIG ERROR 11	Master has unconfigured pedestrian head.	ERROR 040	Master has been notified of CAT1 fault on signal controller.
CONFIG ERROR 12	A signal controller has unconfigured pedestrian head.	ERROR 041	Master has been notified of invalid broadcast on signal controller.
CONFIG ERROR 13	A signal controller has unconfigured vehicle head.		

End Of Life – Disposal Instructions (EOL)

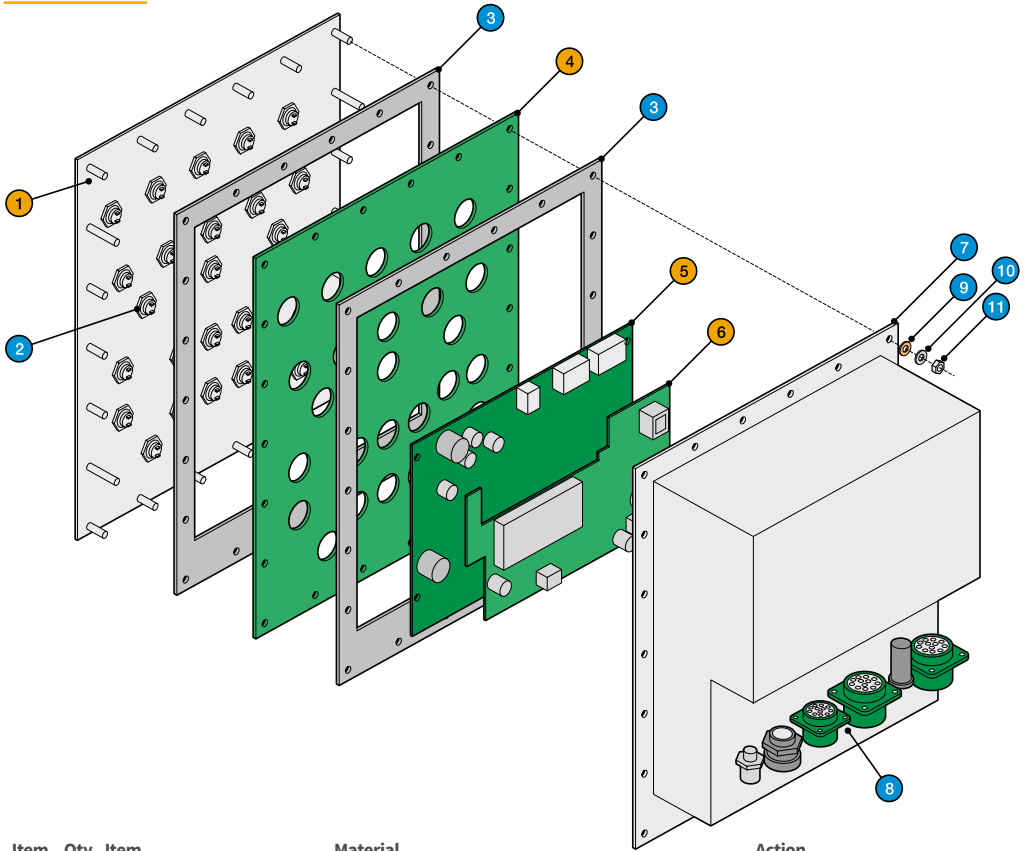
Evo ACM T2 Controller



Item	Qty	Item	Material	Action
1	1	Fascia	Aluminium with vinyl cover, switches & stainless steel bolts	Separate and recycle
2	1	Waterproof seal	Neoprene	Reuse/recycle
3	1	Main controller board	FR-4 glass epoxy with electronic components (may also include Lithium battery x 1)	Separate and recycle
4	1	Communications board	FR-4 glass epoxy with electronic components	Separate and recycle
5	1	Rear cover	Mild steel sheet	Reuse/recycle
6	4	Connectors & fuse holder	Mixed metals and plastic	Reuse/recycle
7	22	Fibre washer	Glass fibre	Reuse/recycle
8	22	Washer	Steel	Reuse/recycle
9	22	Nyloc nut	Steel	Reuse/recycle

End Of Life – Disposal Instructions (EOL)

Evo ACM T5, PT5, PT9 Controllers

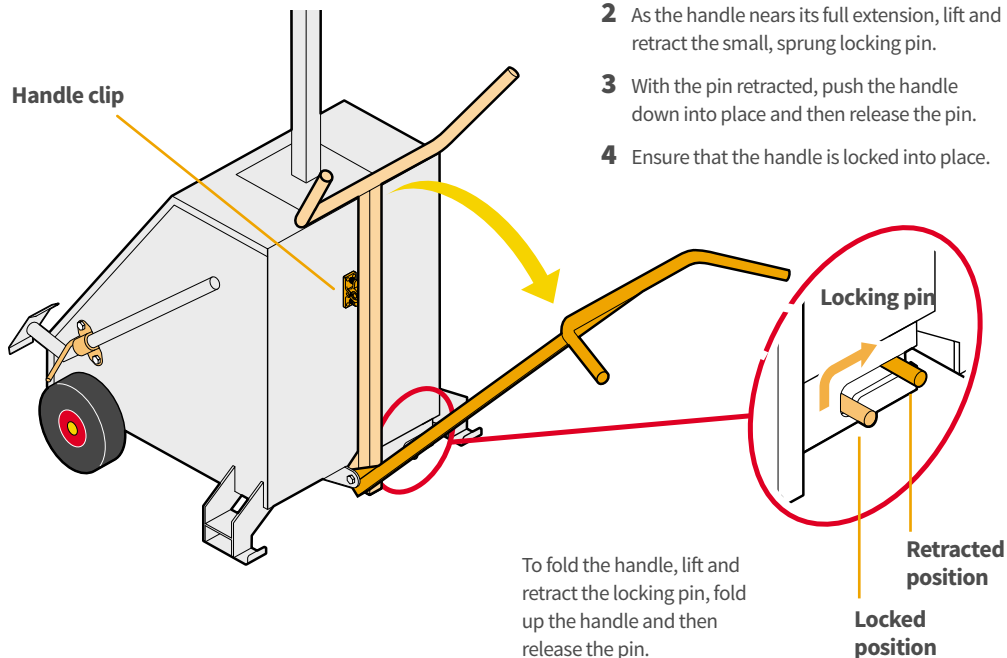


Item	Qty	Item	Material	Action
1	1	Fascia	Aluminium with vinyl cover & stainless steel bolts	Separate and recycle
2	27	Push button	Mixed metals and plastic	Reuse/recycle
3	2	Waterproof seal	Neoprene	Reuse/recycle
4	1	Front panel assembly	FR-4 glass epoxy with electronic components	Separate and recycle
5	1	Main controller board	FR-4 glass epoxy with electronic components	Separate and recycle
6	1	Communications board	FR-4 glass epoxy with electronic components	Separate and recycle
7	1	Rear cover	Stainless steel	Reuse/recycle
8	6	Connectors & fuse holder	Mixed metals and plastic	Reuse/recycle
9	22	Fibre washer	Glass fibre	Reuse/recycle
10	22	Washer	Stainless steel	Reuse/recycle
11	22	Nyloc nut	Stainless steel	Reuse/recycle

Safety Information

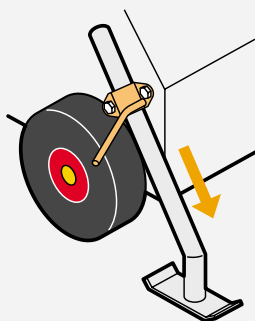
Provides important operation and maintenance information to promote safe and consistent service

IMPORTANT: When moving a Micro base unit, always fold out and lock the handle into place first.

