RADIOCONNECT

PORTABLE TRAFFIC SIGNALS

PRODUCT MANUAL

AUTO-GREEN® TECHNOLOGY

TRAFFIC SIGNALS
HOLLCO
RADIO-CONNECT® 2

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AUTOGREEN® TECHNOLOGY

*See page 39-41 for a full explanation on **AutoGreen®** Technology*

System Overview

DESIGN FEATURES - STANDARD RC2

System Overview

FEATURES OF THE STANDARD RC2

- Two maintenance free 104Ah batteries, providing best in class run-time of 18 days or more, with battery level indication and estimated days remaining
- Sealed intelligent charging system, full charge in under 12 hours
- Battery security designed into a super strong steel skeleton
- Lock-down stabiliser system to prevent unwanted movement when deployed
- High performance radio system for reliable operation
- Advanced FMCW radar, capable of separately tracking each approaching vehicle with their associated range and speed
- Fully featured controller, capable of being either a Master or Slave, supporting up to 4-ways, plus linked or secondary slaves
- **AutoGreen® VA** mode, dynamically adjusts green phase timings for a 2-way, improves efficiency of 'tidal flow' conditions at different parts of the day

WHAT IS AUTOGREEN® TECHNOLOGY?

AutoGreen® is an advanced form of smart radar based Vehicle Actuation (VA) for Hollco portable traffic signals.

AutoGreen® technology has been designed to dynamically adjust signal control to create a safer, greener and more efficient roadworks environment.

AutoGreen® achieves this through a series of traffic scenarios, where signal performance is optimised according to current 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 vary multiple green light parameters and gap times for different situations, to enhance traffic flow, reduce driver frustration and eliminate the need for manual intervention.

AutoGreen® is the UK's first scenario-based portable traffic solution.

System Overview

WHAT ARE THE BENEFITS OF AUTOGREEN®

AutoGreen® offers users the following benefits:

- Signals automatically modify their behaviour to best suit current traffic conditions without the need for manual intervention.
- The system adjusts in response to tidal flow variations throughout the day and also to unexpected peaks in demand whenever these occur.
- 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 real-world performance.
- Correct operation under or near high tension power lines

For a standard 2-phase system on a 50m length of roadworks **AutoGreen®** can improve traffic flow in cars per hour by up to 24% compared to traditional VA based systems based on 'Pink Book' recommendations.

This can reduce driver frustration and remove the need for Manual Control on those sites where traffic density is suitable for **AutoGreen®** control.

AUTOGREEN® VS. TRADITIONAL VEHICLE ACTUATION

AutoGreen® is an advanced form of radar based Vehicle Actuation (VA) for Hollco portable traffic signals.

Traditional VA systems for portable signals use simple Doppler radars as the detection input for the signals. Owing to the lack of high quality detection data, these detectors give rise to a host of known inefficiencies in the system and hence whilst providing an effective VA system it is one that is less than optimised.

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, resulting in increased traffic flows and a reduction in driver frustration.

System Overview

DESIGN FEATURES - TRIPOD RC2 LITE AND TRIPOD AUTOGREEN

Battery integrated into signal head

Rigid, quick deployment tripod

Ultra stable platform

Adjustable leg for use on uneven ground/ kerbs

Easy carry handle

Shown with hinged lockable battery door removed.

Charger Kit and Case containing two spare batteries, two chargers, inverter and extension lead.

System Overview

FEATURES OF THE TRIPOD RC2 LITE AND TRIPOD AUTOGREEN®

- Tripod mounted head, highly portable for quick deployment
- Maintenance free 22Ah battery integrated into the head, providing best in class run-time of at least 36 hours, with battery level indication and estimated hours remaining
- Batteries are hot-swappable for charging
- Battery charger pack available with inverter suitable for in vehicle charging
- High-performance radio system for reliable operation
- Advanced FMCW radar, capable of separately tracking each approaching vehicle with their associated range and speed
- Controller, capable of being either a Master or Slave, supporting up to 4-ways, plus linked slaves (secondary slaves are not supported)
- Optional **AutoGreen VA** mode, dynamically adjusts green phase timings for a 2-way, improves efficiency of 'tidal flow' conditions at different parts of the day

System Overview

DESIGN FEATURES - RETRACTABLE TWIST LOCK HANDLES

Manoeuvrability of the RadioConnect2 is very compact, self contained and versatile. The retractable, twist lock handles are an integral part of the unit that can be stowed and locked away. No more looking for lost handles or handles left back in the vehicle.

1. Grab retractable handles and rotate outwards
2. The unlocked handles can then be extended to full length
3. Rotate handles inwards to lock and make ready to lift
4. The unit can be easily Manoeuvred and once in position reverse the process to retract and stow the handles

System Overview

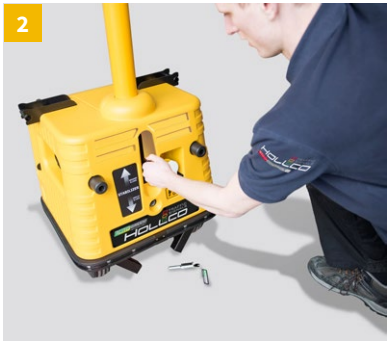
DESIGN FEATURES - RETRACTABLE/LOCKABLE STABILISERS/IMMOBILISER

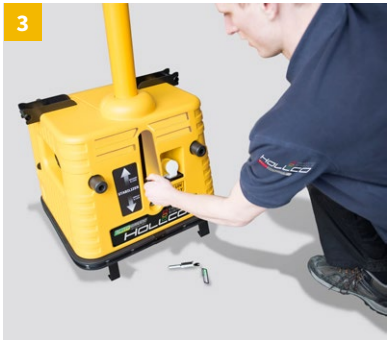
A lock protected lever allows the user to slot down stabilising legs, once deployed and locked the unit is totally immobilised.

1. Use key to unlock the stabilising legs
2. Slide lever from top to bottom, legs deploy
3. Once lever is fully down the legs lock into position by the nature of the linkage
4. Relock to ensure no one can tamper with the unit, once deployed and locked the unit is totally immobile

Note: When not in use the locks can be stored in the Transit Tethering Points.

Tip: Tilting the unit slightly onto the back legs makes it easier to engage or disengage the legs in the fully down position.





Traffic Signal - Standard

SPECIFICATION	
Model	**HRC-TCM-RC2T**
Function	**Master or Slave**
Battery Power Technology	2 off 12V 104Ah Deep Cycle AGM Rechargeable (Lucas LSLC104-12 12V 104Ah)
Battery Charger	2 off IP66 600w integrated smart (3 stage) chargers
Charge Supply Voltage	110v AC only
System Operation Time	Typically 18 days or more
System Charge Time	Typically 12 hours, minimum 9 hours recommended
Traffic Phases	2-phase up to 4-phase as standard
Signal Aspects	Low power LED Approved to BS EN 12368
Signal Dimming	Integrated dimming for night-time operation
Extendable Handles	Integrated
Detection	AGD 302 Smart Radar in accordance with TOPAS 2504A
System Function	Generally in accordance with TOPAS 2502B (see separate compliance matrix)
System Range	5 to 500m subject to line-of-sight variations.
Weight	<130 Kgs including batteries
Security	Fully-integrated design
External Charge Point	Integrated 110v 16A 4H

Traffic Signal - Tripod

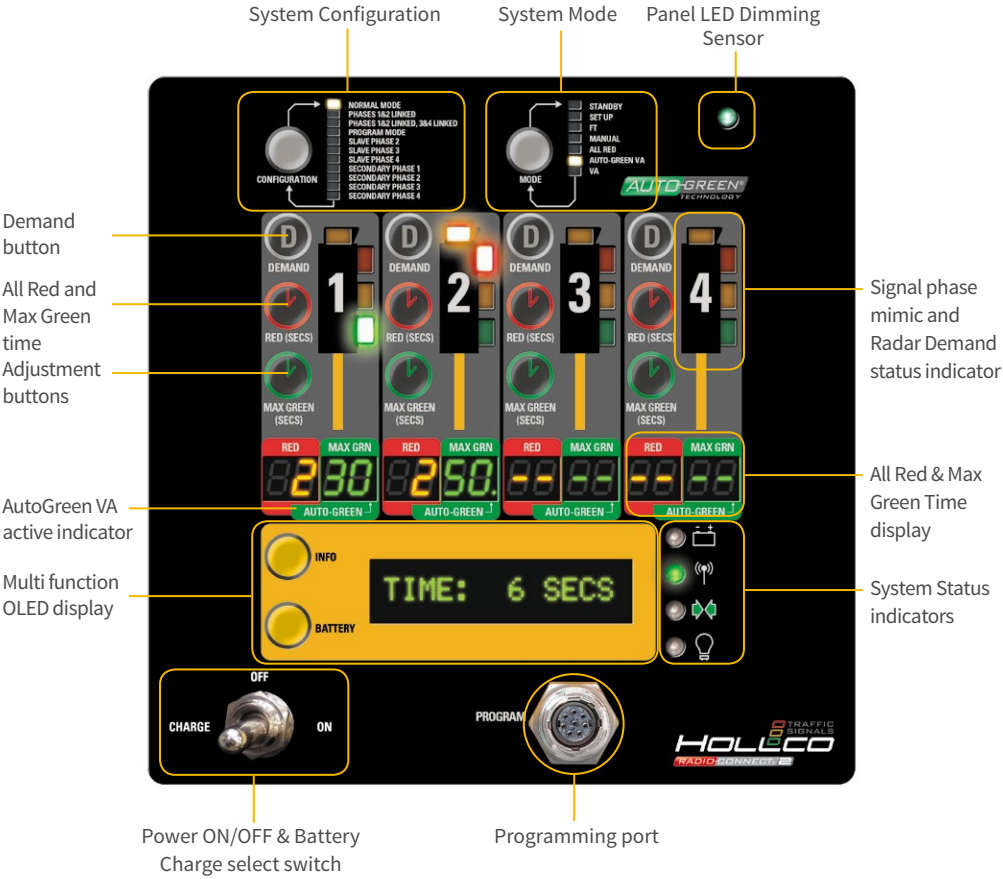
Charger Kit and Case containing two spare batteries, two chargers, inverter and extension lead.

The Tripod neatly folds down to match the height of the Signal head so stowage in vehicles is economical

SPECIFICATION	
Model	**HRC-TCM-RC2T**
Function	**Master or Slave**
Battery Power Technology	12V 22Ah Sealed Lead Acid Rechargeable (Lucas LSLC22-12 12V 22Ah)
Battery Charger	Mains powered 12V dc 4A (Numax 120400 Golf 12V 4A)
System Operation Time	Typically 36 hours (33 to 42 hours)
System Charge Time	Typically 8 hours, minimum 6.5 hours recommended
Traffic Phases	2 to 4 phases
Signal Aspects	Low Power LED Approved to BS EN 12368
Signal Dimming	Integrated dimming for night time operation
Detection	AGD 302 Smart Radar in accordance with TOPAS 2504A
System Function	Generally in accordance with TOPAS 2502B (see separate compliance matrix)
System Range	5 to 500m subject to line of sight variations
Weight	Head 16.3 Kg; Stand 5.8 Kg; Battery 5.8 Kg
Security	N/A
External Charge Point	No in-head charging

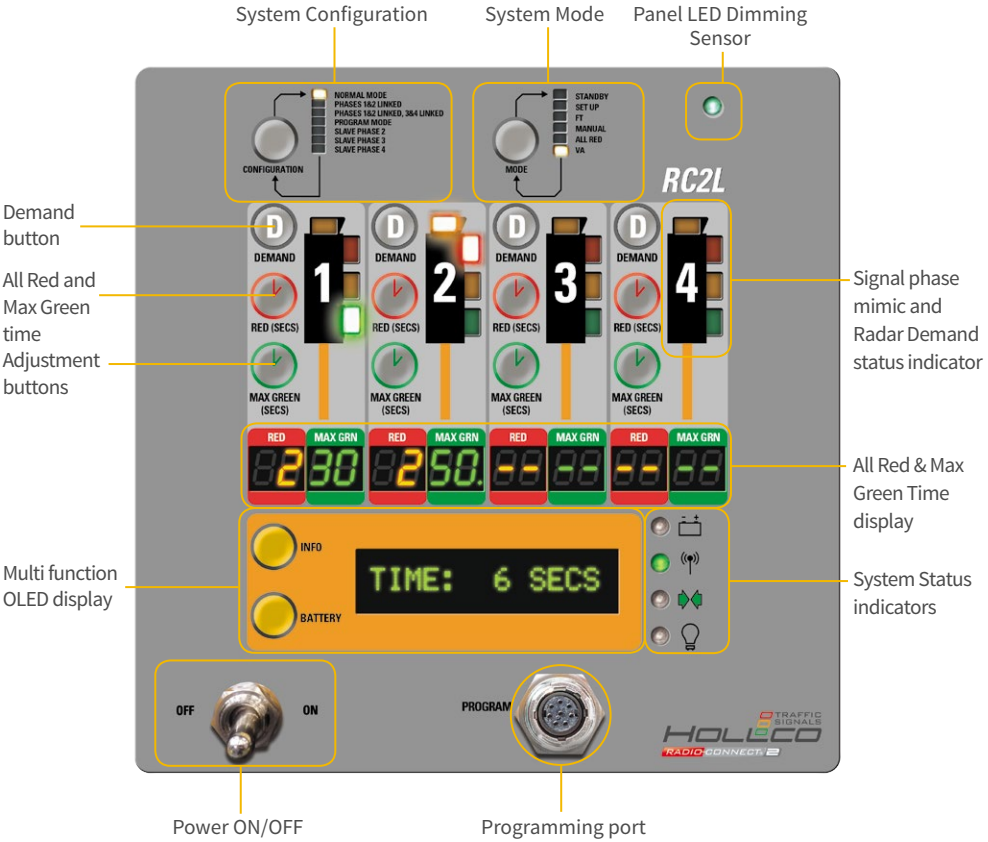
System Operation

FRONT PANEL - STANDARD CONTROLLER



System Operation

FRONT PANEL - TRIPOD LITE CONTROLLER



System Operation

CONTROLLER TYPES

The operator is required to configure each RC2 unit as one of the following types:

MASTER - The Master controller determines the overall operation of the system according to the selected configuration, mode and time settings.

