PORTABLE TRAFFIC LIGHTS

MODELS:

ST-PS3 / ST-PS3DC / ST-PS4 / ST-PS5

PRODUCT MANUAL

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SPHERE

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1. INTRODUCTION

1.1. OBJECTIVES

The objective of this document is to give technical information about PORTABLE TRAFFIC LIGHTS ST-PS5 and describe steps to setup and operate the device.

1.2. SCOPE

This document will describe the design, features, dimensions, technical specifications, setup and operating modes of the ST-PS5 Portable Traffic Lights. Further information can be acquired on the web site or directly with manufacturers.

1.3. INTRODUCTION

The Sphere ST-PS5 Portable Traffic Lights is a modular mobile traffic signal system intended to be applied primarily to shuttle the control of vehicular traffic at road works or bridge works.

Road works where Portable Traffic Lights are applied have a a section of the carriage-way closed, so the single lane must be used alternatively by traffic from the opposite directions.

Other than vehicle-actuated alternating one-way traffic, the ST-PS5 can also be used for controlling the T-junction situations, crossroads traffic and roundabouts, with up to 7 signals operating simultaneuosly in a Daisy Chain operating mode.

The ST-PS5 Portable Traffic Lights are equipped with a directional radar for vehicle-actuated operation, radio communication with a range of up to 1000 m under ideal conditions and emergency mode for quartz control when the radio communication is faulty.

1.4. ADDITIONAL SAFETY PRECAUTIONARY STEPS

To prevent or minimise injury, the following are the recommended precautionary steps using these portable traffic signal. These suggestions need to be included in to the manual.

1) Install these portable traffic signal at locations with no any obstructions and must be visible to the drivers of oncoming vehicles.

2) Ensure that these portable traffic signal not to be installed at locations where people are expected like bus shelters or areas with pedestrian concentrations.

3) At any time during the operation of these portable traffic signal, no one is allowed to stand behind these portable traffic signal. This is to ensure that no one will get hurt in case the traffic signal has propelled or overturned after vehicle collision.

4) Roadwork signs and maximum speed limit signs (30 KPH) must be installed and must be visible to the drivers of oncoming vehicles.

5) Ensure that the traffic light is working properly.

6) Coordination of traffic flow must be correctly managed and controlled by the traffic controllers.

7) Proper use of batteries must be strictly followed. Avoid using damaged batteries.

8) Battery terminals must be properly insulated.

2. DESIGN AND FEATURES

2.1. DESIGN & CONSTRUCTION

When dismounted, Sphere Portable Traffic Lights consist of two separate parts:

1. Signal head made from powder-coating steel consisting of 3 integrated LED signal aspects, 1 vehicle detector (ST-PS4 and ST-PS5 only), 1 RF antenna and a built-in steel pole

2. Battery box which consists of operating interface, space for rechargeable battery, two battery clamps to connect the rechargeable battery to the system, rear transport handle and two never-flat rubber wheels.

ST-PS5 Foldable Signal Head and Battery Box

2. DESIGN AND FEATURES

SPECIFICATION	
Model	**ST-PS5**
Operating Voltage	12V DC rechargeable battery
LED Power Consumption	Imax 0.71A day time mode. Imax 0.08A night-time mode
System Operation Time	Up to 25 days (0-24h based on a 180Ah battery)
LED Type	Wide viewing angle SMD LEDs
Light Sources	105 LEDs per green and red segment 190 LEDs on amber segment
Signal Aspect Diameter	210 mm
Signal Luminosity	840 Cd per segment
Signal Dimming	Integrated gradual dimming
Housing	Galvanized steel with a powder coated surface
Design	Detachable signal head/post Foldable signal head Modular components
Transport Height	2200 mm
Transport Width	685 mm
Transport Weight	61 kg
System	Countdown timer Adjustable pole (additional upgrade) Foolproof system Battery low warning Status monitoring Over-discharge protection Easy use locking system
Default Operating Frequency	433 MHz (Adjustable)
RF Channels	16 Channel Radio Frequencies
Radio Communication Range	Up to 1000m in ideal conditions
Radar Range	Up to 100m
Radar Frequency	24.150 to 24.250 GHz
Operating Modes	Radar 2-way, fixed time, daisy chain, manual green, manual red, manual all-red, flashing amber, lamps off, mobile link, emergency mode
Range of Applications	Single lane, T-junction, cross road, roundabouts. Up to 7 units supported in daisy chain operating mode
EU Declaration of Conformity	ETSI EN 301 489-1 v2.2.0; ETSI EN 301 489-3 v2.1.1; EN 50293:2012; EN 300 220-1 V3.1.1 (2017); EN 300 220-2 V3.2.1 (2018) Sphere portable traffic lights meet all of the requirements of the applicable European Conformity directives

ST-PS Technical Specification

2. DESIGN AND FEATURES

DIMENSIONS & WEIGHT	
Model	**ST-PS5**
Total Height	210 cm
Battery Box Width	76 cm
Battery Box Length	68 cm
Battery Box Height	41.5 cm
Space for Battery	56x27x27 cm
Basic Weight	61 kg
Transport Weights	61 kg

ST-PS Dimensions & Weight

2. DESIGN AND FEATURES

2.2. LED TECHNOLOGY

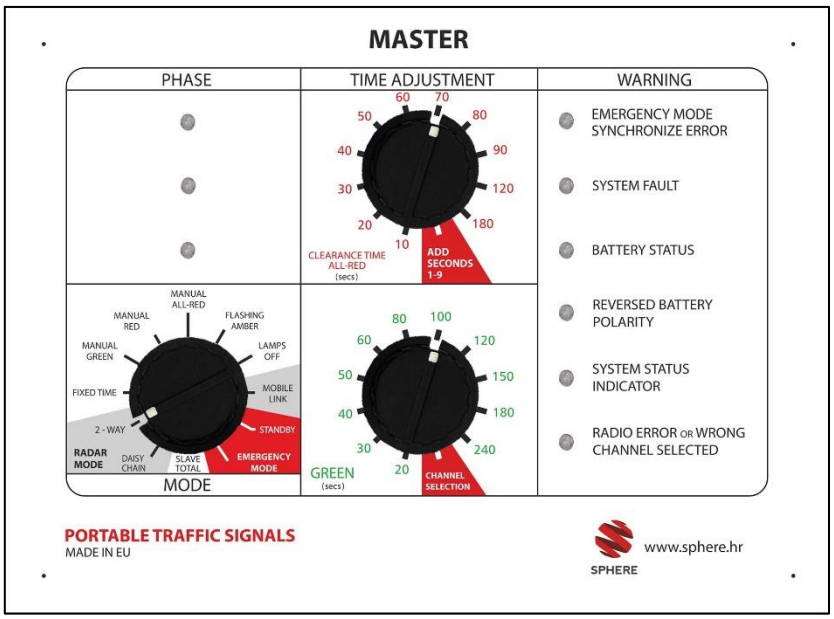
Portable Traffic Lights ST-PS5 signal aspects are made in high quality integrated LED (*light-emitting diode*) technology which has up to five times lower power consumption than the standard halogen bulbs, as well as significantly longer lifespan.