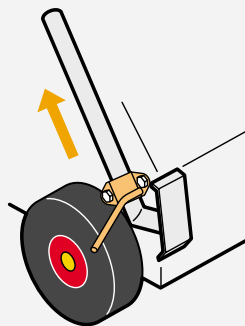


Stabiliser legs

When the Micro is in position, lower the two stabiliser legs to the ground and secure their clamps.



After use, raise and secure both stabiliser legs before moving the Micro unit.



Safety Information

Routine maintenance

Prior to use, please make the following checks:

- On each base unit, check that the handle pivots are clean and that each handle moves with ease.
- On each base unit, check that the locking pin channel and its return spring are clean and that each locking pin moves with ease. If a locking pin does not return to its locked position then the spring may need to be replaced.
- On the trailer, in addition to the standard road-worthiness checks, ensure that the lynch pins (which hold each carriage in place) are clean and can be moved with ease.
- On each base unit, check that the wheels are in good condition and show no signs of cracking or excessive wear.

Remedies

- 1** If necessary, clean off any contaminants using a suitable method.
- 2** Apply a silicon-based lubricant spray to the movable part.

IMPORTANT: Do not use grease on any areas as this will attract further contamination.

Replace any base unit wheels that show signs of wear or damage.

IMPORTANT:

If any damage is discovered, do not use the unit until the problem is fully remedied.

Safety Precautions

It is important that the products concerned should be installed and maintained by competent persons in accordance with good engineering practice, statutory requirements and codes of practice.

To comply with the Department of Transport specification TR 2502, it is mandatory to use Portable Traffic signals as a complete unit with the appropriate detection equipment.

In cases of special junction applications the permission of the appropriate authority must be sought.

It is necessary to utilise batteries within the systems covered by this Manual that involves a need for managed handling, usage and disposal techniques to ensure the safety of operatives and care of the environment.

All work must be performed in accordance with company working practices, in-line with adequate risk assessments. Only skilled and instructed persons should carry out work with the product.

Attention is drawn to the following;

1. This system is compliant to the Restriction of Hazardous Substances (RoHS - European Union directive 2011/65/EU).
2. No user-maintainable parts are contained within the product. Removing or opening the outer casing is deemed dangerous and will void all warranties.
3. Under no circumstances should a product suspected of damage be used. Damage may be suggested by unusual behaviour, an unusual odour or damage to any of the outer enclosures of the system. Please contact Traffic Group Signals Limited for further advice.
4. 'Control of lead at Work Regulations 2002' The Approved Code of Practice for the Control of Lead at Work' from the Health and Safety Commission.
5. Automotive batteries are classed as hazardous waste and therefore must be stored, transported and disposed of in accordance with the following pieces of legislation.

Environmental Protection Act 1990, Part II 2.

Environmental Protection (Duty of Care) Regulations 2014

The Waste Management Licensing Regulations 1994

The Controlled Waste (Registration of carriers and seizure of vehicles) Regulations 2012

Hazardous Waste Regulations 2011 and List of waste regulations 2011

The Carriage of Dangerous Goods by Road Regulations 2009



**Radio Equipment
Directive
(2014/53/EU)**

BE	BG	CZ	DK	DE	EE	IE	EL	ES	
FR	HR	IT	CY	LV	LT	LU	HU	MT	
NL	AT	PL	PT	RO	SI	SK	FI	SE	UK

6. Guidance for the correct deployment of signals and the associated signage can be found in; Traffic Signs Manual Chapter 8: Traffic safety Measures and Signs for Road Works and Temporary Situations



7. Advice and Guidance contained in DfT Traffic Advisory Leaflet 2/11 Portable Traffic Signal for the Control of Vehicular Traffic.

8. This Product is Compliant with the European Radio Equipment Directive 2014/53/EU & UK Radio Equipment Regulations 2017 (SI2017/1206) and operates at 458MHz and can only be operated in the UK.

9. Special product variant which operates at 869MHz for non-UK operation.

Warranty

Evo controllers are 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.

The following warranty periods apply:

LED Aspects (Vehicle and Pedestrian)	3 years**
LED Wait Indicators	3 years
Evo® Controllers	3 years
AGD Radars	2 years

Chargers and all other components 1 year.

Batteries are excluded from this warranty provision.

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 Traffic Group Signals Limited.

Any item of equipment repaired by Traffic Group 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.

Please refer to our Terms and Conditions of Sale for further details on warranty provision.

**See special warranty provision regarding failure of individual LED's within a signal aspect.

Disclaimer

While we (**Traffic Group Signals Limited**) endeavour to keep the information in this manual correct at the time of print, we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information, products, services, or related graphics contained herein for any purpose.

Any reliance you place on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this manual.

This product has been designed, developed and extensively tested as required to ensure its safety and reliability in service. It should be deployed and operated at all times in accordance with the User Manual and all current portable traffic signalling guidance by suitably trained personnel only. Training should cover both the general concepts of portable traffic signalling and the operation of this product itself.

In particular, your attention is drawn to the following:

- **An Introduction to the Use of Portable Vehicular Signals (The Pink Book)**
- **TAL 2/11 & TAL 3/11**
- **Safety at Street Works and Road Works – A code of Practice (The Red Book)**
- **Traffic Signs Manual Chapter 8**
- **Guidance for the Use of Portable Signals - ARTSM (2023)**

Training should be periodically refreshed. It shall be drawn to the operator's attention that with incorrect deployment and / or configuration, this product has the potential to create unsafe traffic conditions.

In the unlikely event that the unit suffers a failure or in any other way performs in a manner that is deemed to be unexpected or potentially incorrect by the operator, all lights at the site in question should be powered off. No attempt to operate the system should be made until such time as the system has been inspected by suitably qualified service personnel.