There must be exactly one Master controller in the system. The Master controller always provides phase 1, but also provides mimic and timing displays for all phases across the system. Configuration and setup of the system is performed at the Master controller and is the only unit from which manual control of the system can be performed.

When choosing where to position the Master, care should be taken to ensure that this unit can easily and safely be accessed in case configuration changes or manual control is required at any time.

SLAVE - Slaves are primary controllers which signal as instructed by the Master controller.

Slave controllers can be configured to operate as phases 2, 3 or 4 as required. A Slave unit does not allow the operator to control signal timings but does display status information including mimics and battery levels. No more than one slave should be configured for a phase. In the event that the operator erroneously configures more than one slave per phase, the system will not startup and will inform the user by displaying "SLAVE PAIR ERROR".

SECONDARY - Secondary controllers follow signals instructed to another primary controller and are provided for use in situations where more than one signal is required on an approach.

Secondary controllers should only be used in off-side positions with a Slave or Master unit installed at the near-side position. Secondary controllers are not monitored by the Master controller, unlike Slave controllers which respond with signal state, radar and status information. All approaches to the controlled area should employ at least one Slave and should never be signalled using Secondary units only.

NOTE: Tripod controllers cannot be deployed as SECONDARY slaves.

NOTE: SLAVE and SECONDARY controllers must be paired with a MASTER controller in order to communicate. This is achieved by programming the Unit ID of the MASTER controller into all of the SLAVE and SECONDARY controllers - See System Maintenance Section, pages 33 to 35.

ACCESS TO CONTROLLER FUNCTIONS

The controller is mounted in the back of the signal head, housed behind the flap door. The door is lockable and it should be kept locked while in use to prevent unauthorised access.

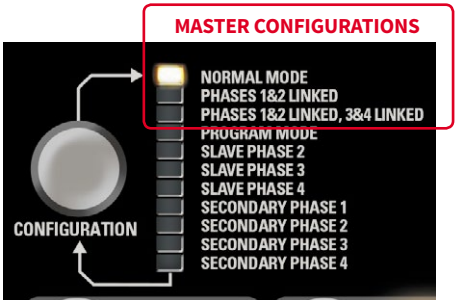
SETTING THE CONTROLLER TO RUN AS A MASTER

1. Open the signal head flap door to reveal the controller operational panel.

2. Turn on the Master controller by setting the isolation switch to **'ON'**. Ensure that the unit is set to the **STANDBY** mode. Configuration changes are only permitted whilst in STANDBY.

3. Press the **CONFIGURATION** button to select to one of the Master configurations (as illustrated on the right) as needed for the site

Only one LED indicates the currently selected configuration setting. Each push of the **CONFIGURATION** button advances the selection as indicated by a flashing LED. After a brief pause the LED stops flashing and the new configuration is set.



NOTE:

- *Whenever the configuration of a controller is changed, it is good practice to power cycle the unit to ensure the new configuration is established. To power cycle the unit, turn the controller off, wait 10 seconds, then turn on again.*

THE AVAILABLE MASTER CONFIGURATIONS ARE:-

Normal Mode	The signals will operate as individual phases.
Phases 1 & 2 linked	The signals will operate with phases 1 & 2 linked, but phases 3 & 4 will operate independently.
Phases 1 & 2 linked & Phases 3 & 4 linked	The lights will operate with Phases 1 & 2 linked and Phases 3 & 4 linked.

Any of the options above will make this controller the Master of the complete signal system and its display panel will show all timings and mimic signal phases active when running.

4. Set up the phases as required by setting the red and green times as needed using the **RED** and **GREEN** buttons on each phase. Phases 2, 3 or 4 can be disabled using the **RED** button to select the **'— —'** setting instead of a red time. All other indications on the disabled phase will then be off. See System Timings Section for guidance on setting red and green times.

5. Also each DEMAND button can be used to disable nudging when the phase is quiescent (available from V1.3.0). This defaults to enabled each time the controller is switched on.

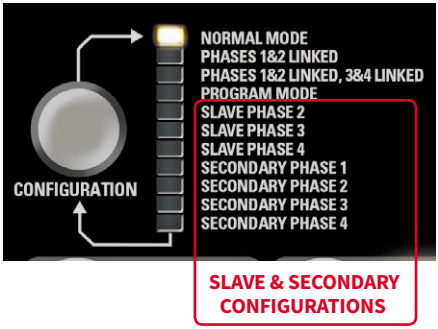
All other remaining controllers from here on must be configured as Slaves or Secondaries.

NOTE:

- *Configuration changes as outlined above, are only permitted when* **STANDBY MODE** *is selected. This is to ensure that configuration setup including enabling and disabling phases of the system is not accidentally changed during the live operation of the complete signal system.*
- *Tripod controllers do not support Secondary Heads.*

SETTING THE CONTROLLER TO RUN AS A SLAVE

With the settings opposite, a controller can be configured as a **SLAVE** or **SECONDARY** and the display on the control panel will show the Slave or Secondary phase number, plus mimic the signal changes of the signal head which it is serving. Secondary phase configurations are not available on Tripod Controllers.



NOTE: *Whenever the configuration of a controller is changed, it is good practice to power cycle the unit to ensure the new configuration is established. To power cycle the unit, turn the controller off, wait 10 seconds, then turn on again.*

SYSTEM MODE

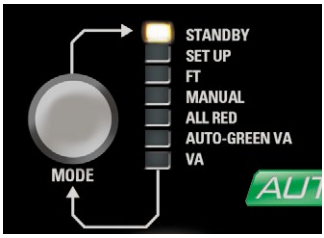
The System Mode can be selected at the Master Controller as follows:

- **STANDBY - Permits configuration selection and setup of Red and Green times for the Phases.**
- **SETUP - Permits the Master to operate the Radio only (no light operation) to setup the system by finding and connecting to configured Slaves.**
- **FT - Sets Fixed Time Operation**
- **MANUAL - Sets Manual Operation**
- **ALL RED - Sets Signals to all Red**
- **AUTOGREEN VA - sets Vehicle Actuation with dynamic Auto Green Operation**
- **VA - Sets Vehicle Actuation operation**

NOTE: AUTOGREEN VA is not available on a Tripod with an RC2 Lite Controller.

A new System Mode is requested by pressing the Mode button the required number of times in order to cycle through the list of available modes. Once a new Mode is selected, the LED for the new Mode will flash. This flashing indicates that the system is in the process of changing into the newly requested mode. This can take a varying period of time to complete as the system waits for an appropriate point in the signalling cycle to change into the new mode. The Mode LED will become solidly illuminated again once the system is running in the requested mode.

STANDBY - SYSTEM INACTIVE, PERMIT CONFIGURATION



At switch-on or when **STANDBY MODE** is selected the controller will go to an inactive state, all lights will go to off and stop operating with no Radio connection established yet.

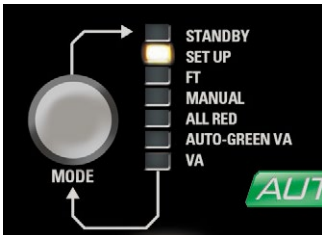
In **STANDBY MODE** the controller can be configured as a Master, Slave or Secondary and the phases selected and linked.

NOTE:

- *If a change is required to the Configuration setting, this must be performed whilst in* **STANDBY MODE**. *It is also possible to enable and disable phases whilst in Standby mode.*
- *Any transition back to* **STANDBY MODE**, *following operation of the system, will end operation of the system with lights out on all phases. The current operational mode will complete any minimum green time (12 secs) before transitioning via All Red for 2 seconds to lights out. The Radio will cease any transmission.*

SYSTEM MODE (CONT.)

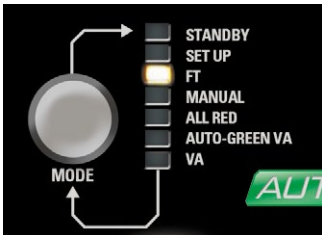
SETUP - CONNECT MASTER TO SLAVES PRIOR TO OPERATION



Select the **SETUP MODE** to find and establish the Radio connection between the Master and all configured Slaves and confirm correct configuration. Whilst in **SETUP MODE** the radar activations can be monitored live on the Demand LEDs for each configured phase. Also the **BATTERY** and **INFO** buttons and system status LEDs are updated via the radio communications. However the lights do not commence operation until one of the following operational modes is selected.

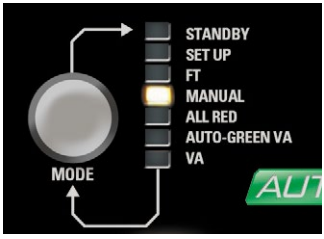
When **SETUP MODE** is selected from an operational mode, the current operational mode will complete any minimum green time (12 secs) before transitioning to all red for 2 seconds then lights out. However the Radio connection between Master and all configured Slaves will be maintained.

FT - FIXED TIME OPERATION



Setting the **SYSTEM MODE** button to the **FT** (Fixed Time) position, the signals will cycle in accordance with the preset times on Red and Green timing controls. Following the time at Red, a phase will transition via Red with Amber for 2 seconds, then it holds the signal at Green for a fixed time, according to the Green Time setting, before it transitions back via Amber for 3 seconds to Red. The timing at Red depends upon the configured number of phases or ways. Please refer to the System Timings section for further explanation.

MANUAL OPERATION



Select the **MANUAL MODE** to allow the operator to manually select the next phase to go to Green.

Press the **DEMAND** button on the phase where a Green stage is required. The lights will cycle to and stay on Green, until the demand is cancelled or a demand is entered for a different phase.

Pressing the **DEMAND** button for the phase at Green will cancel the demand, so that the lights will return to All Red, provided that the minimum 12 seconds of Green has completed. The lights will stay on Red until another Demand is inserted.

Pressing the **DEMAND** button for a phase at Red will cause the system to safely transition to the demanded phase next. Any phase currently at Green will return to Red, observing the required minimum Green time (12 seconds) and the required time at All Red, to clear the site of vehicles from the previous phase, before the Demanded phase goes to Green. Please refer to the System Timings section for further explanation.

Repeat the procedure as required.

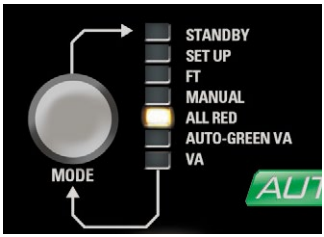
NOTE:

- *The Green will not change until the initial 12 secs. minimum time has elapsed, regardless of when manual demands are entered or cancelled.*
- *When selecting the next Green demanded phase, the Red and Amber preset times will run.*
- *In Manual mode, the green time displays on the controller all show '— —' to indicate that no maximum green time is applied to the operation of the lights.*

System Operation

SYSTEM MODE (CONT.)

HOLD ALL RED

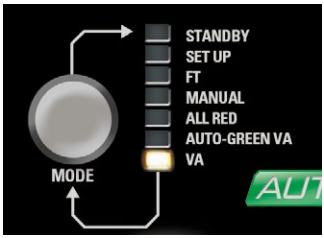


Select the **ALL RED** mode to set the signals to the **ALL RED** state. Any Green stage presently running will return to Red after observing the minimum Green time.

NOTE:

- *The system will then remain in the all-red condition until another mode is selected.*
- *In All-Red mode, the green time displays on the controller all show* ***'— —'*** *to indicate that no maximum green time is applied to the operation of the lights.*

VA - VEHICLE ACTUATION OPERATION



Select the **VA MODE** to operate the system in Vehicle Actuation mode.