Portable Traffic Lights ST-PS5 – LED Signal Aspects

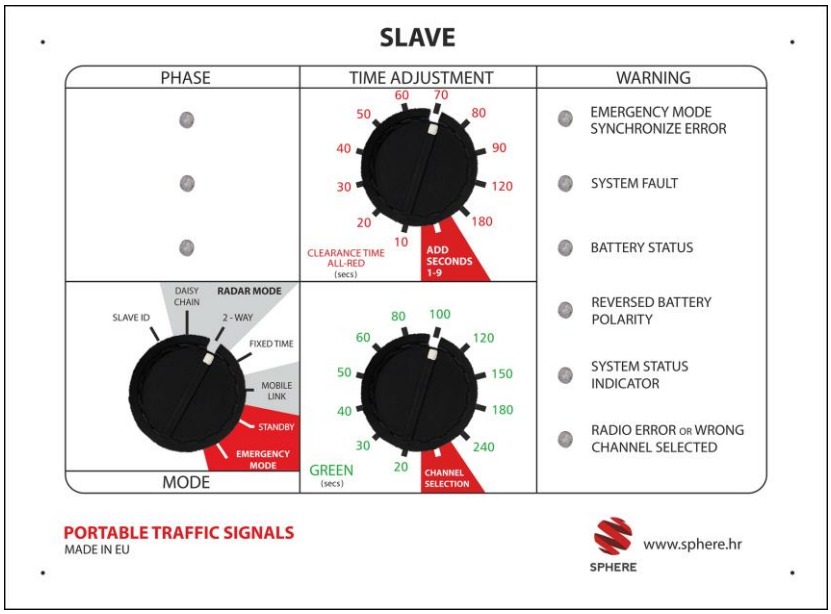
2. DESIGN AND FEATURES

2.3. OPERATOR INTERFACE

The operator interface of ST-PS5 was designed and developed in a large way by listening to recomendations and advices of the road construction workers, who demanded simple, intuitive, precise and fast entering of the desired operating settings.



Operator Interface – MASTER



Operator Interface – SLAVE

The operator interface of ST-PS5 is divided into 4 FUNCTIONAL SECTIONS for easier navigation:

1. PHASE section (RED, AMBER and GREEN phase indicators)
2. MODE section for choosing the desired operating mode
3. TIME ADJUSTMENT section for choosing the duration of ALL-RED/CLEARANCE TIME (secs) and the duration of GREEN (secs)
4. WARNING section

2. DESIGN AND FEATURES

The Operator Interface of ST-PS5 consists of three multifunctional rotary knobs:

1. On the **TIME ADJUSTMENT** section, the CLEARANCE TIME/ALL-RED knob is used to set the duration of CLEARANCE TIME/ALL-RED phase in seconds
2. On the **TIME ADJUSTMENT** section, the GREEN knob is used to set the duration of GREEN phase in seconds
3. On the **MODE** section, the MODE knob is used to set the desired operating mode

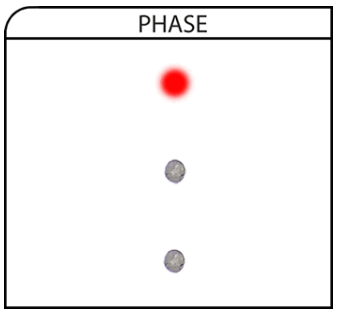
2.3.1. PHASE

On both Master and Slave controllers, the PHASE section provides indication of which signal aspect is currently active.

The PHASE section mimics the following signal head aspects:

1. RED
2. AMBER
3. GREEN

On both Master and Slave, coloured ultra bright LEDs (which represent the signal head aspects) provide indication of which aspect is currently active.

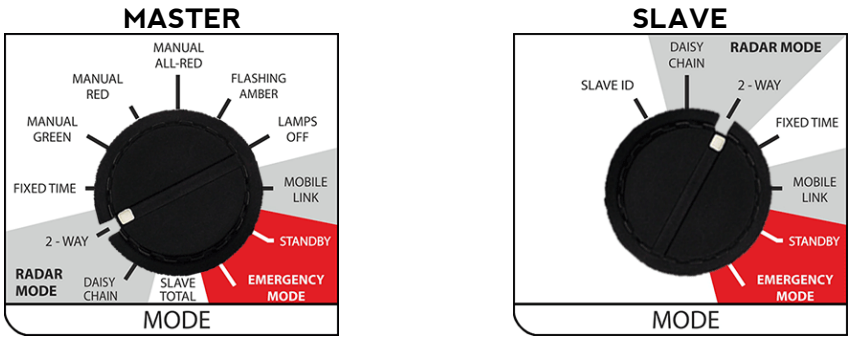


Phase section on the Operator interface – RED Signal Aspect is Activated

2.3.2. MODE

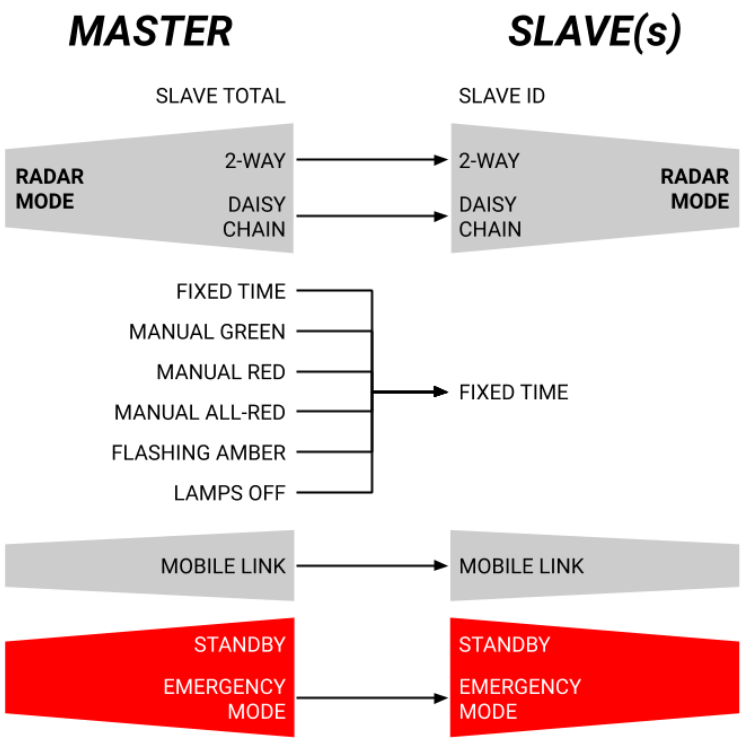
There must be only one Master controller in the system.