Declaration of Conformity



Declaration of Conformity

Certificate No: CE-085 Issue: 1

We Traffic Group Signals Ltd
White Lion House
Gloucester Road
Staverton
Cheltenham
Gloucestershire
GL51 0TF
UNITED KINGDOM

Traffic Group Signals Ltd
White Lion House, Gloucester Road
Cheltenham, GL51 0TF
t: 01242 440 3000
e: info@trafficgroupsignals.com
trafficgroupsignals.com

declare that the DoC is issued under our sole responsibility and belongs to the following product(s):

Equipment Model Type(s): a) Radiomaster
b) Micro
Equipment Description: Portable Traffic Lights

The object of the declaration described above is in conformity with the provisions of the following EC Directive(s), including all amendments, and with national legislation implementing this / these directive(s):

2014/53/EU relating to Radio Equipment,

2011/65/EU RoHS Directive

and that the following standards and Technical Specifications have been applied:

EMC: EN 50293:2012
EN301 489-1 V2.1.0
EN 301 489-1 V2.1.1
EN 301 489-3 V2.1.1

Safety: EN 62368-1:2014/A1:2015,
EN 60950-22:2006
EN 50566:2011
EN 62479:2010

Spectrum EN 300 220-2 V3.2.1
EN300-440 V2.2.1

ROHS EN IEC 63000:2018

Signed

Dated: Wednesday 16th December 2021

For and on behalf of Traffic Group Signals Ltd
P.M. Hutchinson Managing Director

Registered in England and Wales-No. 06552628-GB 123 4567 89

Declaration of Conformity

Certificate No: UKCA-085 Issue: 1

We Traffic Group Signals Ltd
White Lion House
Gloucester Road
Staverton
Cheltenham
Gloucestershire
GL51 0TF
UNITED KINGDOM



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Cheltenham, GL51 0TF
t: 01242 440 3000
e: info@trafficgroupsignals.com
trafficgroupsignals.com

declare that the DoC is issued under our sole responsibility and belongs to the following product(s):

Equipment Model Type(s): a) Radiomaster
b) Micro
Equipment Description: Portable Traffic Lights

conform with the relevant UK Statutory Instruments (and their amendments):
The Radio Equipment Regulations 2017 (SI2017/1256)

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (SI 2012/3032)

and that the following standards have been applied:

EMC: EN 50293:2012
EN301 489-1 V2.1.0
EN 301 489-1 V2.1.1
EN 301 489-3 V2.1.1

Safety: EN 62368-1:2014/A1:2015,
EN 60950-22:2006
EN 50566:2011
EN 62479:2010

Spectrum EN 300 220-2 V3.1.1
EN300-440 V2.2.1

ROHS EN IEC 63000:2018

Signed

Dated: Wednesday 16th December 2021 Place of Issue

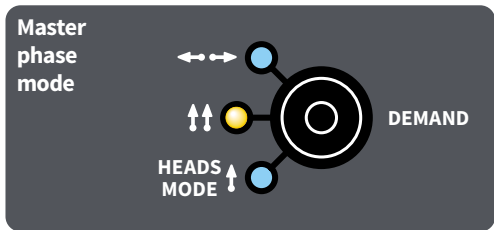
For and on behalf of Traffic Group Signals Ltd
P.M. Hutchinson Managing Director

Registered in England and Wales-No. 06552628-GB 123 4567 89

Appendix 1: ACM T2 as Master Controller

Phase set up examples

This section provides various examples of typical traffic control scenarios. Each example shows how to set the phase mode on the Evo ACM T2 master controller and also the corresponding designations for each signal controller head so that they are all addressed correctly and uniquely within the installation. Firstly, this page offers an explanation of the conventions used within this section.



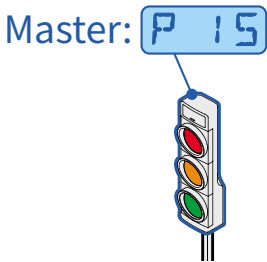
The master phase mode button

This single button fundamentally determines how the master and signal controllers/heads should be physically arranged and designated.

It has four states:

- Off,
- One head per approach (↑),
- Two heads per approach (↑↑), or
- Two opposed heads (↔↔).

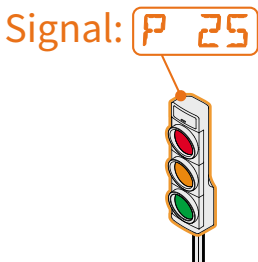
The three pages that follow show the type of head arrangements and designations that are expected for each of the master phase mode settings.



Master Controller signal head

The signal head that is connected directly to the master controller will always have the designation

P 15.



Signal Controller head identities

Each signal controller must be given an appropriate designation identity to match the phase on the master controller that is determining the signals that it should display. The LED-style text in each bubble shows the exact setting you should choose on the text display of each signal Evo ACM T2 controller. The blue and orange outline colours used in these diagrams are help to identify the separate phases.

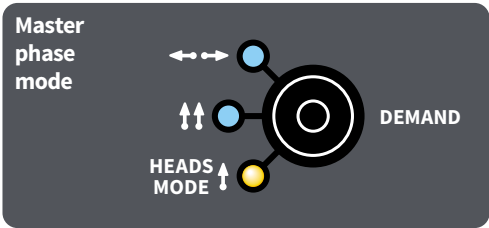
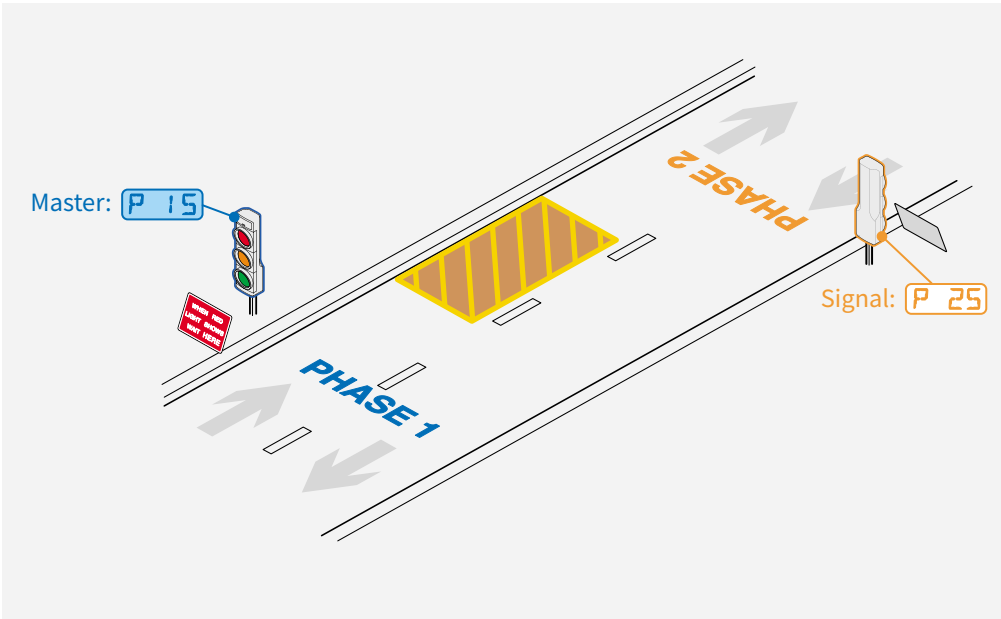
Appendix 1: ACM T2 as Master Controller

Example 1: Basic shuttle working

2 vehicle phases, 2 approaches, 1 head per approach

This example shows a carriageway controlled by two single-approach phases, each with one signal head.