The signals will operate as follows:-

1. A demand for a phase will be entered whilst it is at Red, when the radar detects the first approaching vehicle. The signals automatically change to green to service the demand on a first come first serve basis.
2. The signals will rest at All Red when there are no vehicle demands registered on any phase.
3. The phase goes to green to service the demand for a minimum of 12 seconds. The green stage is extended by the approach of further vehicles, for up to 15 seconds from the last vehicle, or for the maximum green time following a demand entered on another phase.
4. When a phase has just returned to red from green, with no demand on any other phase, then it can return to green in as little as 2 seconds at red, when any vehicle follows on the same approach, irrespective of the red time setting. This is known as **'Red Reversion'** and only operates when there are no demands inserted on other phases.
5. The red times ensure that there is sufficient time for vehicles to travel safely between the heads, to clear the site before the next phase goes to green to service any opposing demand. Please refer to the System Timings section for further explanation.

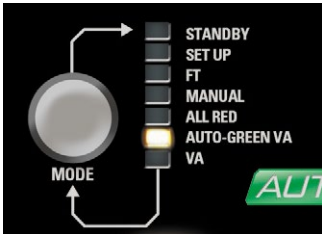
NOTE:

- *A failsafe* **'Nudge'** *demand inserted by the controller into any phase that has been at Red for more than 150 seconds without the radar detecting any vehicle approach. This ensures that the phase is serviced to clear any stationary or undetected vehicle. The 'Nudge' feature in the radar should be turned off.*
- *Nudging can be disabled for a phase when in* **STANDBY MODE** *using the* **DEMAND** *button (available from V1.3.0). This may be required for prevent a little used side road from having a nudge demand being inserted every 150 seconds.*

System Operation

AUTOGREEN VA

Select the **AUTOGREEN VA MODE** to operate the system in a Vehicle Activated mode where the system timing is dynamically controlled according to prevailing traffic conditions. The maximum Green times are adjusted according to vehicle detector input during the Green stage for each phase. This mode is not available in Tripod RC2 Lite.



NOTE:

- *Please read the Operations Section for further information about AutoGreen and considerations on its use and suitable sites prior to deployment.*
- *It is not possible to edit Green times in AutoGreen VA Mode as these are determined automatically by the controller. The value of Green time currently in use is displayed. A decimal point is illuminated next to the Green time for phases that have had their duration extended by the AutoGreen VA algorithm.*

BRINGING INTO OPERATION

Ensure all Controllers are switched on. Whilst in **STANDBY MODE**, make any changes to controller configuration and phase linking if required.

On the master controller set the number of phases and their red times and green times. Also the nudging of quiescence phases can be disabled for any phase as required.

Select **SETUP MODE**. The OLED display will show that the radio is **SEARCHING**.

Wait for the Comms Status indicator to illuminate solidly, indicating that all Slave controllers are communicating successfully with the Master controller via the radio link.

Now select the required operating mode (e.g. **AUTOGREEN VA**) by pressing the **MODE** button a number of times till the required **MODE LED** flashes. The selected **MODE LED** will continue to flash until the signal startup sequence is completed then illuminate solid. The operating mode can be changed at any time.

It is important to watch the traffic flow at regular intervals, and if necessary adjust the Master settings to optimise flow.

If vehicles are not clearing the site before the signals change, increase the Red times by 5 second increments until clearance is achieved in worst case circumstances.

When traffic flow is heavy and excessive vehicle queues begin to form, increase the Green times by 5 second increments on the Phase(s) where the traffic queue is longest. When traffic flow is light and there are long periods with no traffic flowing though the site at green, then the green time should be reduced to increase the cycle rate. This function is performed automatically when running in **AUTOGREEN VA** mode.

System Operation

SETTING LINKED PHASES

For some road layouts, it can be useful to link phases 1 and 2 together (the main road) and phases 3 & 4 together (the side roads). i.e. 'linked together' means the signal head aspects are synchronised to show Red/Amber/Green.

On the Master controller, with **STANDBY MODE** selected, either:

A) Press the **CONFIGURATION** button until **PHASES 1 & 2 LINKED** is selected. This synchronises phase 1 with 2 (opposing approaches on the main road) to operate together, whilst phases 3 and 4 (side roads) can operate independently in turn. Next set up the red and green times for phases 1, 3 and 4 (phase 2 shows 'Li' to indicate it is linked).

OR

B) Press the **CONFIGURATION** button until **PHASES 1 & 2 LINKED, 3 & 4 LINKED** is selected. This synchronises phases 1 with 2 and 3 with 4. This may be used at a crossroads where dual opposing approaches operate alternately. Next set up the red and green times for phases 1 and 3 (phases 2 and 4 shows 'Li' to indicate they are linked to the previous phase).

Finally select the required operating mode using the **MODE** button.

NOTE:

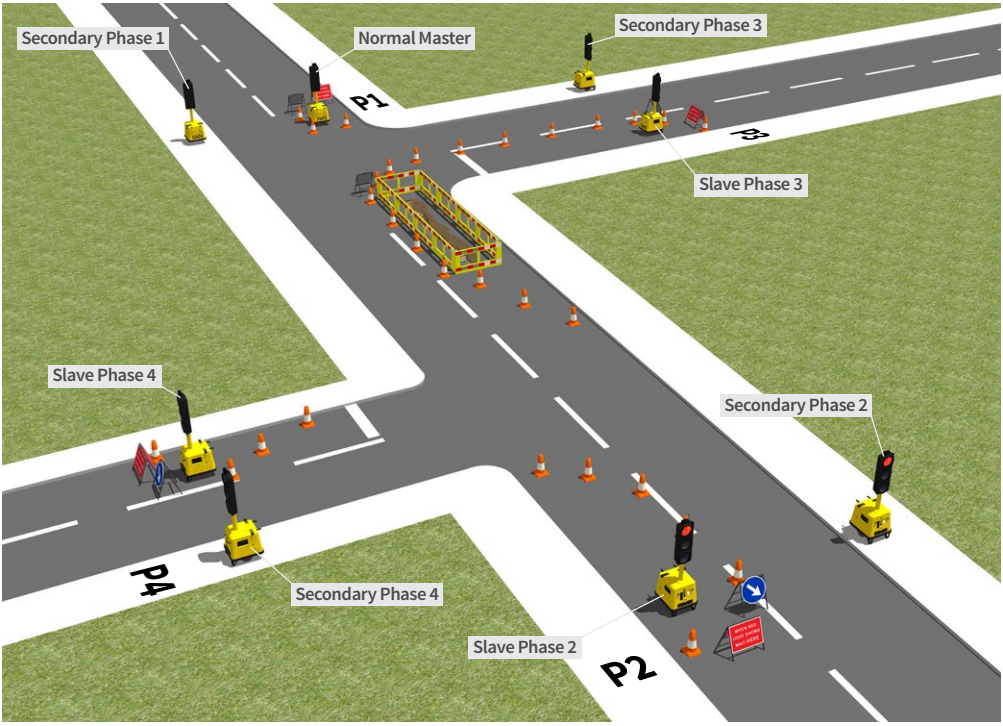
- *When Phases are in linked configuration, all radar detectors will still operate independently. However the nudge function is combined and applies to both phases.*
- *To revert the system configuration to unlinked operation, first select* **STANDBY MODE***, then select the* **NORMAL CONFIGURATION***.*
- *Additionally Secondary Slave controllers can also be used with linked phases where the approach requires a double head. In this scenario, the Primary Slave controller must be positioned on the near-side and the secondary controller positioned on the off-side.*

System Operation

SETTING PRIMARY AND SECONDARY HEADS (DOUBLE HEAD OPERATION)

Some sites may require double heads on one or more signal phases, i.e. 2 signal heads on the same approach with synchronised Red/Amber/Green. Note that Tripod units do not support Secondary Heads.

An example is shown below with the Configuration setting for each unit indicated:



In this configuration only the radar units in the master and primary slaves operate. Secondary heads cannot return vehicle demands to the master controller.

NOTE:

- *That various combinations of phases can be set as double heads. The labeling on the controllers make the setting self-explanatory. Additional heads can be set as secondary heads on any of up to 4 phases as required.*
- *When units are set as Double Heads only, the radars on the primary signal head will still operate and therefore only 1 nudge per phase still functions. This reduces excessive nudges and traffic hold-ups.*

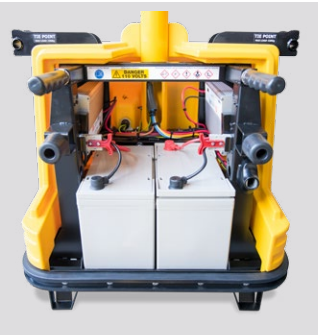
THE FOLLOWING RULES SHOULD BE ADHERED TO IN REGARD TO THE USE OF SECONDARY HEADS:

- No approach should be signalled by secondary heads only. The approach must also employ either a master or a slave head.
- Secondary heads should be used in the off-side road position only. Near-side signalling should be performed using a master or a slave head.

System Operation

BATTERY CHARGING - STANDARD RC2

The Standard Radioconnect2 system is fitted with two integral 110Vac to 12volt 16 Amp charge output chargers.



To place the signal system on charge, the system's battery base unit needs to be connected to a suitable 110V AC supply (with constant current loading) and the main controller switch set to the **CHARGE** position as shown right.

While the system is under charge, the controller's display will show the current charging state of each of the batteries, cycling alternately on the display between BAT 1 then BAT 2.

The voltage & charging condition stages will also be shown as:

- Stage 1) **Bulk** is displayed during the initial bulk charge stage (to 80% capacity)
- Stage 2) **Absorb** is displayed during the final charge absorption stage (batteries usable but not at full capacity yet)
- Stage 3) **Float** is displayed at full capacity, when trickle charging (ready for use, keeps the batteries topped up)

NOTE:

- *The system batteries can not be re-charged with the traffic signals in operation, or with the controller power switch set to anything other than charge.*
- ***BEWARE:** The battery base unit is designed for connection to 110v supplies only and should not be connected to a 230v supply as this may result in damage.*
- *The RC2 draws a larger current from the 110v supply during charging than the RC1 product. An assessment of power facilities should be made to ensure these are sufficient for the required number of RC2 units.*
- *It is recommended that no more than seven RC2's be charged simultaneously at bulk or initial few hours of absorb from a single 30A 110V supply.*
- *Ensure all controllers are switched to OFF before switching on the 110V supply to minimise the effects of in-rush current.*
- *The Stage 2 (absorption) charge is important to maintain battery life. Stage 2 should be completed after Stage 1 wherever possible.*

System Operation

BATTERY CHARGING - TRIPOD RC2

The Tripod RC2 Lite and Tripod Auto Green units do not support in head charging.

The RC2 Tripod uses a single 22Ah battery located in the lower section of the head, behind a hinged door with a magnetic catch. To access the compartment, pull the door on the non-hinged side.

The battery must be removed for charging. The batteries have a cable attached with an integral fuse and the connector is also compatible for use with the charger.

It is possible to hot swap a fully charged replacement battery by first plugging it into the second connector in the head, before removing the battery that needs charging.

Shown with hinged lockable battery door removed.

The charger kit supplied consists of two chargers, a DC to AC inverted (for in vehicle charging) and two spare 22Ah batteries in a portable case.

Connect the battery to one of the chargers (ensuring black is connected to black and red to red). Plug the charger into the supply and switch it on. The right LED indicator below the power switch on the charger will indicate as follows:

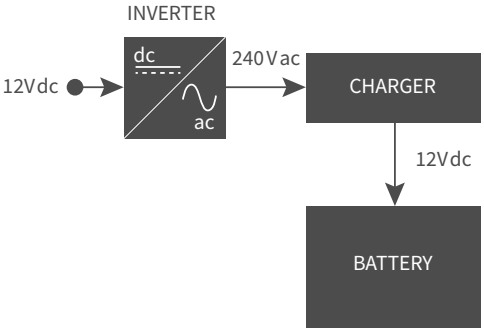
Red - A battery in the bulk stage of charging (high current).

Red/Green (alternating) - A battery in the absorb stage of charging (reducing current).

Green - A fully charged battery (being trickle charged).

The 22Ah battery takes approximately 6 hours 30 minutes (at room temperature) to fully charge (from 11.8V to 14.6V). It completes bulk charge (around 14.2V) in approximately 4 hours 30 minutes and is usable with approximately 80% capacity.

Tripod Battery: Lucas LSLC22-12 12v 22Ah
Compatible Charger: Numax 120400 Golf 12V 4A
Suitable for sealed (vented) Lead Acid batteries up to 48Ah



SAFETY NOTE: *When inserted the battery must always be secured by a strap. The battery must be removed when the head is not on the tripod stand and when lifting the head on or off the stand, as well as for transportation and storage.*

System Operation

BATTERY LEVEL AND DURATION OF SYSTEM OPERATION

1) Pressing the **BATTERY** button during normal operation of the controller will display a pessimistic and optimistic estimate of the operating duration remaining in days for the Standard RC2 unit. e.g.