To select the operating mode, move the MODE knob to the corresponding mode position (e.g., to use the portable traffic lights in a 2-WAY RADAR mode, move the MODE knob on both MASTER and SLAVE units to the position 2-WAY RADAR MODE)



Selecting the 2-Way Radar Mode on MASTER and SLAVE units

You can choose between one of the following operating modes:



Operating Modes for Master Unit and Slave Unit(s)

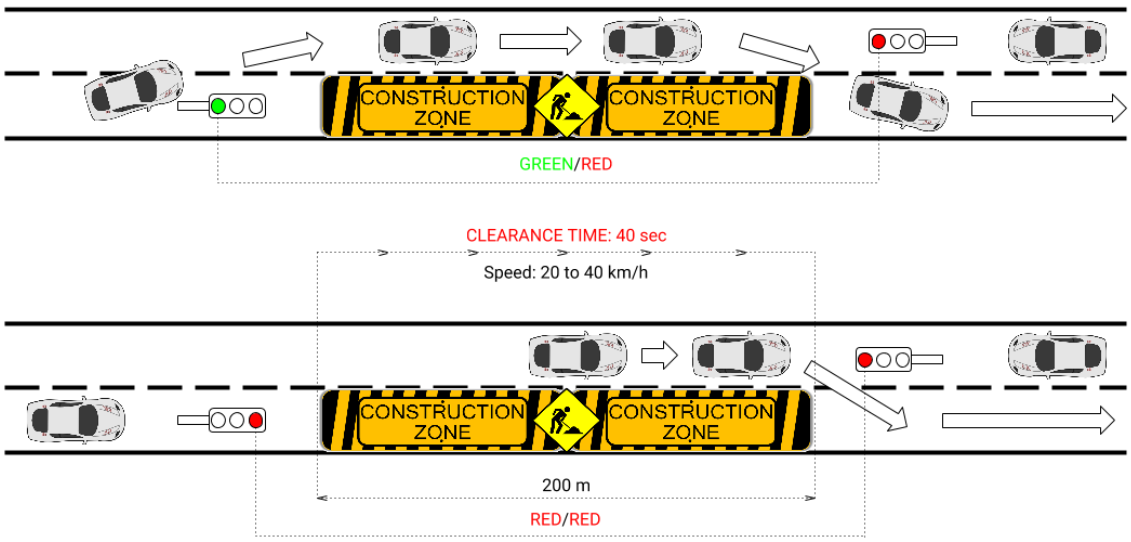
The upper diagram shows all available operating modes and how to pair them (e.g., to use the MANUAL GREEN operating mode, move the MODE knob on the MASTER unit to the position MANUAL GREEN and move the MODE knob on the SLAVE unit to the position FIXED TIME).

The SLAVE TOTAL/SLAVE ID positions are for DAISY CHAIN programming, while STANDBY position is for EMERGENCY MODE only.

For a detailed instruction for each operating MODE, skip to the paragraph 4. Operating Modes.

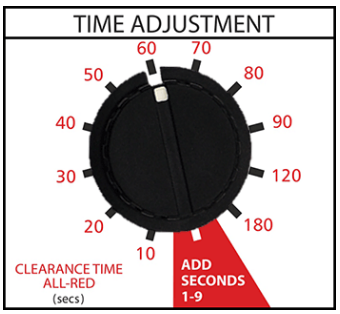
2.3.3. TIME ADJUSTMENT – Clearance Time/All-Red

The CLEARANCE TIME (ALL RED) is the time interval allotted for vehicles to safely pass through the one-lane construction zone before opposing traffic is released. During CLEARANCE TIME (ALL RED) the red displays are shown to all approaches.



CLEARANCE TIME (ALL RED) ensures that the traffic within the workzone have enough time to clear the workzone before the other lights turn green

You can set the timing of CLEARANCE TIME (ALL RED) from 10 -180 seconds by rotating the corresponding knob to the desired setting.



If the duration of CLEARANCE TIME/ALL-RED must be set between 11-189 seconds, e.g. 73 seconds instead of 70 or 80, move to the paragraph 2.3.4. TIME ADJUSTMENT – Add Seconds 1-9.

2. DESIGN AND FEATURES

ALL RED/CLEARANCE TIME

Travel Distance	Vehicle Speed (km/h)						
(m)	15 km/h	20 km/h	25 km/h	30 km/h	40 km/h	50 km/h	60 km/h
25	10	9	8	7	6	6	6
50	16	13	11	10	9	8	7
100	28	22	18	16	13	11	10
150	40	31	26	22	18	15	13
200	52	40	33	28	22	18	16
250	64	49	40	34	27	22	19
300	76	58	47	40	31	26	22
350	88	67	54	46	36	29	25
400	100	76	62	52	40	33	28
500	124	94	76	64	49	40	34
600	148	112	90	76	58	47	40
700	172	130	105	88	67	54	46
800	196	148	119	100	76	62	52
900	220	166	134	112	85	69	58
1000	244	184	148	124	94	76	64

Table for adjusting the Clearance Time (in seconds)

Unit	Fixed Time/2-Way Radar Mode/Emergency Mode (2 Units)							
Master	All-Red	Green	All-Red	Red	All-Red	Green	All-Red	Red
Slave	All-Red	Red	All-Red	Green	All-Red	Red	All-Red	Green

Unit	Daisy Chain (3 Units)							
Master	All-Red	Green	All-Red	Red	All-Red	Red	All-Red	Green
Slave 1	All-Red	Red	All-Red	Green	All-Red	Red	All-Red	Red
Slave 2	All-Red	Red	All-Red	Red	All-Red	Green	All-Red	Red

Unit	Daisy Chain (4 Units)							
Master	All-Red	Green	All-Red	Red	All-Red	Red	All-Red	Red
Slave 1	All-Red	Red	All-Red	Green	All-Red	Red	All-Red	Red
Slave 2	All-Red	Red	All-Red	Red	All-Red	Green	All-Red	Red
Slave 3	All-Red	Red	All-Red	Red	All-Red	Red	All-Red	Green

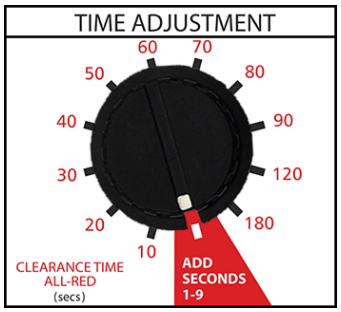
Traffic Lights Phase Sequences

2.3.4. TIME ADJUSTMENT – Add Seconds 1-9

If there is a strict need for the duration of CLEARANCE TIME/ALL-RED to be set between 11 and 189 seconds, you can use the ADD SECONDS 1-9 option.