 **AutoGreen** We recommend using AutoGreen mode for 2-phase shuttle working configurations.



Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

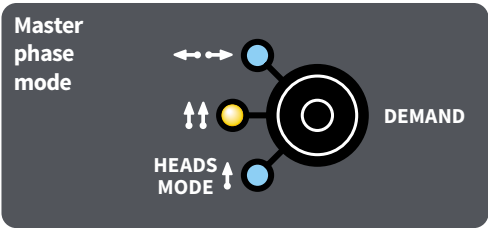
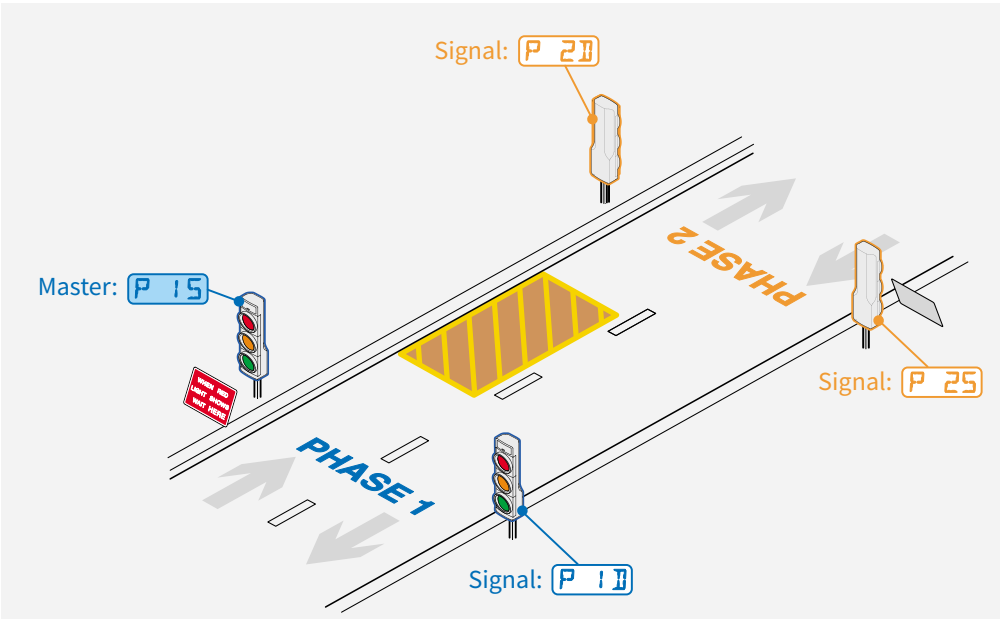
Appendix 1: ACM T2 as Master Controller

Example 2: Two head shuttle working

2 vehicle phases, 2 approaches, 2 heads per approach

This example shows a carriageway controlled by two single-approach phases, each with dual signal heads.

 **AutoGreen** We recommend using AutoGreen mode for 2-phase shuttle working configurations.



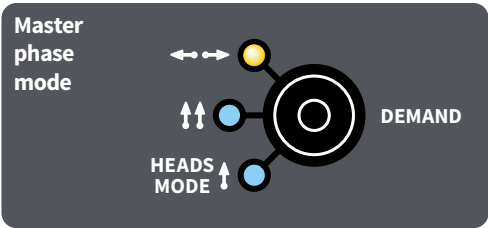
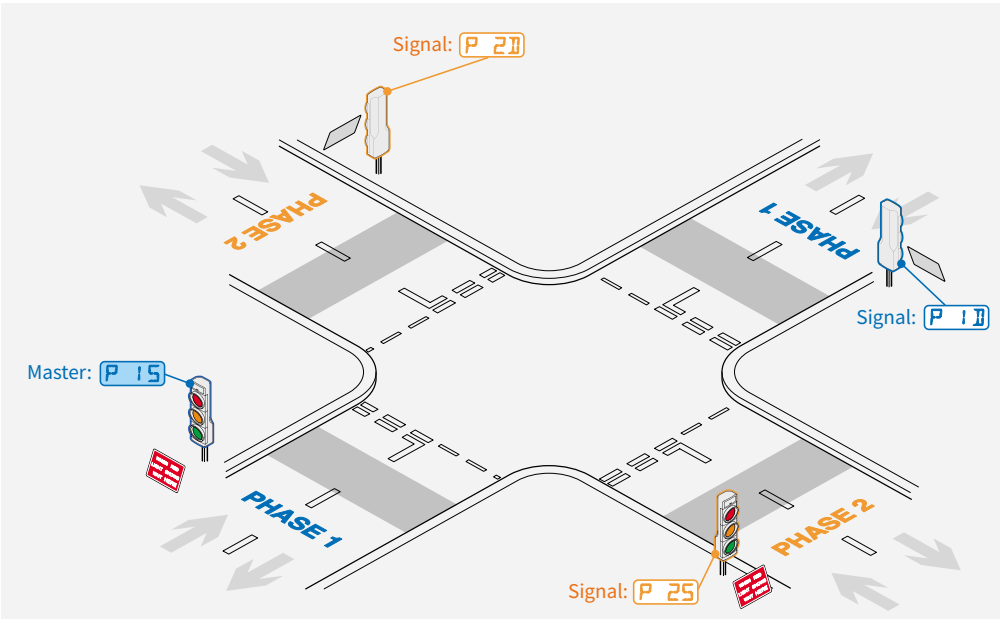
Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

Appendix 1: ACM T2 as Master Controller

Example 3: Crossroad

2 vehicle phases, 4 approaches, 2 opposed heads (per phase)

This example shows a crossroad controlled by two dual-approach phases, each with one signal head per approach.



Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

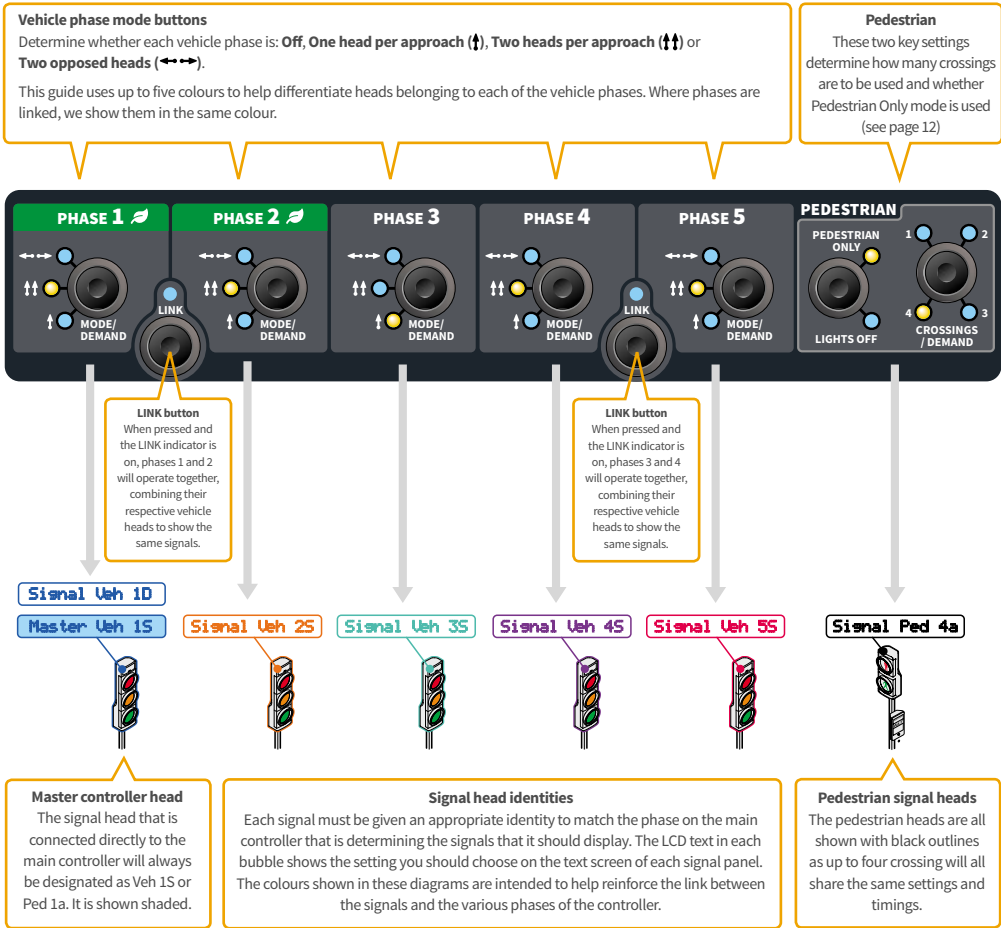
Appendix 2: ACM PT5 as Master Controller

Phase set up examples

This section provides various examples of typical traffic control scenarios. Each example shows how to set the vehicle phase and pedestrian modes on the Evo master controller and also the corresponding phase numbering for each signal head so that they are all addressed correctly and uniquely within the installation.

This page offers an explanation of the conventions used within this section. The row of controls shown at the foot of each example are not exactly as they appear on the controller, however, they should provide reasonable visual cues as to how each mode should be set. Of course, other button presses (timings, etc.) are required to produce a working layout.

Note: The positioning of Phase 5 on the Evo ACM PT5 differs from the Evo Multi PT5 controller layout.



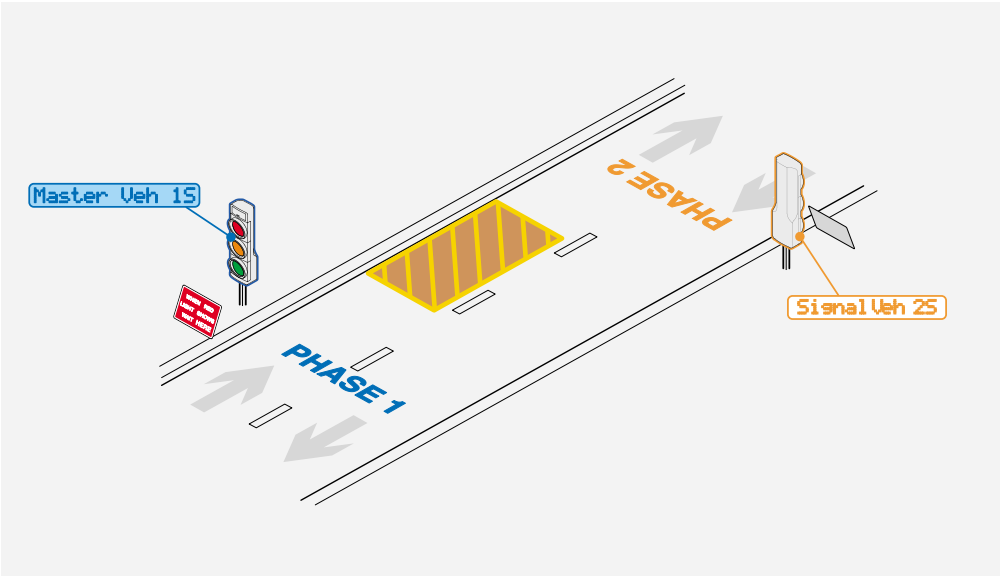
Appendix 2: ACM PT5 as Master Controller

Example 1: Basic shuttle working

2 vehicle phases, 2 approaches, 1 head per approach

This example shows a carriageway controlled by two single-approach phases, each with one signal head.

 **AutoGreen** We recommend using AutoGreen mode for 2-phase shuttle working configurations.



Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

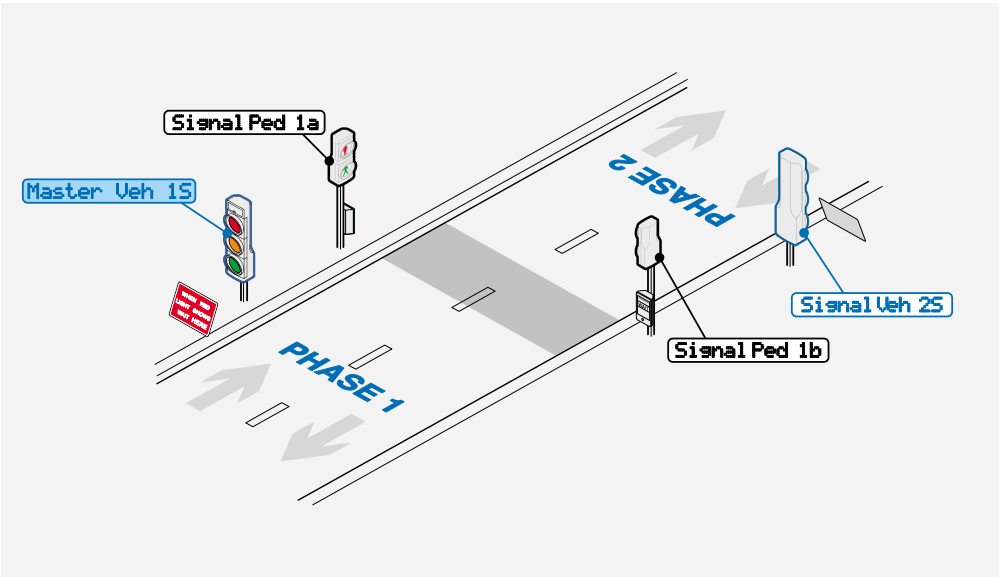
Appendix 2: ACM PT5 as Master Controller

Example 2: Standalone pedestrian crossing

2 vehicle phases, 2 approaches, 1 head per approach with single pedestrian crossing

This example shows a basic pedestrian crossing and uses the **PEDESTRIAN ONLY** mode to use the most appropriate settings.