SYS: 2d - 5d
PH1: 16d - 19d

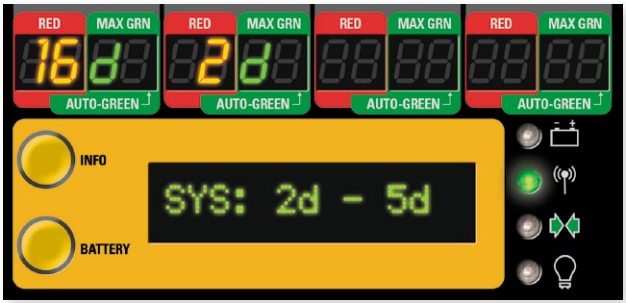
...and in hours for the Tripod RC2L unit. e.g.

SYS: 7h - 16h
PH1: 31h - 38h

Note 1: 'SYS' displayed by the Master controller indicates the lowest battery level in the set of controllers; **'PH1'** is displayed by the Master controller for phase 1.

2) On the second press of the **BATTERY** button, the combined voltage of the batteries in the pod base are displayed (see note 2 below). e.g.

PH1: 12.9V



Standard RC2 Battery Display

Tripod RC2 Lite Battery Display

3) At the Master controller further presses of the **BATTERY** button will display individual estimates for each of the connected primary controllers **(marked PH1, PH2, PH3 and PH4)**. Any phase that is not connected will be displayed as follows:

PH3: OFF

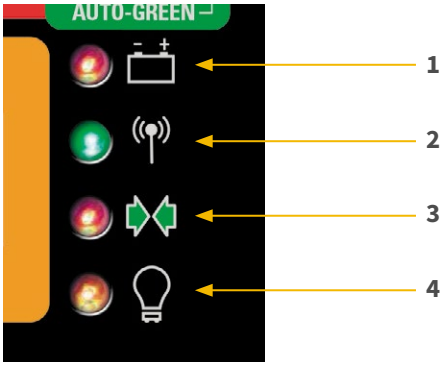
Note 2: A battery will display a voltage of 12.9V or more when fully charged, 12.5V at half charge, then 11.9V when Battery Low status is first indicated. Battery Low is initially indicated (LED ON, not flashing) for a standard unit with 2 to 5 days remaining and for a tripod with 7 to 16 hours remaining. It is recommended that the batteries are charged as soon as possible after the Battery Low status is first indicated.

NB: When the Battery Low status light is flashing then the battery has run out of charge. At this point (at or below 11.5V) shutdown and turn-off is imminent. The voltage level begins to fall more rapidly.

BEWARE: *Do not continue to operate when the Battery Low status light is flashing as the batteries may become excessively depleted, resulting in the aging effect being accelerated.*

System Operation

SYSTEM STATUS INDICATORS



1. 'BATTERY LOW'
Under normal operation, this Red LED is not lit. If this is illuminated, batteries need to be re-charged. If it begins to flash, batteries need to be re-charged immediately. If batteries are not re-charged, the signals will return to All Red for 2 seconds and then the system will switch off.

2. 'COMMUNICATION'
Under normal operation, this Green LED is illuminated (Radio Communication is good). If the light begins to flash, Radio Communication has been lost. Red and Green times may be extended until Radio Communication has been regained. This is a 'Cat 2' fault and this may be shown on the master controller display. Where Radio Communication cannot be re-established, the system will declare a 'Cat 1' fault and immediately transition to the Lights Out condition (i.e. all aspects throughout the system will be extinguished). If the system does not recover after auto restart then look for sources of persistent radio interference or radio communication failure.

3. 'CONFLICT'
Under normal operation, this Red LED is not lit. If it is illuminated then either a potentially dangerous signal sequence has been detected (such as Green against Lights Out conflict between two opposing phases) or an illegal signal state has occurred (such as a lamp driven ON). The lights will immediately transition to a lights out state. This is a 'Cat 1' fault. If the Conflict does not resolve itself on auto restart then a faulty unit needs to be replaced.

4. 'LAMP FAIL'
Under normal operation, this Yellow LED is not lit. If lit it indicates, there is a lamp failure. Check all signal heads to see which lamp has failed and replace the faulty unit. Where a single red lamp has failed throughout the system, a 'Cat 3' fault will be declared and no green signal that opposes the faulty red aspect will be illuminated until the issue is resolved. In the event that more than one red lamp fails, then a Cat 1 fault will be declared and the system will transition immediately to the Lights Out condition. If there is no recovery following auto restart then replace the faulty units.

AUTO RESTART
The response to any 'Cat 1' fault condition is immediate Lights Out. To minimise nuisance call outs the system automatically attempts a restart after a recovery period. The recovery period is initially 60 secs (15 secs from software version 1.3.0) but any repeat within 10 minutes will cause this period to ramp up from 1 minute to 2, 5, 10 and finally 30 minutes.

Pressing the MODE button during the recovery count down (software version 1.2.5 or later) will end the recovery count down and attempt an immediate restart.

SYSTEM INFORMATION
On the Master controller the INFO button provides additional status information and can be pressed in any operational mode, including STANDBY or when displaying faults and errors etc.

The following is displayed on each press of the INFO button, before it returns back to the original display:

1) Radio channel
2) Count of Cat 1, Cat 2 and Cat 3 faults
3) Unit ID
4) Company ID

Site Deployment

SIGNAL SITE DEPLOYMENT

Both the tripod and the trolley based signals have been comprehensively tested in a wind tunnel in all orientations. The trolley version is very highly stable and should be the signal of choice for very exposed locations. The tripod design has proved to be one of the most stable tripod versions on the market owing to the compact signal design and the large footprint.

It is extremely important when deployed that both the trolley and the tripod remain in place and are not able to be moved or rotated in medium to high wind conditions to remain safe.

The following recommendations are drawn directly from wind tunnel tests.

Deployment	Acceptable Wind Speed	Tripod Signal Condition	Trolley Signal Condition
Benign Locations (Well sheltered)	Up to 40mph (< 18m/S)	No ballast required	No ballast required
Normal Locations** (Semi exposed roads, low lying rural locations etc)	Up to 58mph (< 26m/S)	Add 30 Kg of ballast. Not recommended under gusting conditions.	No ballast required
Exposed Locations (Hillside locations, moorland, valley wind corridors, exposed coastal locations etc.)	Up to 65mph (< 29m/S)	Not recommended	No ballast required but add 30Kg if site liable to gusting conditions is recommended
Extreme Conditions	> 65mph (> 29m/S)	Not recommended	Not recommended

**The level for Normal Locations is the minimum recommended signal deployment condition

Ballast can be effectively deployed in the form of sandbags. One sandbag for each leg of the tripod.

Site Deployment

TRIPOD DEPLOYMENT

The information below demonstrates the easy deployment of the Tripod.

Tripod is easily carried to deployment spot.

Deploy by simply sliding the spring loaded catch down.

Legs deploy and catch locates at base of stand.

Leg with handle can be adjusted to compensate for kerb height if necessary.

Once secure mount the head.

Locate head onto base.

Head will drop into place precisely.

And can be secured by locking screw below battery compartment.

In high wind conditions use sand bags to secure the signal.

System Timing

SIGNAL TIMINGS

Position the required signing in accordance with the Traffic Signs Manual Chapter 8. Position the signal heads in the required positions at the ends of the site, ensuring that each Unit is switched on.

For 2-Way sites:

Measure the distance between the two WAIT HERE boards. Set Red and Green times based on this 'Distance' measurement based on the data provided in Tables 1 and 2. When Red times are entered, the OLED will display a message in the form 'P1 Distance 100m', indicating that Phase 1 red time is being edited and corresponds currently to a distance of 100m.

For level sites, the same value should be entered for phase 1 and phase 2, with each based on the 'Distance' measurement performed.

Where a site has a steep gradient, it is possible to include additional Red time on one of the phases to account for slower clearance through the site, for example cyclists on a steep gradient, whilst maintaining a standard Red time for the downhill phase transition.

For 3-Way and 4-Way sites:

Measure the distance between each WAIT HERE sign and the Datum Point. Set the Red time for each phase according to this 'Datum' measurement using the data provided in Tables 1 and 2. When Red times are entered, the OLED will display a message in the form 'P1 Datum 50m', indicating that Phase 1 red time is being edited and corresponds currently to a Datum value of 50m.

NOTE:

- *For 3-Way and 4-Way sites it is not possible to include additional Red times relating to a site with a steep gradient.*
- *When the controller is utilising* **Autogreen VA** *Mode the Green times are set automatically.*
- *If operating as a 2-way, ensure that phases 3 & 4 are disabled (red time display shows* **'— —'),** *or a 3-way, disable phase 4 Red timer, otherwise the set will not operate correctly and cycle through its set times.*

Table 1 Setting the Red Times

Distance (metres)	10	20	30	40	50	70	100	150	200	250	300	350	400	500
All-Red time (seconds)	1	2	3	4	5	7	10	15	20	25	30	35	40	50

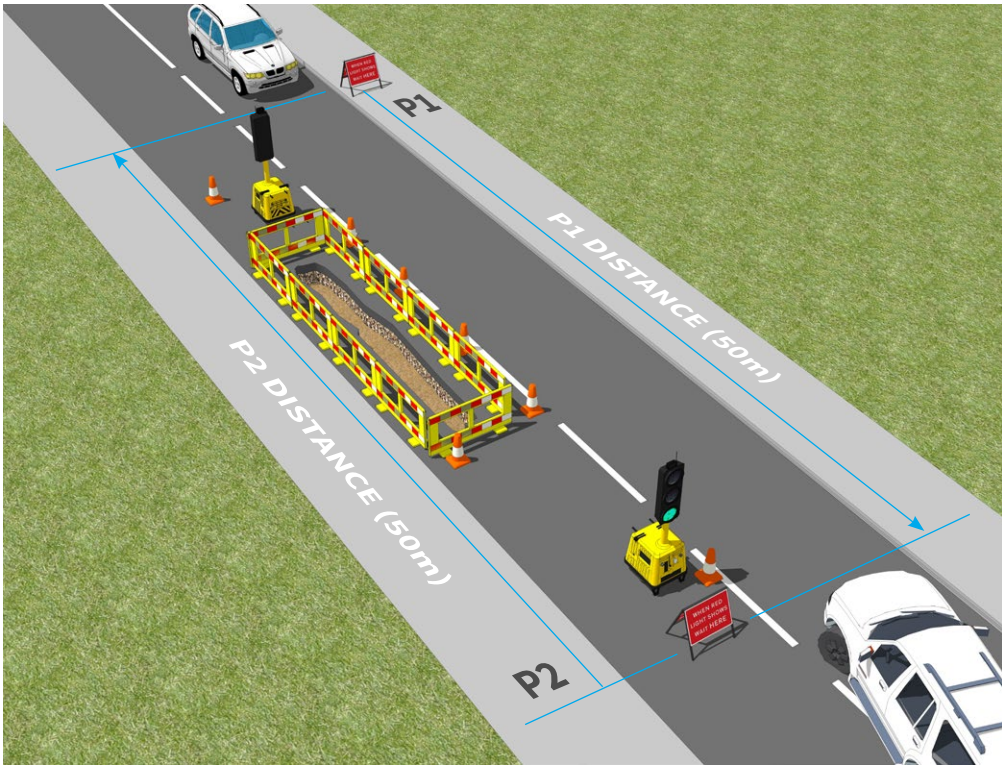
Table 2 Setting the Green Times

Distance (metres)	30	75	135	195	500
Green time (seconds)	35	40	45	50	

System Timing

SIGNAL TIMINGS

All RED Distance (two-way) set-up example



Set phase 1 All-Red to **05** Seconds. The OLED will display: P1 Distance: **50m**

Set phase 2 All-Red to **05** Seconds. The OLED will display: P2 Distance: **50m**

Set phase 3 All-Red to disabled **––**

Set phase 4 All-Red to disabled **––**

With this configuration:

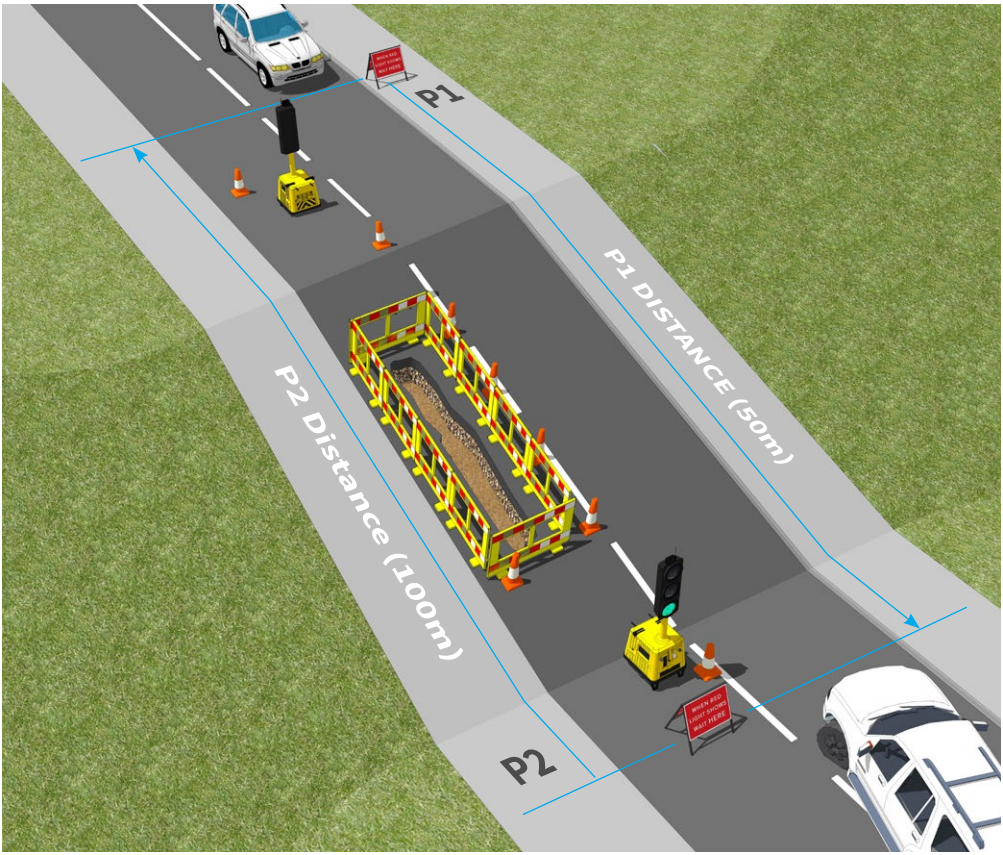
Phase 1 -> Phase 2 All Red time will be 5 seconds.