E.g. there is a need for the duration of CLEARANCE TIME/ALL-RED to be set at 75 seconds instead of 70 or 80 as predefined on the operator interface:

1. Move the CLEARANCE TIME/ALL-RED knob to the position ADD SECONDS 1-9



2. On the amber light, the countdown timer will commence counting from 1 to 9 where each number represents the additional second

3. When the desired additional second is displayed (e.g. 5 seconds), move the CLEARANCE TIME/ALL-RED knob backwards. This procedure memorizes and adds the additional 5 seconds to each entered duration of CLEARANCE TIME/ALL-RED phase

4. Move the CLEARANCE TIME/ALL RED knob to the position 70, and the 5 seconds of additional time will be automatically added, thus resulting in 75 seconds of clearance time

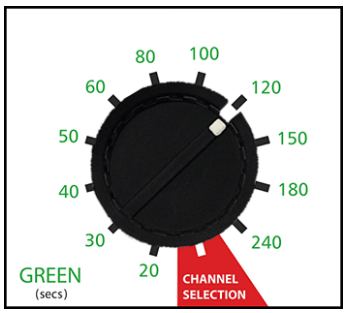
If you want to remove the additional seconds feature, you can either move the CLEARANCE TIME/ALL-RED knob to the position ADD SECONDS 1-9 and then immediately move it backwards before the countdown from 1-9 commences, or simply RESET the portable traffic lights by turning OFF and ON the ON/OFF key.

In the EMERGENCY MODE, set the MODE knob to the position STANDBY prior to the Add Seconds 1-9 operation.

2.3.5. TIME ADJUSTMENT – Green

The GREEN rotary knob is used to set the duration of GREEN phase after which the signal head will turn to 3 seconds AMBER, and then RED (in the EU version, otherwise according to the corresponding national regulations).

You can set the duration of GREEN time by rotating the corresponding knob to the desired setting.



- In RADAR MODE, the GREEN phase runs as maximum green phase, depending on the volume of traffic.

  The minimum green phase always runs and is factory set at 12 seconds and is non-adjustable.

  The green phase is extended by the oncoming vehicles that trigger the radar detectors up to the maximum green phase which is user user-adjustable and can be set from 20-240 seconds (only in 2-way and daisy chain modes).

  If no more vehicles are registered between the minimum and maximum green phase, the current green phase is ended.

- In FIXED TIME, the GREEN phase runs according to the fixed setting regardless of the volume of traffic.

  The duration of each GREEN phase is the same, and is user-adjustable ranging from 20-240 seconds.

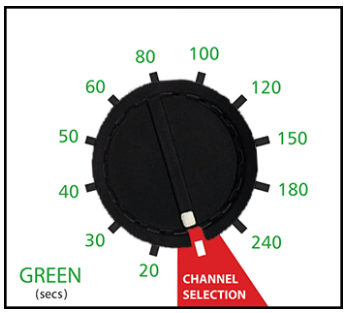
2.3.6. TIME ADJUSTMENT – Channel Selection

You can use the CHANNEL SELECTION feature if you have more than one set of Portable Traffic Lights close to each other and you want them to operate independently from each other in radio operating mode.

You can choose between channels ranging from 1 to 16, where channel No.1 has a frequency of 433.00 MHz, up to a channel No.16, which has a frequency of 434.60 MHz.

E.g. to program the channel No. 12 on the portable traffic lights:

1. Move the GREEN knob to the position CHANNEL SELECTION



2. On the amber light, the countdown timer will commence counting from 1 to 16 where each number represents one of the available channels for selection

3. When the desired channel is displayed (e.g. **12**), move the green knob to green time setting.

This procedure permanently stores the channel number into the memory of the portable traffic lights.

If you want to program another channel into the portable traffic lights, repeat the above procedure, with the new channel number.

2.3.7. WARNING

For a more detailed solutions regarding the WARNING fault indicators, please skip to the paragraph 5 – TROUBLESHOOTING.

2.3.7.1. EMERGENCY MODE SYNCHRONIZE ERROR

If the **EMERGENCY MODE SYNCHRONIZE ERROR** indicator starts to blink, that means that the unit is not properly synchronized to operate in an emergency mode. This happens if the operating mode knob is set on the STANDBY position, or if the time phases have been altered after the initial Emergency Mode synchronization.

SOLUTION: Synchronize the unit / Skip to paragraph 4.2. on how to synchronize portable traffic lights in an Emergency Mode.

2.3.7.2. SYSTEM FAULT

If the **SYSTEM FAULT** indicator is illuminated in red, that means that the main processor of the controller is faulty.

SOLUTION: Request service / return. Replace controller.

2.3.7.3. BATTERY STATUS

The **BATTERY STATUS** indicator displays in green, amber or red colour the voltage of the battery.

BATTERY WITH GREATER THAN 20% OPERATING CAPACITY	BATTERY AT LESS THAN 20% OPERATING CAPACITY	BATTERY LOW Recharge ASAP.	BATTERY DEPLETED. Signal heads OFF. Recharge immediately.
> 12 V	12 V – 11.5 V	11.5 V – 11.0 V	< 11.0 V

2.3.7.4. REVERSED BATTERY POLARITY

If the battery connections are connected to the wrong polarity of the rechargeable battery, the **REVERSED BATTERY POLARITY** will illuminate in RED colour.

Integrated safety measure prevents the damage of the portable traffic lights if the battery connections are connected to the wrong polarity of the rechargeable battery.

SOLUTION: Connect the RED BATTERY CLAMP to the (+) positive polarity and the **BLACK BATTERY CLAMP** to the (–) negative polarity of the battery.