Note: When the **PEDESTRIAN ONLY** mode is invoked, all active phases operate as one.



Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

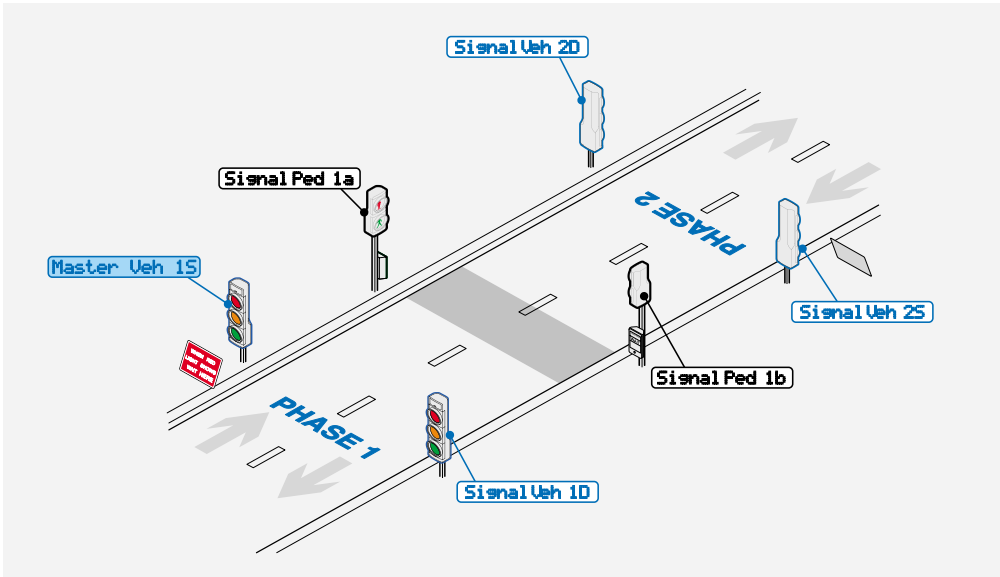
Appendix 2: ACM PT5 as Master Controller

Example 3: Standalone pedestrian crossing with 2 vehicle heads per approach

2 vehicle phases, 2 approaches, 2 heads per approach with single pedestrian crossing

This example shows a pedestrian crossing that might be used on a faster road with extra vehicle signals for added visibility and uses the **PEDESTRIAN ONLY** mode to use the most appropriate settings.

Note: When the PEDESTRIAN ONLY mode is invoked, all active phases operate as one.



Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

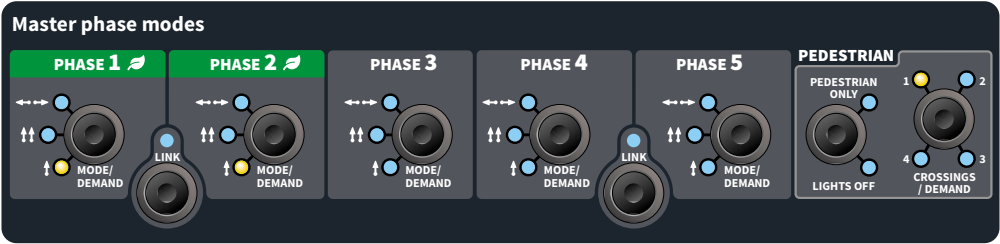
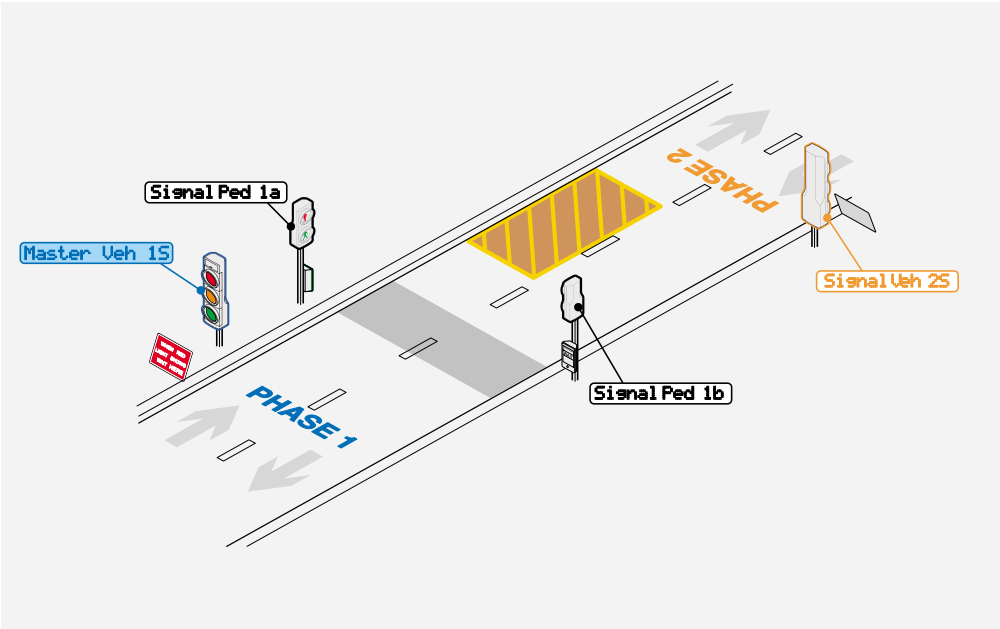
Appendix 2: ACM PT5 as Master Controller

Example 4: Shuttle working plus pedestrian crossing

2 vehicle phases, 2 approaches, 1 head per approach with single pedestrian crossing

This example shows a pedestrian crossing combined with shuttle working.