Phase 2 -> Phase 1 All Red time will be 5 seconds.

System Timing

SIGNAL TIMINGS

All RED Hill Site (two-way) set-up example



Set phase 1 All-Red to **05** Seconds. The OLED will display: P1 Distance: **50m**

Set phase 2 All-Red to **10** Seconds. The OLED will display: P2 Distance: **100m**

Set phase 3 All-Red to disabled **––**

Set phase 4 All-Red to disabled **––**

With this configuration:

Phase 1 -> Phase 2 All Red time will be 5 seconds.

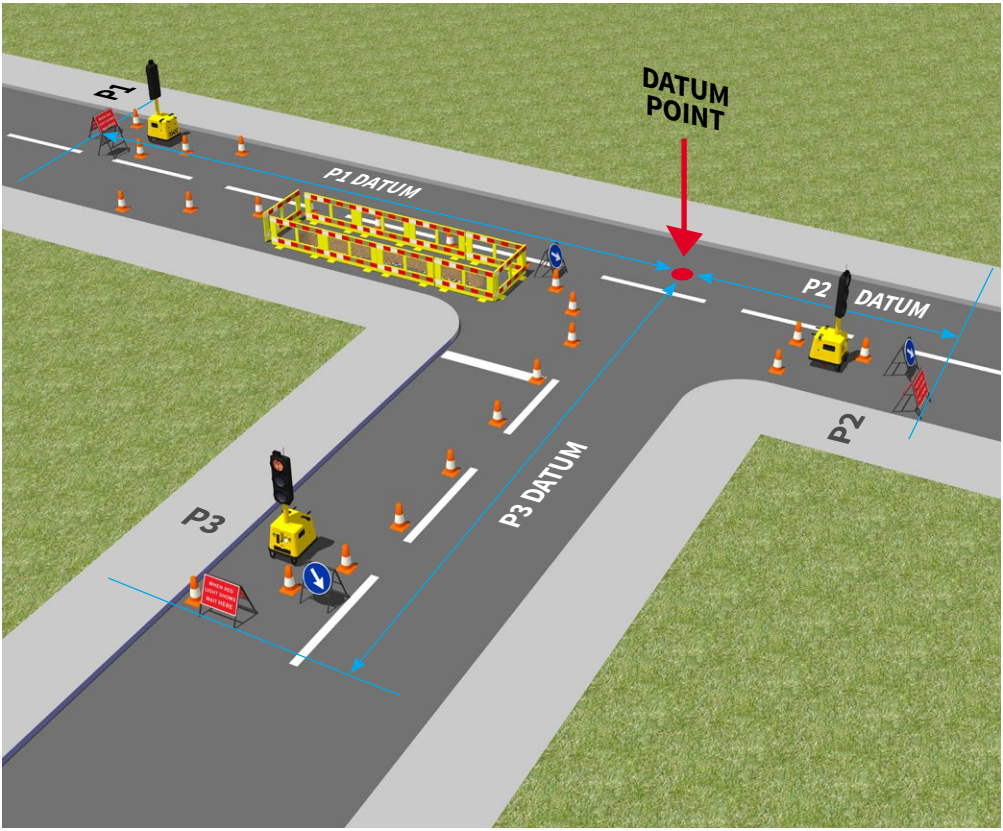
Phase 2 -> Phase 1 All Red time will be 10 seconds.

System Timing

SIGNAL TIMINGS

All RED Datum (three-way) set-up example

(Correct datum point setting leads to increased efficency of site by optimising the inter-green time)



Set phase 1 All-Red to **05** Seconds. The OLED will display: **P1 Datum: 50m**

Set phase 2 All-Red to **01** Second. The OLED will display: **P2 Datum: 10m**

Set phase 3 All-Red to **02** Seconds. The OLED will display: **P3 Datum: 20m**

Set phase 4 All-Red to disabled **––**

With this configuration:

Phase 1 -> Phase 2 All Red time will be 6 (5+1) seconds.

Phase 2 -> Phase 3 All Red time will be 3 (1+2) seconds.

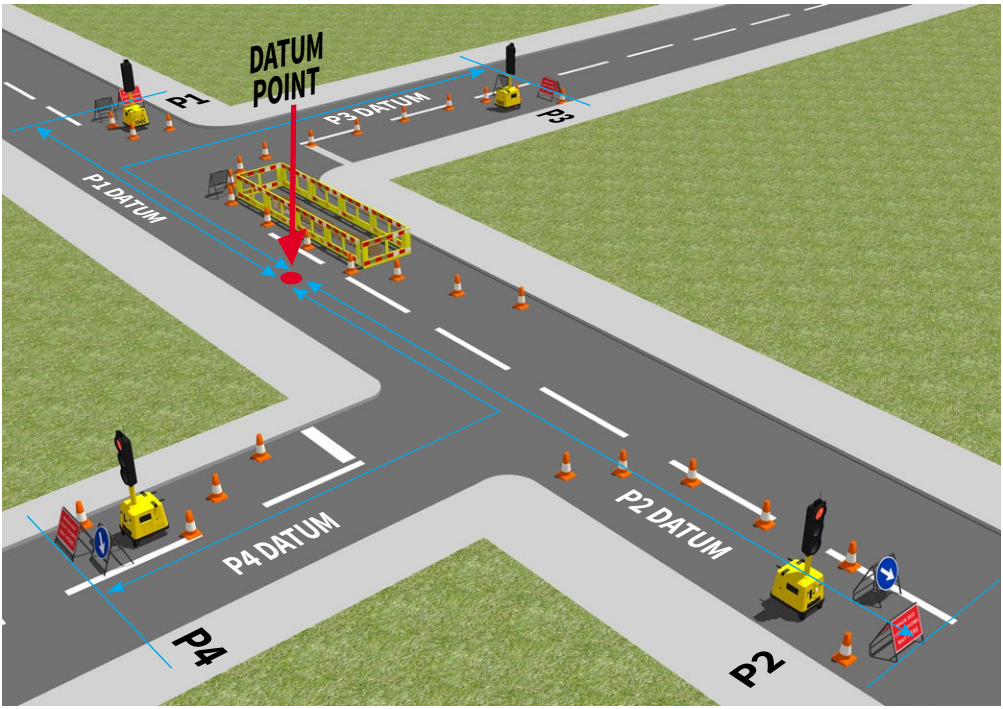
Phase 3 -> Phase 1 All Red time will be 7 (5+2) seconds.

System Timing

SIGNAL TIMINGS

All RED Datum (four-way) set-up example

(Correct datum point setting leads to increased efficency of site by optimising the inter-green time)



Set phase 1 All-Red to **02** Seconds. OLED will display: **P1 Datum: 20m**

Set phase 2 All-Red to **03** Seconds. The OLED will display: **P2 Datum: 30m**

Set phase 3 All-Red to **05** Seconds. The OLED will display: **P3 Datum: 50m**

Set phase 4 All-Red to **04** Seconds. The OLED will display: **P4 Datum 40m**

With this configuration:

Phase 1 -> Phase 2 All Red time will be 5 (2+3) seconds.

Phase 2 -> Phase 3 All Red time will be 8 (3+5) seconds.

Phase 3 -> Phase 4 All Red time will be 9 (5+4) seconds.

Phase 4 -> Phase 1 All Red time will be 6 (4+2) seconds.

System Maintenance

PAIRING SLAVE CONTROLLERS TO A MASTER

RC2 units make use of identifier numbers **(IDs)** during radio communications to determine which other units they will operate with as a set. RC2 units are supplied from the factory pre-configured to allow them to work as pairs.

Commonly however, it is necessary to vary which units work together (for example to create 3-Way or 4-Way sets) and this is achieved through a process called **'Pairing'.** Pairing simply means configuring the slave and secondary units to identify the master unit of the set of units to work together.

Before describing the pairing process, it is important to understand the three types of ID that exist within the units as follows:

COMPANY ID: Each Hollco customer is nominated a unique Company ID and this is programmed into units during manufacture. In order to work together as a set, units must all have the same Company ID. The Company ID cannot be modified by the user.

UNIT ID: Each RC2 unit has a unique four digit ID which set in the factory and, like the Company ID, cannot be changed by the user.

SET ID: This ID is configured by the end user and must be set to match the unit ID of the Master Controller of the set to operate together.

A set of lights will only work together if both of the following are true:

- All units have the same Company ID.
- All slave and secondary units have been programmed with the Set ID that matches the unit ID of the Master Controller.

NOTE:

- In cases where a change to the Company ID in a unit is required (for example if a unit is sold to another organisation), this can be performed by Hollco service engineers. Please contact Hollco directly for further information.
- If more than one Slave Controller is configured for the same phase and has the same Set ID then this is known as a 'Duplicate Slave'.
- Problems will occur during start-up whilst the Master is attempting to connect to its Slaves and a Duplicate Slave exists, is within range and is turned on. If this condition is detected then the Master displays "SLAVE PAIR ERROR" and returns to STANDBY.
- Problems may also occur whilst the set is operating and a Duplicate Slave is within range. When the Master changes channel (because of radio interference) then when reconnecting to its Slaves a 'Cat 1' Fault will occur and the set will attempt to Auto Restart after a recovery period.

System Maintenance

PAIRING SLAVE CONTROLLERS TO A MASTER

AT THE MASTER CONTROLLER:

Firstly identify the Master Controller that you will be using to control the whole set and make a note of the **SET ID** of this unit as follows.

1. Switch on the Master Controller and in **STANDBY MODE** select **PROGRAM CONFIGURATION**.
2. Make a note of the four digit ID displayed on the OLED display of the Master Controller.
3. Re-select the desired **CONFIGURATION** for the Master (e.g. **NORMAL**) and switch it off.

AT EACH SLAVE OR SECONDARY CONTROLLER:

Now go to each of the Slave and Secondary Controllers in the set and perform the following steps to pair them to the Master Controller using the Set ID noted above.