2.3.7.5. SYSTEM STATUS INDICATOR

The **SYSTEM STATUS INDICATOR** illuminates in following colours:

RED *(Displays on Master unit only)*	GREEN *(Displays on Master unit only)*	BLUE *(Displays on Master unit only)*	MAGENTA
Vehicle detected SLAVE	Vehicle detected SLAVE	Vehicle detected MASTER	Radio Communication Error in Daisy Chain *(View Troubleshooting)*

2.3.7.6. RADIO ERROR OR WRONG CHANNEL SELECTED

The illuminated **RADIO ERROR or WRONG CHANNEL SELECTED** means that either:

1. The Radio Communication between MASTER and SLAVE(s) has been lost or
2. The units have different channels programmed (e.g. The Master operates on Channel No.7, while the Slave operates on Channel No. 11)

SOLUTION: Check the paragraph 5 – TROUBLESHOOTING.

2.4. MICROPROCESSOR TECHNOLOGY

The functions of the Portable Traffic Lights ST-PS5 are operated by a modern microcontroller who controls and permanently checks the functionality of the entire device. If any irregularity occurs, ST-PS5 immediately displays an error message on the operator interface and immediately transitions to FLASHING AMBER condition.

The microcontroller and the circuit board in the controller are sealed in a special waterproof case for increased safety.

2.5. LOW POWER CONSUMPTION

With a single battery charge of 180Ah, the ST-PS5 can have a running time of up to 25 days.

2.6. AUTO-BRIGHTNESS TECHNOLOGY

Our own developed AUTO-BRIGHTNESS technology keeps the brightness of the signal aspects always at the optimum level.

3. SETUP OF PORTABLE TRAFFIC LIGHTS

3.1. INSTALLING THE SIGNAL HEAD WITH POLE TO THE BATTERY BOX

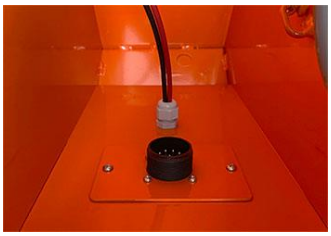
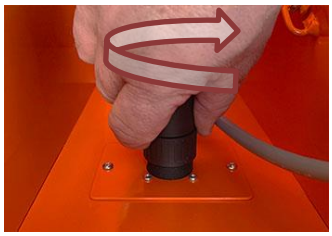
Insert the signal head pole to the mount of the battery box like on the pictures below:

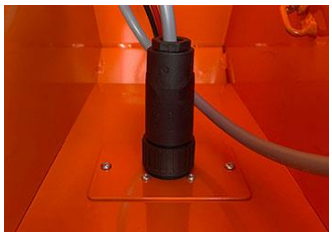


3.2. CONNECTING THE SIGNAL HEAD CABLE WITH THE BATTERY BOX SOCKET

To connect the communication cable from the signal head to the battery box:

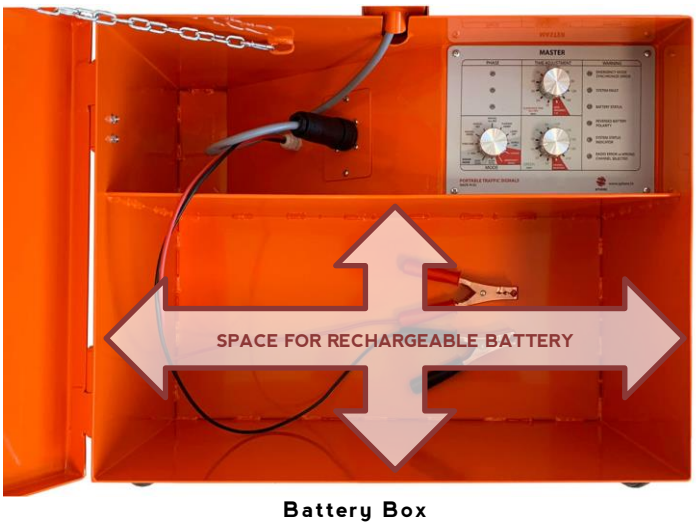
1. Insert the signal head connector into the battery box socket
2. Secure the signal head connector to the socket by tightening the threaded joint



3.3. BATTERY INSTALLATION

To install the rechargeable battery into the battery box, you must place the battery inside the space provided by the battery box.



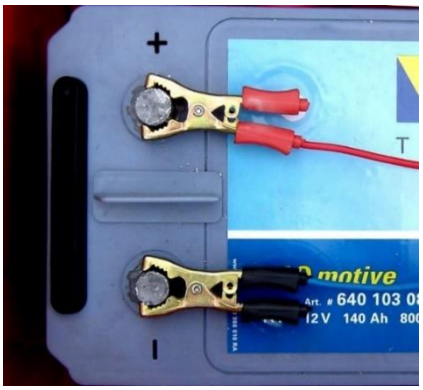
Battery Box

3. SETUP OF PORTABLE TRAFFIC LIGHTS

To connect the rechargeable battery with the Portable Traffic Lights ST-PS5, use the provided BATTERY connectors and connect them with the battery poles of the Rechargeable Battery:

1. **RED BATTERY CONNECTION** to the **POSITIVE (+)** polarity of the battery
2. **BLACK BATTERY CONNECTION** to the **NEGATIVE (-)** polarity of the battery.

RED BATTERY CLAMP	BLACK BATTERY CLAMP
(+) POSITIVE POLARITY OF THE BATTERY	(-) NEGATIVE POLARITY OF THE BATTERY



Connect the RED BATTERY CLAMP to the (+) Positive Polarity and BLACK BATTERY CLAMP to the (–) Negative Polarity of the Battery

As soon as the battery is connected, the system powers ON.

3.4. ALIGNING THE RADAR DETECTORS (ST-PS4 and ST-PS5 Only)

Always align the directional radar detector so that oncoming traffic is registered correctly, because otherwise troublefree vehicle-activated operation of the traffic signal cannot be warranted.

Correct alignment can be checked by using the red LED on the front of the radar detectors or by using the LED SYSTEM STATUS INDICATOR information on the front panel of the MASTER controller.

SYSTEM STATUS INDICATOR (blue LED means that the vehicle was detected by the master unit)

or SYSTEM STATUS INDICATOR (red or green LED means that the vehicle was detected by the slave unit)

4. OPERATING MODES

You can use the portable traffic lights in:

- Radar Mode (Radio Communication with Radar)
- Fixed Time Mode (Radio Communication without Radar)
- Emergency Mode (Use when the radio communication between master and slave(s) is faulty).