 **AutoGreen** We recommend using AutoGreen mode for 2-phase shuttle working configurations.



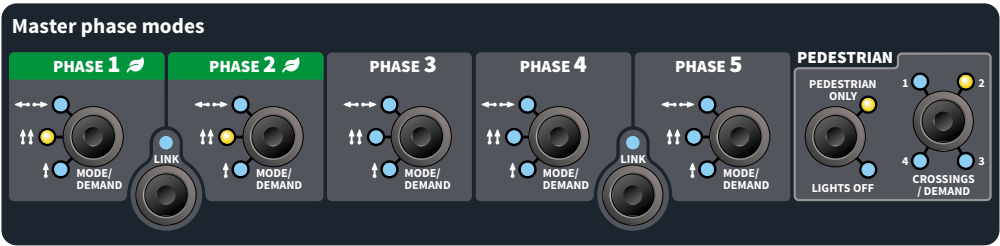
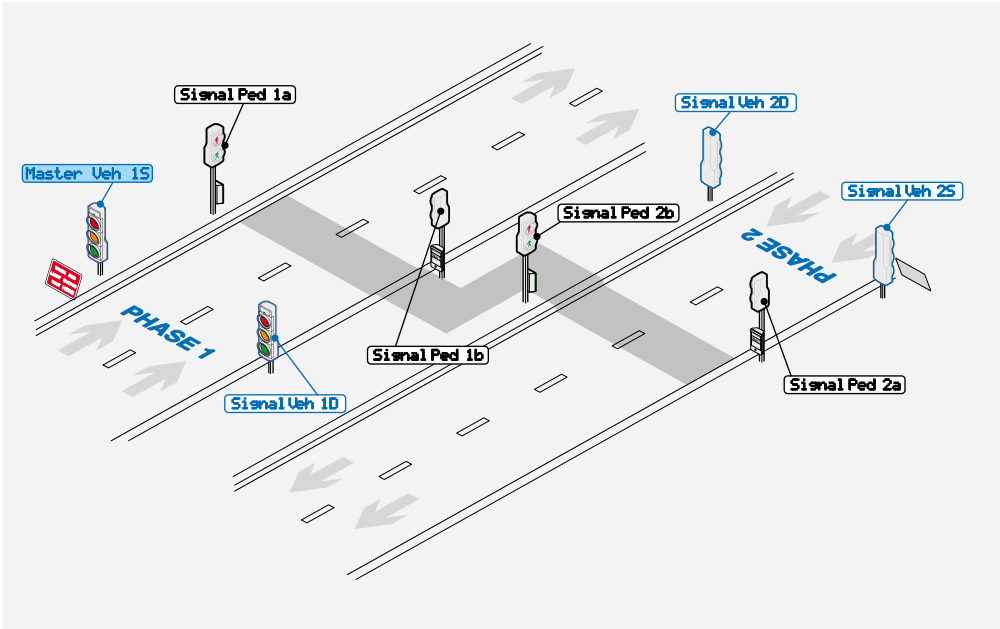
Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

Appendix 2: ACM PT5 as Master Controller

Example 5: Combined carriageway plus pedestrian crossings

This example shows two linked pedestrian crossings that are staggered across two carriageways. The layout uses the **PEDESTRIAN ONLY** mode to use the most appropriate settings.

Note: When the **PEDESTRIAN ONLY** mode is invoked, all active phases operate as one.

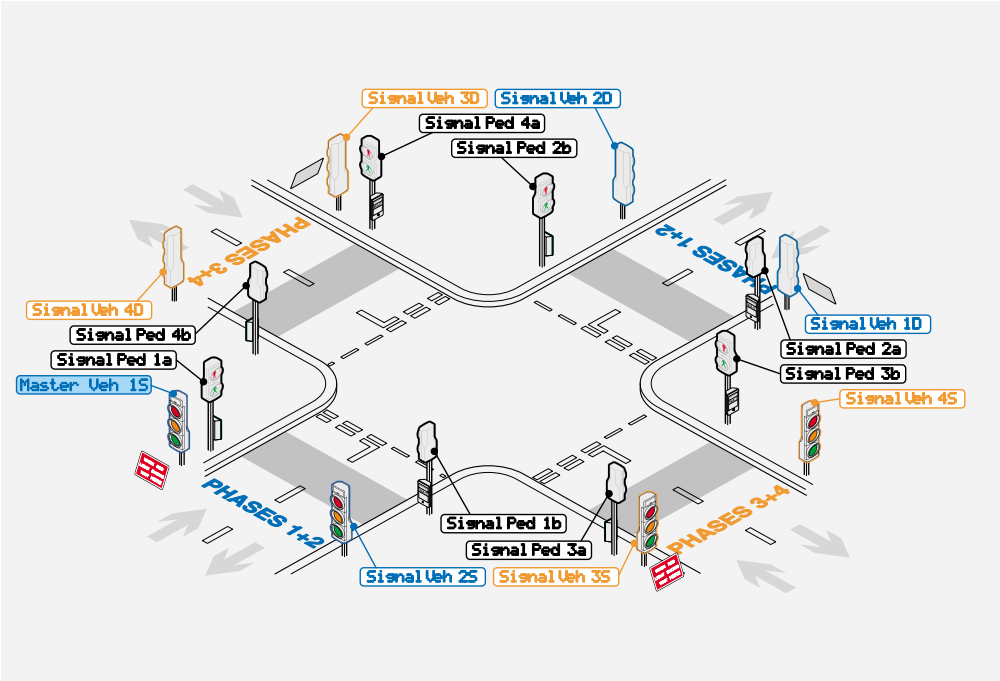


Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

Appendix 2: ACM PT5 as Master Controller

Example 6: Two-way crossroad plus pedestrian crossings

This example shows a crossroad with two vehicle (linked) phases and four pedestrian crossings.

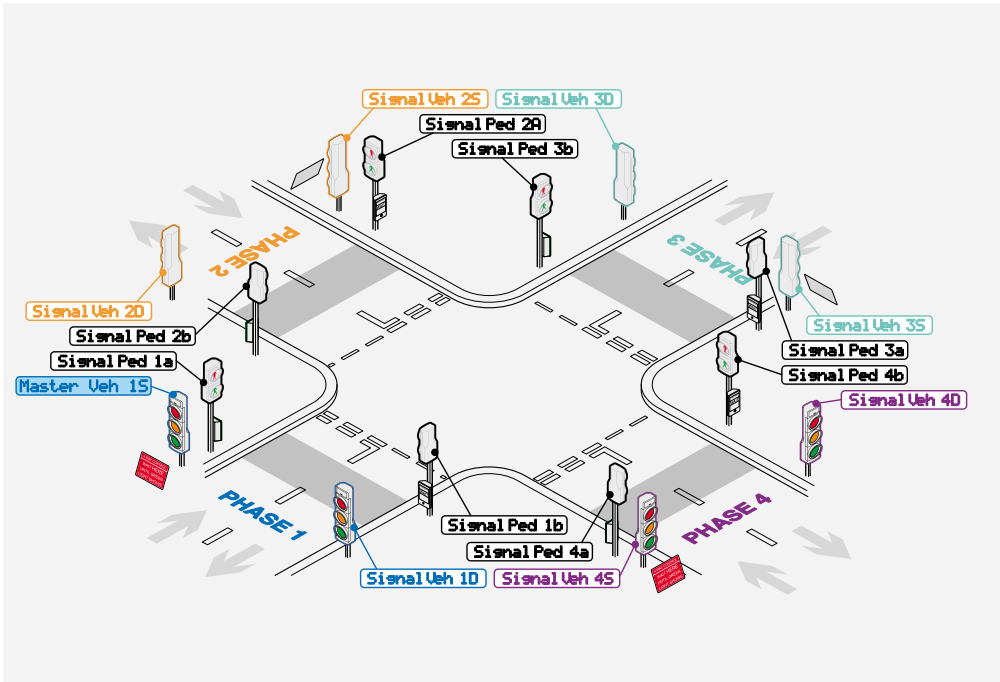


Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

Appendix 2: ACM PT5 as Master Controller

Example 7: Four-way crossroad plus pedestrian crossings

This example shows a crossroad with controlled by four vehicle phases with four pedestrian crossings.