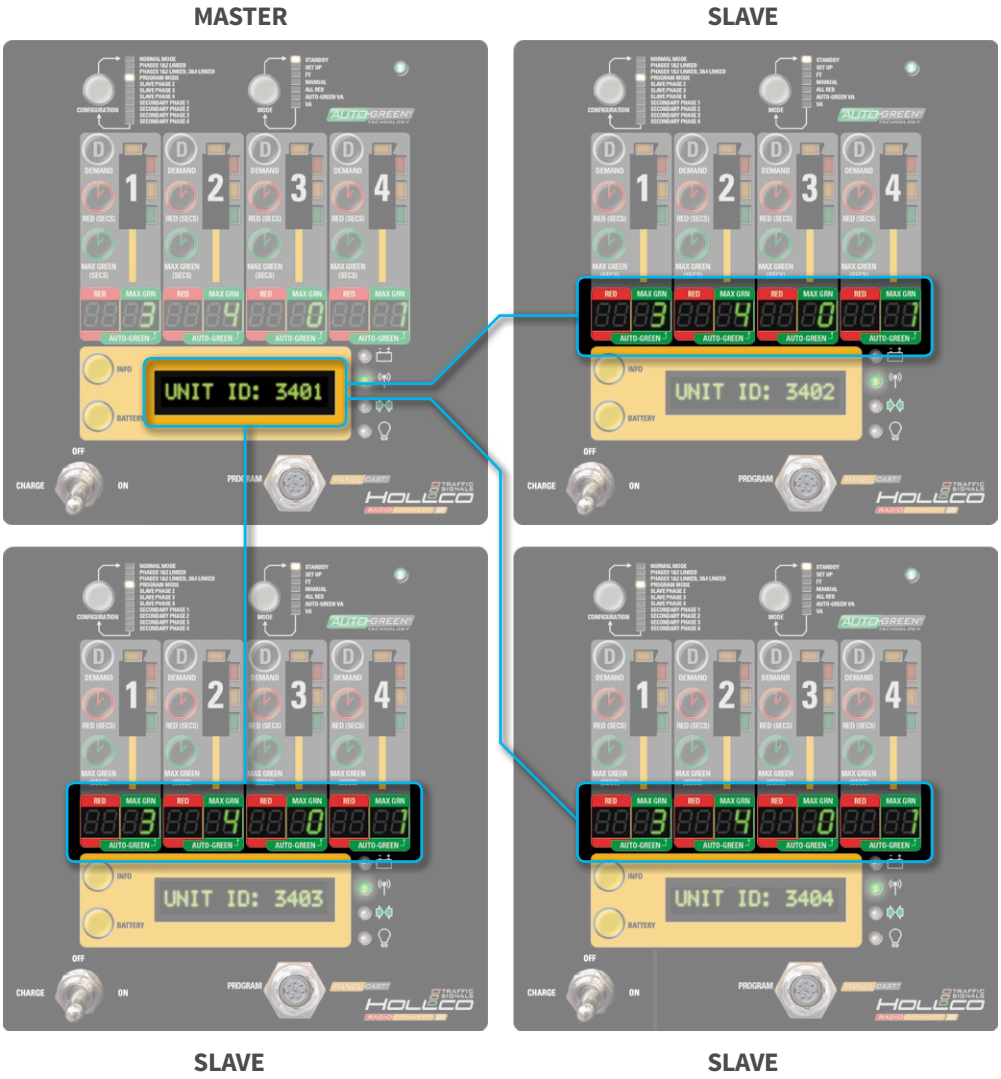
1. Switch on the Slave / Secondary Controller and in **STANDBY MODE** select **PROGRAM CONFIGURATION**.
2. The current Set ID is displayed on the green 7-segment LEDs.
3. Each digit can be changed as needed by pressing the **DEMAND** button for the associated Phase until it matches the Set ID of the Master Controller noted above.
4. Re-select the desired **CONFIGURATION** for the Slave / Secondary Controller (e.g. **SLAVE PHASE 2**) and switch it off.
5. Repeat steps 1 to 4 for the remaining Slave / Secondary Controllers. Then the system can be brought into operation.

SEE VISUAL REPRESENTATION OPPOSITE >

NOTE: *In order for the system to operate successfully as a set the following must be true:*

1. *All controllers which are part of the same set of lights to operate together must have the same Company ID and be paired with the same Set ID, which is the unit ID of the Master Controller.*
2. *For each of the configured slave phases (2 to 4) on the Master controller there is one matching controller configured as a Slave for that phase (2 to 4).*
3. *Any additional controllers for a phase must be configured as a Secondary controller for that phase.*

PAIRING ADDITIONAL SLAVE CONTROLLERS TO A MASTER (CONT.)



System Maintenance

GENERAL BATTERY MAINTENANCE

The Standard RC2 Controllers are fitted with 12V valve regulated AGM sealed lead acid batteries which **DO NOT** require any cell checking or topping up with de-ionised water. However in order to keep the batteries in peak condition, it is highly recommended that once the batteries have been discharged after use they should be recharged fully as soon as possible.

PLEASE NOTE: All controllers must be switched off before returning to the depot to prevent battery drain and potential depletion.

The batteries should not be left uncharged for extended periods when the system is not being used, as this can lead to premature battery failure.

WARNING: Always use the batteries recommended. The use of batteries other than those recommended will invalidate warranty, unduly affect performance, lifetime and may be dangerous. Batteries with a different specification may not match the charging characteristics, discharge rate or cut-off points assumed by the system.

Please specify the following when ordering replacement or spare batteries:

STANDARD BATTERY TYPE:	TRIPOD BATTERY TYPE:
Lucas LSLC104-12, 12V 104Ah Sealed Lead Acid / VALVE REGULATED LEAD ACID Battery	Lucas LSLC22-12, 12V 22Ah Sealed Lead Acid / VALVE REGULATED LEAD ACID Battery
Battery Transport Information - The batteries are classified as follows:	
Wet, non-spillable, electric storage UN2800 Class 8 Packaging Group III	Wet, non-spillable, electric storage L036

System Maintenance

SECURE BATTERY COMPARTMENT

In the event that the batteries do need removing the sequence below demonstrates the removal of the locking bar and cowling in order to access the battery compartment.

DANGER

Always deploy stabilising feet before removing batteries.

Unlock the battery secure bar.

Once unlocked the bar can be removed.

Simply pull the bar out.

The bar will slide completely out of the unit.

Put to one side.

Remove the cover of the base unit by sliding horizontally out.

The full interior of the unit is now easily accessible.

The batteries can now be unplugged.

And easily removed by the integral handles. Reverse the procedure to re-install.

System Maintenance

BATTERY USE AND PERFORMANCE

Battery use throughout the life of the system has been shown to be a significant lifetime cost. The unwanted operational costs of ownership usually come from two main sources:

1. **Replacement of batteries from poor use and management**
2. **Degradation of battery capacity resulting in more trips to site to swap batteries**

The traffic signal has been specially designed to maximise the life of the battery system. The batteries are a special long life sealed battery which require no maintenance and are designed for multiple charges.

The batteries will allow the standard units to run typically for 18 days* and the tripod units to run typically for 36 hours*. Battery Low is initially indicated (LED ON, not flashing) for a standard unit with 2 to 5 days remaining and for a tripod with 7 to 16 hours remaining. A suitable message is displayed indicating if charging is required **SOON** or **TODAY** or **NOW**.

When the Battery Low status light is flashing then the battery will shortly run out of charge, shutdown and turn-off is imminent. The system will automatically perform a controlled system lights off and power down. This cut-off point is optimised for the specified batteries to maximise battery life.

With care, the batteries should provide for a minimum of 300 full cycles of use.

Minimise your life-time operating costs by adopting the following:

- **Do not store the system with fully discharged batteries**
- **When charged do not leave the system stored and inactive for more than 10 weeks**
- **Always use the specified battery**
- **Do not mix battery types**
- **Always charge the batteries using the charging system provided****

Notes:

** Battery run time is typically from a fully charged system at 20°C and a 1:1 bright to dim ratio every 24 hrs operating as a 2 Phase system with head separation of 50m or less. The run-time is decreased by lowering ambient temperatures which decrease the batteries capacity. In winter, there is usually more dim time availability to somewhat offset the decrease in battery capacity as a result of lowered temperatures. Operators should not rely on the quoted typical run time as a minimum run-time for deployment. As the batteries age their capacity will be reduced which will reduce the run-time. The run- time is affected by head separation as the radio communications automatically boosts its output for longer ranges which draws more current from the system.*

*** The charging system is set up to deliver the optimum amount of charge current for the batteries specified. This is so maximum life is achieved at the fastest charge rate. Fitting other batteries to the charge system or charging the batteries with another charger will allow the system to work but is unlikely to give the expected performance(s).*

Operation

AUTOGREEN

AutoGreen® based Signal System

- Advanced low-power Radar system with multi-target capture capability.
- RC2 series controller with using the unique radar data with specially optimised traffic management algorithms.

Some combinations of controller types cannot connect and operate together as a set, as detailed in the table opposite in red. During Amber Start-up, after selecting the operating mode or SETUP, the master controller will display "SLAVE PAIR ERROR" and return to STANDBY if an invalid slave type is detected.

Overview

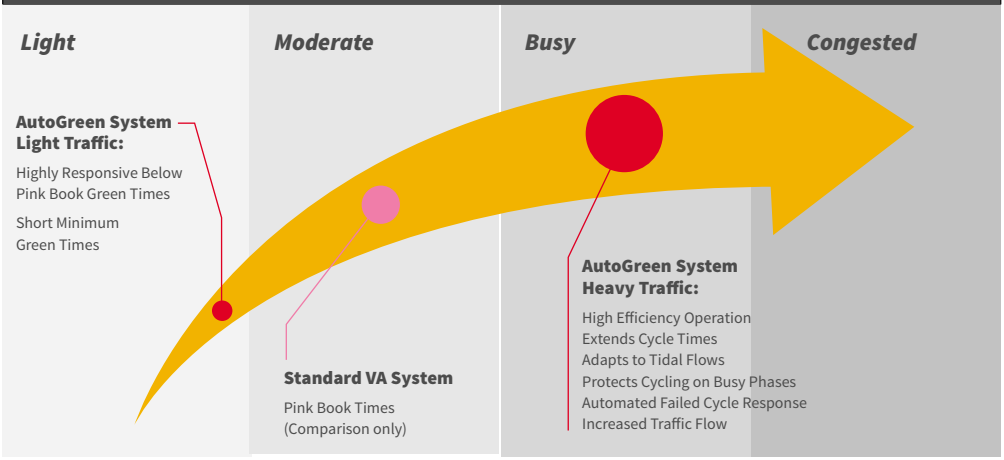
AutoGreen VA is a new operating mode with a sophisticated software algorithm that adjusts phase timings according to traffic flow conditions. Use of AutoGreen at wide range of sites will ensure optimal signal operation throughout the day automatically both reducing queues and waiting times.

AutoGreen makes use of the extensive capabilities of a new FMCW radar developed specifically for this application by AGD Systems. As illustrated below, the AutoGreen radar allows the system to automatically adjust the operation of the lights according to the current traffic conditions. The system also automates a range of actions that a person on site would perform in response to specific traffic scenarios and delivers these in a consistent and quantified manner.

AUTOGREEN® COMPATIBILTY BETWEEN RC2® CONTROLLERS

	MASTER TYPE:		
SLAVE TYPE:	**STANDARD**	**TRIPOD AG**	**TRIPOD LITE**
Standard	✓	✓	✓
Tripod AG	✓	✓	✓
Tripod Lite	X	X	✓

AUTOGREEN® IS A SCENARIO-BASED FUNCTION - *SCENARIOS PROGRESS FROM 'LIGHT' THROUGH TO 'CONGESTED'*



An extensive programme of **AutoGreen**® research and trials across the UK has resulted in a truly unique product, optimised for real-world traffic conditions. AutoGreen has been shown to out-perform traditional VA based operation for busy sites - please ask for more details.

AUTOGREEN (CONT.)

Deployment Guidance

For many sites, AutoGreen can manage traffic without operator input at any time throughout the day. This is a significant extension beyond the capabilities of traditional Doppler radar portable signals.

For sites where traffic flows are especially high and / or where other complicating factors exist, it becomes necessary to plan the deployment of portable signals in more detail and to consider a range of mitigations for any issues that are identified. A commonly employed such mitigation is the use of Manual Control. AutoGreen has been designed to significantly reduce the number of sites at which Manual Control is required. It will however still be necessary in a small proportion of deployments.

Some examples of the type of factors that should be considered when assessing a site with a view to deploying an AutoGreen system are:

- Traffic Flow Rates on the roads to be put under portable signal control.
- Traffic Flow Rates on nearby roads that could be affected by the deployment.
- Sites that are subject to significant 'tidal flow' demands giving high asymmetric flows at different times of the day.
- The location of any key routes which require special consideration in terms of any impact from the proposed site.
- Proximity of the portable signals to other junctions and pedestrian crossings.
- The level and variability of demand at nearby pedestrian crossings.
- Pinch points close to the works that could inhibit or block traffic flow.
- Time specific fluctuations in demand, for example as a result of a nearby school or sporting event.

Hollco Signals offer a training course which provides attendees with further knowledge to allow them to make the best assessment of specific sites in regard of the deployment of AutoGreen or of a range of other systems.

For more information on training, please contact your local sales representative or **email info@trafficgroupsignals.com.**

AUTOGREEN (CONT.)

TMO Guidance

As a Traffic Management Operative using AutoGreen, there are a number of things to be aware of as follows:

- AutoGreen requires that you specify red times only. All green times will be calculated automatically.
- When entering red times, set the amount that is required to safely clear the site in normal conditions based on its geometry and gradient. AutoGreen will increase red times automatically in order to alleviate problems at peak times therefore you should generally not need to add in extra time for this.
- AutoGreen maintains a concept of a 'Max Green' time for each phase and will optimise this automatically.
- AutoGreen will adjust Max Green times once every cycle by either adding or subtracting from the current Max Green time. Reductions in Max Green times can also occur at other times in response to specific traffic problems observed by the AutoGreen radars.
- The AutoGreen adjusted Max Green time in operation for each phase is available to view on the controller at any time in the usual manner.
- Under 'normal' traffic flows, the Max Green will generally drift towards the Pink Book value for the given site. For light traffic the Max Green will be slightly below the Pink Book value to increase the responsiveness of the system. However, for heavy traffic flows, the Max Green can be significantly increased above the Pink Book value as the system quickly adjusts to maximising the traffic throughput on the site.
- The AutoGreen system has been designed to be very responsive and for a 100m site it can adapt from its lightest traffic operation through to managing the highest throughput in less than 25 minutes.