RADAR MODE	RADIO OPERATING MODE	EMERGENCY MODE (Non-Radio Mode)
2-WAY (PS4 AND PS5 ONLY) DAISY CHAIN (PS3DC AND PS5 ONLY)	FIXED TIME MANUAL GREEN MANUAL RED MANUAL ALL-RED FLASHING AMBER LAMPS OFF DAISY CHAIN (OPTIONAL)	EMERGENCY MODE

4.1. RADIO OPERATING MODE (THE DEFAULT OPERATING MODE)

Sphere portable traffic lights are fitted with a 433.05-434.79MHz antenna that provides reliable wireless radio communication between portable traffic signal units. For the best results, the portable traffic signal units should be positioned line-of-sight to each other. A maximum range of up to 1 kilometer between the Master and Slave(s) can be achieved in ideal conditions.

Portable traffic lights must be set on the same channel for a wireless communication to be established between Master and Slave(s).

When using the Sphere Portable Traffic Lights in a Radio Operating Mode, the MASTER unit controls the SLAVE unit(s) via Radio Linked Communication, meaning that setting the operating modes or time phases is done exclusively on the MASTER unit.

MASTER – The Master controller determines the overall operation of the system according to the selected configuration, operating mode and time settings. There must be only one Master controller in the system.

SLAVE - Slaves are primary controllers which signal as instructed by the Master controller. The operator cannot control the signal timings on Slave units in a radio operating mode.

The operator sets the timings of ALL RED/CLEARANCE TIME and GREEN exclusively on the MASTER unit, which when set, will result in the immediate synchronization of all units connected via radio link (1 Master and 1 or more Slaves).

You can use 1 Master unit with:

- 1 Slave unit in a FIXED TIME operating mode
- 1 Slave unit in a 2-Way RADAR operating mode
- Up to 6 Slaves in a DAISY CHAIN operating mode.

IN A RADIO OPERATING MODE, SETTING UP THE OPERATING MODES (fixed time, 2-way radar, manual green…) OR TIME PHASES (clearance time/all-red, green) IS DONE EXCLUSIVELY ON THE MASTER UNIT!

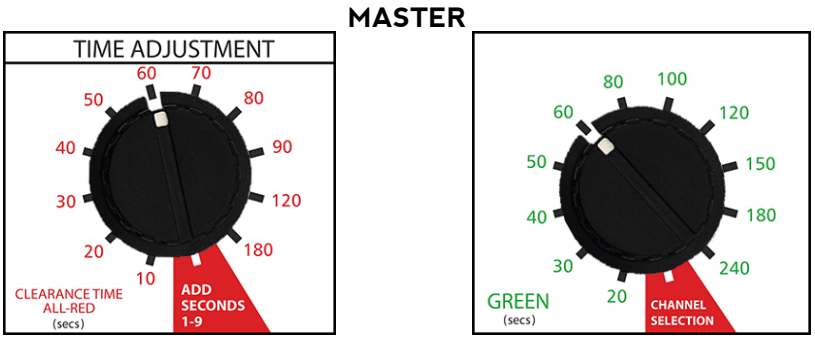
IMPORTANT

4. OPERATING MODES

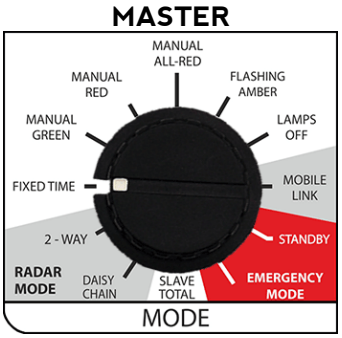
4.1.1 FIXED TIME

To use Portable Traffic Lights pair in Radio Mode where the duration of RED, GREEN and ALL-RED/CLEARANCE TIME phases is fixed, the operator must:

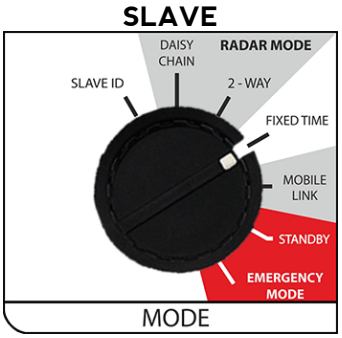
1. Set the CLEARACE TIME/ALL RED and GREEN on the MASTER unit



2. Move the operating mode knob on the MASTER unit to the position FIXED TIME



3. Move the operating mode knob on the SLAVE unit to the position FIXED TIME



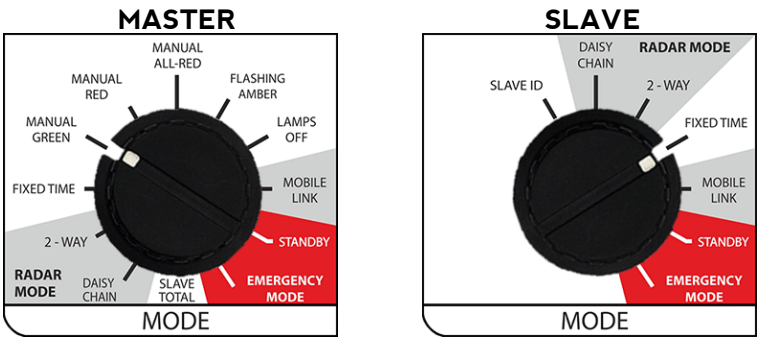
This operation establishes wireless communication between MASTER and SLAVE unit, the synchronization process is completed and the operator can start using the portable traffic lights.

The operator can set or change the duration of ALL RED/CLEARANCE TIME and the duration of GREEN time on the MASTER unit at any time.

4.1.2. MANUAL GREEN

If the situation arrises where there is a need to set continous GREEN on MASTER unit, and subsequently continous RED on SLAVE unit, the operator must:

1. Move the operating mode knob on the MASTER unit to the position MANUAL GREEN
2. Move the operating mode knob on the SLAVE unit to the position FIXED TIME

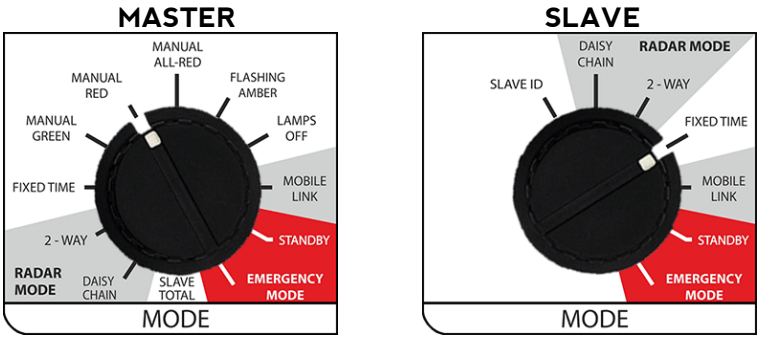


With this operation the MASTER unit will display continous GREEN phase, while the SLAVE unit will display continuous RED phase until another mode is selected.