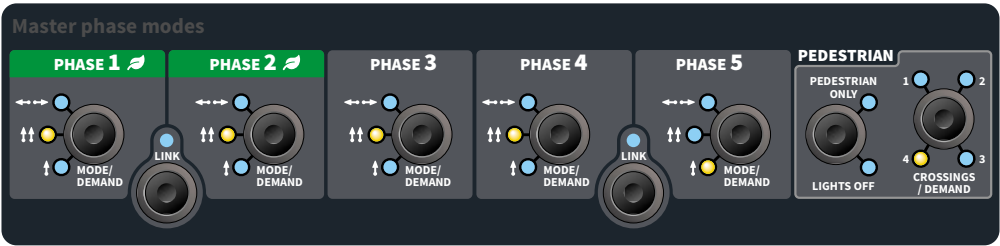
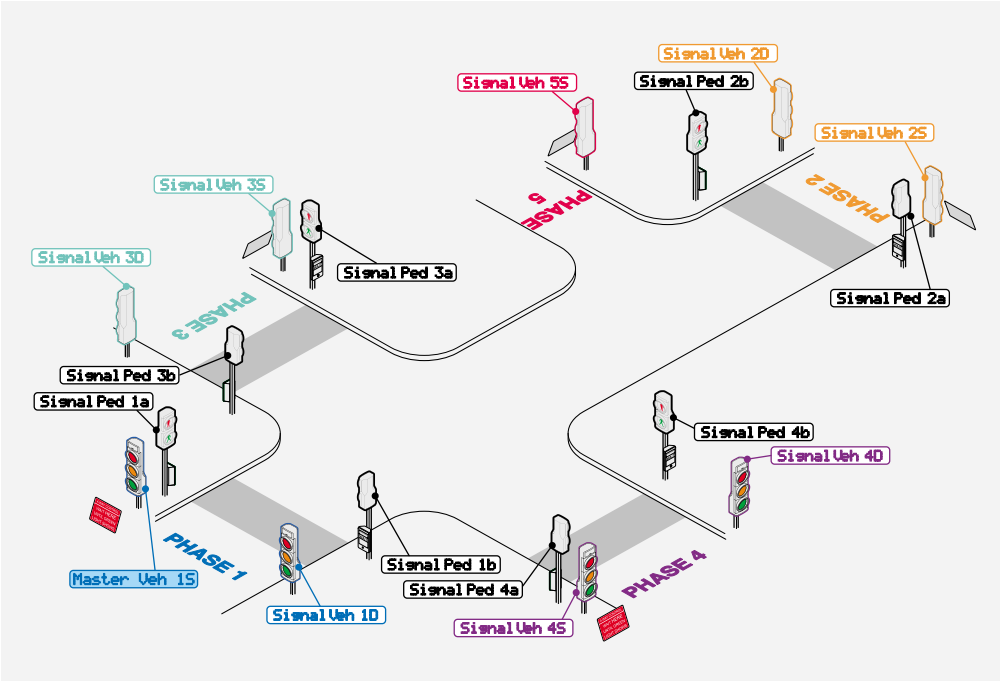


Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

Appendix 2: ACM PT5 as Master Controller

Example 8: Five-way staggered junction plus pedestrian crossings

This example shows a major junction controlled using all five vehicle phases as well as four pedestrian crossings.

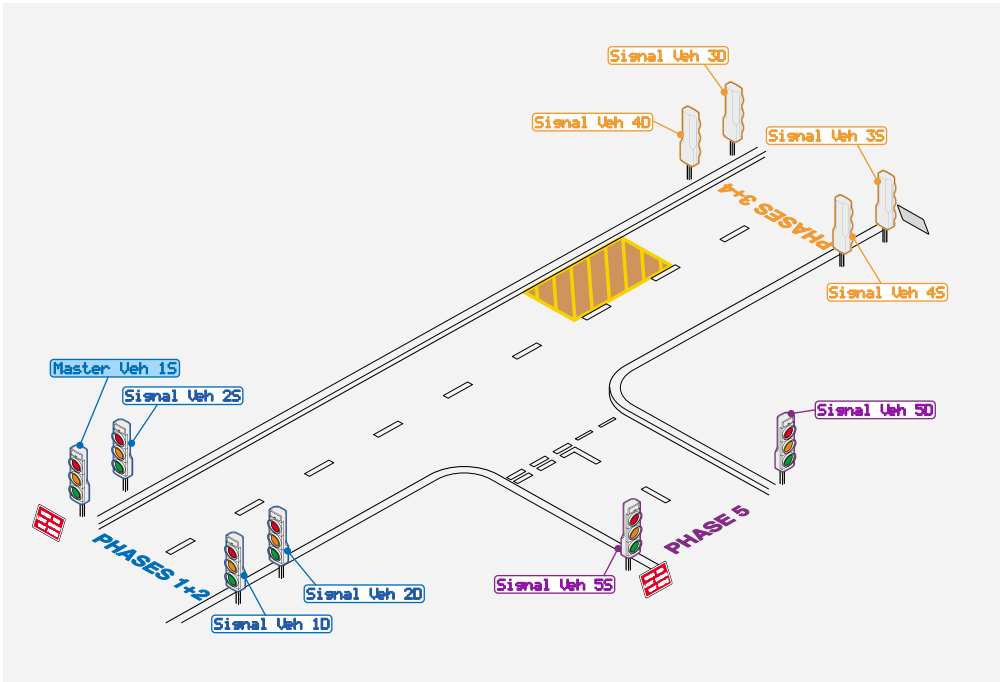


Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.

Appendix 2: ACM PT5 as Master Controller

Example 9: Fast carriageway with side road

This example shows the control of shuttle working on a fast carriageway with a side road.



Note: All junction layout examples given in this document are meant for rough guidance only. Please refer to Highways Agency specifications for actual signal, sign and cone placements for any particular junction types.



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