Site Monitoring

For some higher profile AutoGreen sites operating without operator input, especially those running for a number of days, it may be prudent to visit the site shortly after deployment in order to check on its operation. To assess how well AutoGreen is performing at the site, it is recommended that the site should be observed at peak time for a period of around 20 minutes. During this time, in the unlikely event that a significant issue occurs at the site, such as a breakdown of flow, AutoGreen should correct for it on the next cycle. If an issue takes longer than two cycles to resolve, or if it recurs multiple times during the 20 minute observation period, it may be worth revisiting the planning of this site and considering other strategies including the use of Manual Control.

Troubleshooting

CONTROLLER FUNCTION AND ERRORS

1. Displays "CHARGE SELECTED?" when the switch is in the CHARGE position

The "CHARGE SELECTED?" prompt is displayed when the 110V ac supply is connected and turned ON but sometimes does not get cleared when the switch is in the CHARGE position.

This is a known issue that generally occurs when the batteries are already fully charged. Provided the switch is in the CHARGE position and the 110V ac supply is connected and ON then the chargers are still delivering charge. The battery charge status may occasionally be displayed.

To confirm the batteries are fully charged: switch to the OFF position, disconnect the 110V supply and press the BATTERY button to display BAT1 voltage and again for BAT2 voltage. Both batteries should be at or above 13.0V.

2. Displays remains blank when the switch is in the CHARGE position

When the 110V ac supply is connected and turned ON then with the switch in the OFF position normally "CHARGER ON" followed by "CHARGE SELECTED?" is displayed.

However, a blank display may indicate a fault, which can be diagnosed as follows.

A blank display in this case might indicate one of the following problems: (i) the 110V ac supply may not be present or connected; (ii) the trip switch may have disconnected the 110V supply from the chargers; (iii) the chargers may not be functional or the controller is not detecting the chargers are ON; (iv) the OLED display may be faulty; (v) the controller may not be functional.

With the power switch in OFF position press BATTERY button to display BAT1 and again for BAT2.

Is there a Battery Voltage displayed on the OLED for BAT1 and/or BAT2?

YES – So the display and controller are functional.
Ensure both batteries are connected with some charge (> 12V). Check that the 110V ac is connected and present and chargers are powered. Try again, otherwise refer to the 'Charger Function and 110V Supply Trip' section below.

NO – Check batteries are connected with some charge (> 12V); refer to the 'Battery, Fuse and Wiring Continuity' section below for further diagnosis.

Call support - If not resolved by the above.

3. LEDs are not illuminated, and the OLED display remains blank

The controller appears to remain off / inactive when the power switch is moved to the ON position. A blank display may indicate a fault, which can be diagnosed as follows.

A blank display in this case might indicate one of the following problems: (i) the batteries may be disconnected; (ii) the batteries may be depleted to less than 10.8V; (iii) the fuse may have blown; (iv) the OLED display may be faulty; (v) the controller may not be functional.

With the power switch in OFF position press BATTERY button to display BAT1 and again for BAT2.

CONTROLLER FUNCTION AND ERRORS (CONTINUED)

3. LEDs are not illuminated, and the OLED display remains blank (Cont)

Is there a Battery Voltage displayed on the OLED for BAT1 and/or BAT2?

YES – So the display and controller are functional and at least one battery is connected with sufficient voltage. Ensure both batteries are connected with some charge (> 12V). Try again, otherwise refer to the 'Battery, Fuse and Wiring Continuity' section below.

NO – Check batteries are connected with some charge (> 12V); then try again and refer to the 'Battery, Fuse and Wiring Continuity' section below.

Call support - If not resolved by the above.

4. Just displays "Hollco RC2" but no LEDs illuminated and does not start in stand-by mode

When switched ON only "Hollco RC2" is displayed and controller does not appear to start up in Standby mode and no LEDs are illuminated (e.g. Configuration or Mode).

Controller is not functional. Suspect: controller main board software not running.

Request service / return. Replace controller.

5. LEDs illuminate but the OLED display remains blank

The OLED display remains blank when the power switch is moved to the ON position, however the LEDs illuminate, and controller otherwise appears to turn on and be active.

Controller is functional but suspect a fault with OLED display.

Request service / return. Replace controller.

6. Displays "CAT1 recover ##s"

Whilst operating, "CAT1 recover ##s" is displayed (where '##s' or '##m' is a count down in seconds or minutes to restart). Signals are at lights out.

The signals have been forced to a lights out condition. This is a fail-safe feature and the controller will attempt a restart at the end of the recovery period. The status LEDs may indicate a possible cause. Press the MODE button to attempt an immediate restart. If recovery is unsuccessful or the CAT1 is persistent or frequent, then further diagnosis may be required to identify and resolve the problem.

One of the following may have occurred: (i) more than a single red lamp has failed; (ii) an illegal or dangerous signal sequence has been detected; (iii) a communication failure longer than 6 seconds has occurred; (iv) the software watchdog has detected a failure.

CONTROLLER FUNCTION AND ERRORS (CONTINUED)

7. Displays "CAT2 Error"

Whilst operating, "CAT2 Error" is displayed.

A temporary loss of communications (between 2 to 6 seconds) has been detected. An occasional temporary loss of communications (CAT2 Error) is quite normal and the controller will automatically change channel and continue to operate. However, if it becomes more frequent or more persistent (CAT1) then refer to the 'Radio and Communications' section below.

8. Displays "CAT3 Error"

Whilst operating, "CAT3 Error" is displayed.

A single red lamp failure has occurred. The signals continue to operate but no green signal that opposes the faulty red aspect will be illuminated until the issue is resolved. The Lamp Fail LED will illuminate on the controller which detected the fault as well as at the master controller.

Note that the Lamp Fail LED also indicates when other lamp faults occur, but "CAT3 Error" is not displayed, except when a single red lamp failure occurs.

9. Displays "SERVICE REQUIRED"

Any time after or when switching ON, "SERVICE REQUIRED" is displayed and controller does not appear to connect or operate.

Diagnosis: the UNIT ID and/or COMPANY ID in the controller has been lost or got corrupted. This can be confirmed by selecting PROGRAM MODE using the CONFIGURATION button.

Request service / return. Replace controller.

RADIO AND COMMUNICATIONS

10. Master controller displays "SEARCHING" but does not connect

During start-up "SEARCHING" is displayed continuously on the master controller and the radio LEDs keep flashing without connecting.

The master controller has not yet successfully established communications with all of the configured slave phases. This could be any of the following reasons. Not all of the slaves are: (i) turned on, or (ii) within range, or (iii) not paired to the master, or (iv) not configured to the correct phase, or (v) possibly broken antenna or faulty radio.

Call support - If not resolved by the above.

11. Master controller displays "STARTING" followed by "CAT2 Error"

During start-up "STARTING # Sec" is displayed on the master controller but then within a few seconds "CAT2 Error" followed by "CAT1 recover ##s" a few seconds later.

Communications was lost after the master controller successfully established communications with all of the configured slave phases. This could be any of the following reasons: (i) more than 500m between master and furthest slave, or (ii) unreliable or poor signal, perhaps due to interference or obstruction in line of site, or (iii) another set of lights nearby, or (iv) possibly broken antenna or faulty radio.

Call support - If not resolved by the above.

Troubleshooting

RADIO AND COMMUNICATIONS

12. Displays "SLAVE PAIR ERROR"

During start-up shortly after the radio connects, "SLAVE PAIR ERROR" is displayed and the controller returns to STAND-BY mode.

A duplicate slave or an incompatible slave was detected during start-up.

Check that only the slave controllers that are part of the set of lights are paired with the master controller and that there is only one primary slave for each configured phase. Check each slave is correctly configured and that the SET ID matches the UNIT ID of the master. Avoid operating a mixed set of RC2 Lite controllers with a standard or AutoGreen Tripod controllers. Switch OFF any other slaves that are not part of the set that are within range or ensure that they are paired with a different master.

Call support - If not resolved by the above.

13. Master controller displays "CAT2 Error" then "CAT1 recover ##s"

While operating "CAT2 Error" is displayed more frequently than 10 or 20 times a day and occasionally may be followed by "CAT1 recover ##s" a few seconds later.

An occasional temporary loss of communications (CAT2 Error) is quite normal and the controller will automatically change channel and continue to operate. However when it becomes more frequent or more persistent (CAT1) then this could be due to any of the following reasons: (i) more than 500m between master and furthest slave, or (ii) unreliable or poor signal, perhaps due to interference or obstruction in line of site, or (iii) another set of lights nearby, or (iv) possibly broken antenna or faulty radio.

Call support - If not resolved by the above.

BATTERY, FUSE AND WIRING CONTINUITY

The voltages of the batteries can be checked with the power switch in the OFF position (provided the batteries are connected and not depleted). Press BATTERY button to display BAT1 and again for BAT2.

Otherwise open battery compartment and measure the voltages with a meter.

Once the voltage of a 12V battery is known, use the following guide to determine its operational state:

0.0V	Battery disconnected or discontinuity at fuse
< 10.8 V	Battery depleted. Voltage too low for controller to start. Attempt recharging slowly over extended period; take care not to overheat. Replace battery if damaged or does not hold charge.
10.8 V to 11.5 V	Battery too low for controller to operate safely. Shutdown imminent. Recharge immediately.
11.5 V to 11.9 V	Battery low warning: CHARGE TODAY / SOON. Recharge ASAP. (25% to 45% of voltage range)
11.9 V to 12.5 V	Battery at less than 50% of operational capacity (45% to 75% of voltage range).
12.5 V to 12.8 V	Battery with greater than 50% of operational capacity (75% to 90% of voltage range).
> 12.9 V	Battery fully charged.

BATTERY, FUSE AND WIRING CONTINUITY (CONTINUED)

Note:

a. The controller should continue to operate down to 11.5V.

b. Below 11.9V it is recommended that the batteries are recharged ASAP.

c. The controller should not be deployed unless the batteries are charged above 12.5V.

If one of the batteries has a significantly different voltage, then this may indicate a problem with the battery or its charger or the continuity of the fuse or wiring.

If the battery does not seem to be getting charged, then:

- Check that the charger is working – see Charger section below for further guidance.
- Try swapping the batteries between units to see if the battery is charged in another unit.

The continuity of the fuse and wiring can be checked as follows:

- Remove the back-cover to the signal head.
- With a meter measure the voltages at the connector block below the controller: for BAT1 measure between black and red; for BAT2 measure between black and brown.
- A reading close to zero volts would indicate disconnected or blown fuse.
- A reading that is significantly lower than the battery voltage would indicate a high resistance connection.

CHARGER FUNCTION AND 110V SUPPLY TRIP

TBC

RADAR FUNCTION

The function of the radar is not monitored by the controller but is indicated on the Demand LED for the phase when in VA, AutoGreen or Set Up modes. The radar is self-checking and if it fails it will fail-safe to continuous demand. When disconnected the radar input also fails to continuous demand.

The function of the radar can be checked by doing a walk test (walk 4 or 5 fast paces towards the radar from the front) using Set Up mode. The LED on the radar indicates on detection and the Demand LED for the phase should also illuminate.

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 Hollco 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

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.

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

Warranty

Radio-Connect 2 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 3 years**
RC2® 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 Hollco Limited.

Any item of equipment repaired by Hollco 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 **(Hollco 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 RC2 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**

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.

AutoGreen® has been developed in collaboration with the Kent Lane Rental Scheme.

Certification

Certificate No: **CE-002** Issue: 1

EU Declaration of Conformity (DoC)

We Hollco Limited,
Unit 1 Hawthorne Court, Bourton Business Park, Bourton on the Water, Gloucestershire
GL54 2HQ UNITED KINGDOM
Telephone:+44 (0) 01451 820703 email: enquiries@hollco.co.uk

Declare that the DoC is issued under our sole responsibility and belongs to the following products:

Equipment Models/Types:	RadioConnect 2 Standard	Part: HRC-TCM-RC2ST
	RadioConnect 2 Tripod version	Part: HRC-TCM-RC2TR
Equipment Description:	RadioConnect 2 is a portable, stand-alone automated roadside traffic control unit.	