4.1.3. MANUAL RED

If the situation arrises where there is a need to set continous RED on MASTER unit, and subsequently continous GREEN on SLAVE unit, the operator must:

1. Move the operating mode knob on the MASTER unit to the position MANUAL RED
2. Move the operating mode knob on the SLAVE unit to the position FIXED TIME

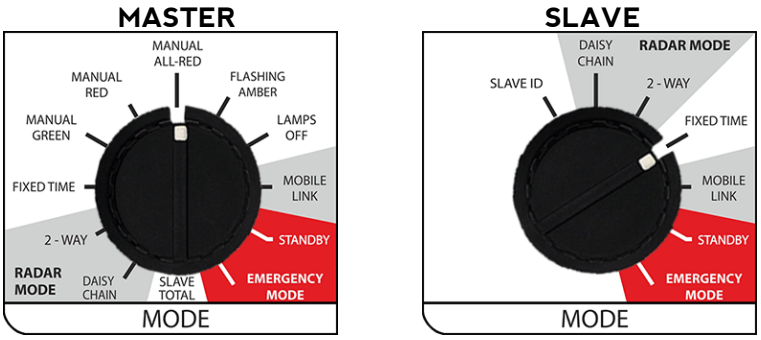


With this operation the MASTER will display continouse RED phase, while the SLAVE unit will display continuous GREEN phase until another mode is selected.

4.1.4. MANUAL ALL-RED

If the situation arrises where there is a need to close the two-way traffic permanently by using a continuous RED phase on both MASTER and SLAVE units, the operator must:

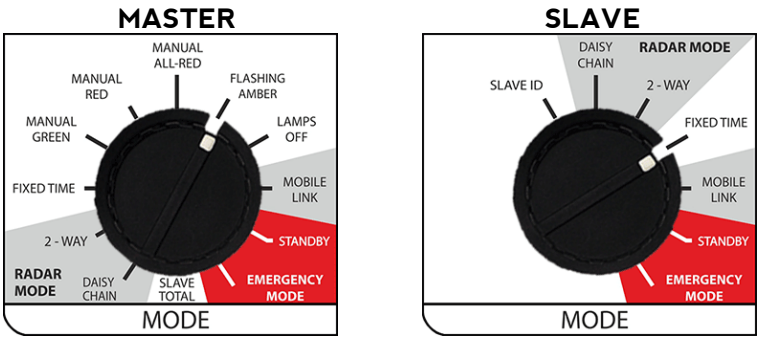
1. Move the operating mode knob on the MASTER unit to the position MANUAL ALL-RED
2. Move the operating mode knob on the SLAVE unit to the position FIXED TIME



4.1.5. FLASHING AMBER

If the situation arrises where there is a need for a continuous FLASHING AMBER phase on both MASTER and SLAVE units, the operator must:

1. Move the operating mode knob on the MASTER unit to the position FLASHING AMBER
2. Move the operating mode knob on the SLAVE unit to the position FIXED TIME

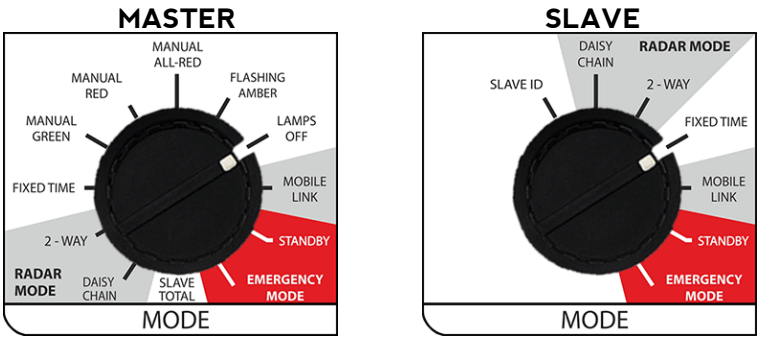


4. OPERATING MODES

4.1.6. LAMPS OFF

If the situation arrises where there is a need to turn OFF signal aspects on both MASTER and SLAVE units, the operator must:

1. Move the operating mode knob on the MASTER unit to the position LAMPS OFF
2. Move the operating mode knob on the SLAVE unit to the position FIXED TIME



4.1.7. SHUTDOWN PROCEDURE FOR RADIO MODE

For safe shutdown procedure in radio mode, the operator must do the following on the MASTER unit:

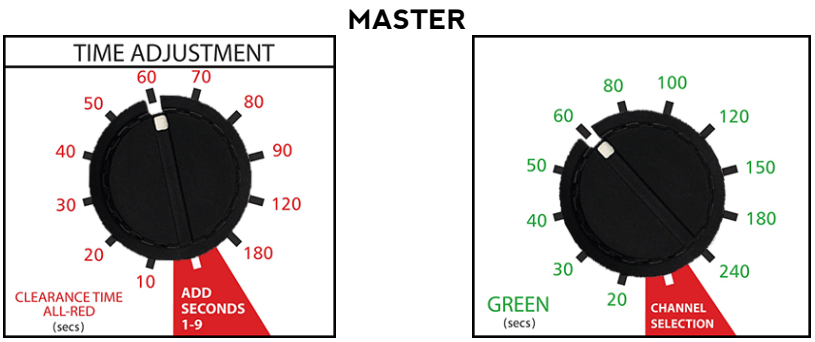
1. Move the operating mode knob on the MASTER unit to the position MANUAL ALL-RED. All the lights will switch to all-red phase, thus closing the entrance to the construction zone
2. Wait until all traffic has cleared the construction zone
3. Move the operating mode knob on the MASTER unit to the position FLASHING AMBER for a nominal time of 10 secs
4. Move the operating mode knob on the MASTER units to the position LAMPS OFF
5. Move the portable traffic lights sideways so they no longer face the oncoming drivers
6. Turn OFF the portable traffic lights by pressing the ON/OFF KEY to the position OFF