The object of the Declaration described above is in conformity with the relevant Union harmonised legislation:

EMC Directive (EMCD) 2014/30/EU	Low Voltage Directive (LVD) 2014/35/EU
Radio Equipment Directive (RE-D) 2014/53/EU	Restrictions of Hazardous Substances (RoHS2) 2011/65/EU

The following harmonised standards and technical specifications have been applied:

EN 50293:2012	EN 62368-1
EN 301 489-3 v1.6.1	EN 300 440-2 V1.4.1
Technical File: HRC-TCM-RC2TF	

Additional Information:

The Traffic Detector Radar transmits; 24.050 to 24.250GHz band with <100mW eirp

The Wireless Data Link transmits; 458.500 to 458.950MHz band with <500mW eirp

The product(s) also conforms with the National and/or International standards and specifications:

TOPAS TR2502B Performance Specification for Portable Traffic Signal Control Equipment for use at Roadworks
See Technical File (HRC-TCM-RC2TF) for exemptions and deviations

BS EN 12368 Traffic Control Equipment – Signal Heads

Signed Dated

P J Hutchinson
Director
For and on behalf of Hollco Limited

Certification

Parc Sapemea 2379	Test Certificate Number 8684-6 Issue 2		Product Assessment and Reliability Centre Ltd Unit 4 Alverdiscott Road Industrial Estate Bideford, Devon, EX39 4LQ Telephone: +44 (0) 1237 421255 info@parctest.co.uk www.parctest.co.uk
	Date of Issue:	23/01/2018	
Page 1 of 1	Reason for Re-issue	Customer address correction	Commercial in Confidence

Date Samples Arrived:	13/11/2017	**Customer Name and Address:**	Hollco Limited, Unit One, Hawthorne Court, Bourton Business Park, Bourton on the Water, Gloucester, GL54 2HQ
Date Testing Started:	13/11/2017		
Date Testing Completed:	13/12/2017		
Customer Purchase Order No:	403313		

Description of Test Samples:	**Identity/Serial Numbers:**
1 off Hollco Radioconnect 2 Standard (P/N: HRC-TCM-RC2ST) traffic signal with integral AGD302 (P/N:302-100-000) radar detector	DE0003 RC2M (AGD302 Serial:108723-0001)

Test(s) Performed in the following order unless otherwise specified:		**In Accordance With:**
Dry Heat	UKAS	BS EN 50556:2011 & BS EN 60068-2-2:2007 Test Bd
Cold Temperature	UKAS	BS EN 50556:2011 & BS EN 60068-2-1:2007 Test Ab
Cyclic Damp Heat	UKAS	BS EN 50556:2011 & BS EN 60068-2-30:2005 Test Db Variant 2
Function Test	Non-UKAS	As per customer documents: *Environmental Test House Work Instruction for Hollco RadioConnect2* (Issue 1.0, 01/11/2017) & *AGD326 and AGD302 Environmental Test House Work Instructions* (issue 1, 08/11/2017)

Report Summary:

The sample was subjected to a Dry Heat test in accordance with BS EN 50556:2011 Section 6.3.5 Class AB3 & BS EN 60068-2-2:2007: Test Bd:

- 16 hours @ +60 °C
- Samples powered throughout test exposure
- Function tests during final hour at high temperature, during cool down period and once back at ambient temperature.

The sample was subjected to a Cold Temperature test in accordance with BS EN 50556:2011 Section 6.3.6 Class AE2 & BS EN 60068-2-1:2007: Test Ab:

- 16 hours @ -15 °C
- Function tests during final hour at low temperature, during warm up period and once back at ambient temperature.
- Samples unpowered except during function checks during final hour at low temperature, during the warmup period and once back at ambient temperature

The sample was subjected to a Cyclic Damp Heat test in accordance with BS EN 50556:2011 Section 6.3.7 Class AK2 & BS EN 60068-2-30:2005 Test Db Variant 2:

- Temperature extreme: +40 °C
- Samples powered throughout test
- Function checks during first 3 hours of each cycle and during cool down period following final cycle (ref. BS EN 50556:2011 Table 3)

The sample was subjected to function tests (non-UKAS) at various points throughout the test programme. The sample performed as specified each time it was tested. The sample was subjected to exterior visual inspections (non-UKAS) following each test. No significant changes were observed during the test programme.

Distribution: 1. PARC Ltd File 2. Les Bain	**Test Engineer:**	Kevin Parsons	Digitally signed by K. Parsons Date: 2018.01.23 13:16:02 Z
Sample Disposal: Sample/s returned with customer representative	**Approved by:**	Sam Wort, Senior Test Engineer	Digitally signed by Sam Wort Date: 2018.01.24 08:54:53 Z

DOC REF: TC2_1

Certification

Parc Sapemea 2379	Test Certificate Number 8684-7 Issue 2		Product Assessment and Reliability Centre Ltd Unit 4 Alverdiscott Road Industrial Estate Bideford, Devon, EX39 4LQ Telephone: +44 (0) 1237 421255 info@parctest.co.uk www.parctest.co.uk
	Date of Issue:	23/01/2018	
Page 1 of 1	Reason for Re-issue	Customer address correction	Commercial in Confidence

Date Samples Arrived:	13/11/2017	**Customer Name and Address:**	Hollco Limited, Unit One, Hawthorne Court, Bourton Business Park, Bourton on the Water, Gloucester, GL54 2HQ
Date Testing Started:	20/11/2017		
Date Testing Completed:	15/12/2017		
Customer Purchase Order No:	403313		

Description of Test Samples:	**Identity/Serial Numbers:**
1 off Hollco Radioconnect 2 Standard (P/N: HRC-TCM-RC2ST) traffic signals with integral AGD302 (P/N:302-100-000) radar detector	DE0003 RC2M (AGD302 Serial:108723-0001)

Tests:		**In Accordance With:**
Random Vibration, Bump & Shock	UKAS	TR2130E, BS EN 50556:2011, BS EN 60068-2-64:2008 Test Fh & BS EN 60068-2-27:2009 Test Ea
Drop	UKAS	TR2130E & BS EN 60068-2-31:2008 Test Ec
Impact	UKAS	BS EN 50556:2011, BS EN 62262:2002 & BS EN 60068-2-75: 2014 Test Eh
Function Test	Non-UKAS	As per customer documents: *Environmental Test House Work Instruction for Hollco RadioConnect2* (Issue 1.0, 01/11/2017) & *AGD326 and AGD302 Environmental Test House Work Instructions* (issue 1, 08/11/2017)

Report Summary:

The sample was subjected to a Random Vibration (Transportation) test in accordance with TR2130E Section 5.1 Class AM2 (levels defined in Table 3 of BS EN 50556:2011).

The samples were subjected to a Random Vibration (Operational) test in accordance with TR2130E Section 5.2 Class AL2 (levels defined in Table 3 of BS EN 50556:2011).

The sample was subjected to a Bump test in accordance with TR2130E Section 5.6 & BS EN 60068-2-27:2009 Test Ea. The Bumps were applied in the vertical axis only.

The sample was subjected to a Shock test in accordance with TR2130E Section 5.3 & BS EN 60068-2-27:2009 Test Ea using a 400 m/s², 2 ms pulse.

The sample was subjected to a Drop test in accordance with TR2130E Section 5.4 & BS EN 60068-2-31:2008 Test Ec:

- 1 drop of each of 4 edges of bottom face onto concrete
- Sample tilted so that edge is raised 50 mm from test surface and allowed to drop freely

The sample was subjected to an Impact test in accordance with BS EN 50556:2011 Section 6.3.3, BS EN 62262:2002 & BS EN 60068-2-75: 2014 Test Eh. Five IK07 impacts were applied per accessible face.

The sample was subjected to function tests (non-UKAS) at various points throughout the test programme. The sample performed as specified each time it was tested. The sample was subjected to exterior visual inspections (non-UKAS) following each test. No significant changes were observed during the test programme.

Distribution: 1. PARC Ltd File 2. Les Bain	**Test Engineer:**	Kevin Parsons	Digitally signed by K. Parsons Date: 2018.01.23 13:16:54 Z
Sample Disposal: Sample/s returned with customer representative	**Approved by:**	Sam Wort, Senior Test Engineer	Digitally signed by Sam Wort Date: 2018.01.24 09:09:05 Z

DOC REF: TC2_1

Certification

Parc Sapemea 2379	Test Certificate Number 8684-8 Issue 2		Product Assessment and Reliability Centre Ltd Unit 4 Alverdiscott Road Industrial Estate Bideford, Devon, EX39 4LQ Telephone: +44 (0) 1237 421255 info@parctest.co.uk www.parctest.co.uk
	Date of Issue:	23/01/2018	
Page 1 of 1	Reason for Re-issue	Customer address correction	Commercial in Confidence

Date Samples Arrived:	13/11/2017	**Customer Name and Address:**	Hollco Limited, Unit One, Hawthorne Court, Bourton Business Park, Bourton on the Water, Gloucester, GL54 2HQ
Date Testing Started:	17/11/2017		
Date Testing Completed:	17/11/2017		
Customer Purchase Order No:	403313		

Description of Test Samples:	**Identity/Serial Numbers:**
1 off Hollco Radioconnect 2 Standard (P/N: HRC-TCM-RC2ST) traffic signals with integral AGD302 (P/N:302-100-000) radar detector	DE0005 RC2M (AGD302 Serial:108723-0003)

Test(s) Performed in the following order unless otherwise specified:		**In Accordance With:**
Water Ingress - IPX6 – Jetting Water	UKAS	BS EN 60529:1992 + A2:2013
Function Test	Non-UKAS	As per customer documents: *Environmental Test House Work Instruction for Hollco RadioConnect2* (Issue 1.0, 01/11/2017) & *AGD326 and AGD302 Environmental Test House Work Instructions* (issue 1, 08/11/2017)

Report Summary:

The sample was subjected to the IPX6 Water Ingress test. Only the two side, front, back and top faces were sprayed. Following spraying of the front, back, and two side faces the surface of the base section (battery enclosure) was dabbed dry with tissue, then opened for inspection (non-UKAS). Water ingress was observed. The sample was then re-assembled, laid on its front, and the top face sprayed. The surface of the sample was dabbed dry with tissue and opened for inspection (non-UKAS). Water ingress was observed within the signal head enclosure. No water ingress was observed in the three signal aspects, control module, modem module, AGD302 Radar Detector or 110 V AC power connector.

The sample content was subjected to a function check by the customer after the five surfaces had been sprayed but before the final internal inspection. The customer representative reported that the sample functioned as specified.

Distribution: 1. PARC Ltd File 2. Les Bain	**Test Engineer:**	Kevin Parsons	Digitally signed by K. Parsons Date: 2018.01.23 13:17:34 Z
Sample Disposal: Sample/s returned with customer representative	**Approved by:**	Sam Wort, Senior Test Engineer	Digitally signed by Sam Wort Date: 2018.01.24 09:11:06 Z

Certification

Parc Sapemea 2379	Test Certificate Number 8684-9 Issue 2		Product Assessment and Reliability Centre Ltd Unit 4 Alverdiscott Road Industrial Estate Bideford, Devon, EX39 4LQ Telephone: +44 (0) 1237 421255 info@parctest.co.uk www.parctest.co.uk
	Date of Issue:	23/01/2018	
Page 1 of 1	Reason for Re-issue	Customer address correction	Commercial in Confidence

Date Samples Arrived:	17/11/2017	**Customer Name and Address:**	Hollco Limited, Unit One, Hawthorne Court, Bourton Business Park, Bourton on the Water, Gloucester, GL54 2HQ
Date Testing Started:	24/11/2017		
Date Testing Completed:	27/11/2017		
Customer Purchase Order No:	403313		

Description of Test Samples:	**Identity/Serial Numbers:**
1 off Hollco Radioconnect 2 Tripod (P/N: HRC-TCM-RC2TR) with integral AGD302 Radar samples (P/N:302-100-000)	DE0004 RC2M (AGD302 Serial:108723-0002)

Test(s) Performed in the following order unless otherwise specified:		**In Accordance With:**
Drop & Topple	UKAS	TR2130E & BS EN 60068-2-31:2008 Test Ec
Function Test	Non-UKAS	As per customer documents: *Environmental Test House Work Instruction for Hollco RadioConnect2* (Issue 1.0, 01/11/2017) & *AGD326 and AGD302 Environmental Test House Work Instructions* (issue 1, 08/11/2017)

Report Summary:

The full sample assembly (Signal Head mounted on Tripod) was subjected to a topple test:

- Test surface: Concrete
- 1 topple about imaginary lines drawn between the feet of each pair of legs (3 topples total)
- Signal head rotationally positioned so that edge/corner strikes test surface during one topple

The bracket at the top of the tripod was observed to bend around the weld with each successive topple. The door to the control panel also popped open during one of the topples but the lock was not damaged, and the door was re-secured.

The signal head (including AGD302 Radar) was subjected to a Drop test:

- Test surface: Concrete
- Drop height: 50 mm
- 1 drop onto each edge and corner of the signal head (20 drops total)

The samples were subjected to function tests (non-UKAS) at various points throughout the test programme. The samples performed as specified each time they were tested.

Exterior visual inspections (non-UKAS) were conducted after each drop. No obvious damage was observed beside superficial surface marks. The metal product plate also came unstuck from the control panel door during the Drop test.

Distribution: 1. PARC Ltd File 2. Les Bain	**Test Engineer:**	Kevin Parsons	Digitally signed by K. Parsons Date: 2018.01.23 13:18:09 Z
Sample Disposal: Sample/s returned with customer representative	**Approved by:**	Sam Wort, Senior Test Engineer	Digitally signed by Sam Wort Date: 2018.01.24 09:13:45 Z

DOC REF: TC2_1

Notes

ADVANCED PORTABLE TRAFFIC SIGNALS

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TRAFFIC SIGNALS
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RADIO CONNECT 2

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