4.2. RADAR MODE (ST-PS4 and ST-PS5 Only)

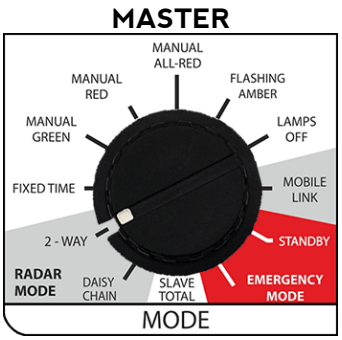
4.2.1. 2-WAY

To use Portable Traffic Lights pair in Radio Mode where the duration of GREEN depends on the volume of traffic, the operator must:

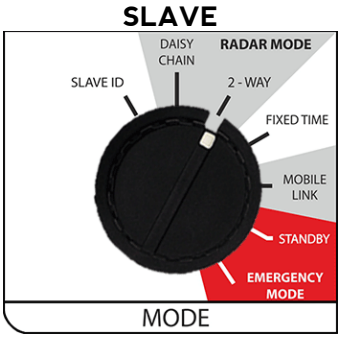
1. Set the clearance time/all-red and maximum green on the MASTER unit



2. Move the operating mode knob on the MASTER unit to the position 2-WAY (RADAR MODE)



3. Move the operating mode knob on the SLAVE unit to the position 2-WAY (RADAR MODE)



This operation establishes wireless communication between MASTER and SLAVE unit, the synchronization process is completed and the operator can start using the portable traffic lights.

4. OPERATING MODES

The operator can set or change the duration of ALL RED/CLEARANCE TIME and the duration of maximum GREEN time on the MASTER unit at any time.

4.2.2. SHUTDOWN PROCEDURE FOR RADAR MODE

For safe shutdown procedure in 2-Way radar mode, the operator must do the following on the MASTER unit:

1. Move the operating mode knob on the MASTER unit to the position MANUAL ALL-RED. All the lights will switch to all-red phase, thus closing the entrance to the construction zone
2. Wait until all traffic has cleared the construction zone
3. Move the operating mode knob on the MASTER unit to the position FLASHING AMBER for a nominal time of 10 secs
4. Move the operating mode knob on the MASTER units to the position LAMPS OFF
5. Move the portable traffic lights sideways so they no longer face the oncoming drivers
6. Turn OFF the portable traffic lights by pressing the ON/OFF KEY to the position OFF

4.3. DAISY CHAIN (ST-PS3DC and ST-PS5 Only)

Sphere Portable Traffic Lights can support up to 7 units in a Daisy Chain operating mode - 1 Master and up to 6 Slaves.

The operator can use the Portable Traffic Lights in a Daisy Chain mode when there is a need to regulate the traffic when the contruction zone revolves around T-junction, Cross Junction or Roundabouts and when there are more than 2 traffic entrances to the construction zone.

In a Daisy Chain mode, each Portable Traffic Lights will go to the GREEN signal phase in turn, and then other units will be set to ALL-RED or RED.

FOR EACH SLAVE UNIT THE OPERATOR MUST ENTER ITS OWN UNIQUE ID NUMBER TO USE IN A DAISY CHAIN MODE.

e.g. if the Operator wants to use 1 Master and 3 Slave units:

- the first SLAVE unit will have its own unique ID number set at 1
- the second SLAVE unit will have its own unique ID number set at 2
- the third SLAVE unit will have its own unique ID number set at 3

- the MASTER unit will have the total numer of SLAVE units set at 3

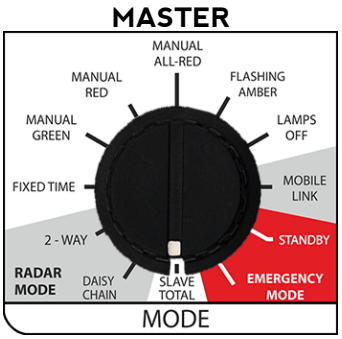
IMPORTANT

In the daisy chain operating mode, the PS3DC model will have its duration of red and green phase fixed, while the PS5 model will have its duration of red and green phase adjusted by radar.

4.3.1. SETTING UP THE MASTER UNIT IN DAISY CHAIN

To use the MASTER unit in a Daisy Chain mode, you must enter the total number of SLAVE units you want the Master to control in a DAISY CHAIN mode:

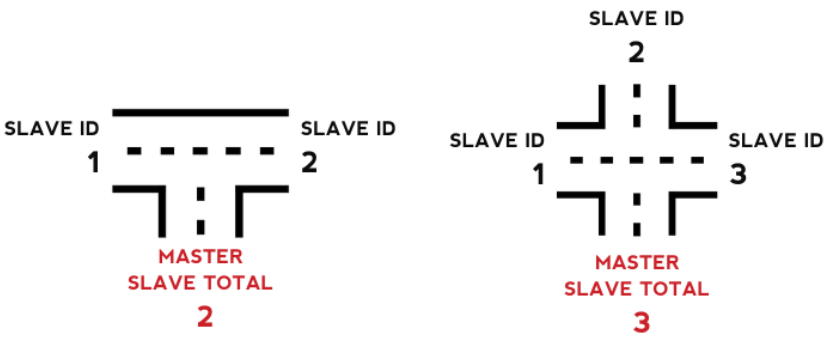
1. Move the MODE knob to the position SLAVE TOTAL



2. On the amber light, the countdown timer will commence counting from 1 to 6 where each number represents the total amount of SLAVE units

3. When the total amount of SLAVE units for the MASTER to control is displayed on the amber light, move the MODE knob to the position DAISY CHAIN

E.g., When the total number of SLAVEs is 3: Move the MODE knob from the position SLAVE TOTAL to the position DAISY CHAIN when the number 3 is displayed on the amber light.



This procedure permanently stores the total number of the SLAVES into the memory of the MASTER unit.

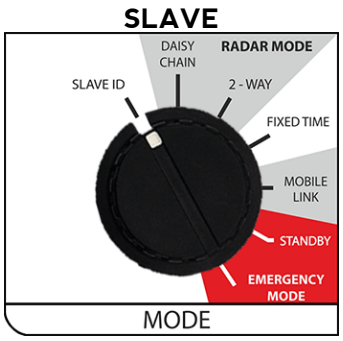
If you want to enter a different number of SLAVES into the MASTER unit, repeat the above procedure.

4.3.2. SETTING UP THE SLAVE UNITS IN DAISY CHAIN

To use SLAVE units in a Daisy Chain mode, you must assign traffic light ID number (SLAVE ID) for each SLAVE unit separately.

The SLAVE ID number for each SLAVE must be assigned consecutively and in ascending order, starting with "1". You can assign SLAVE ID number in range from 1 to 6.

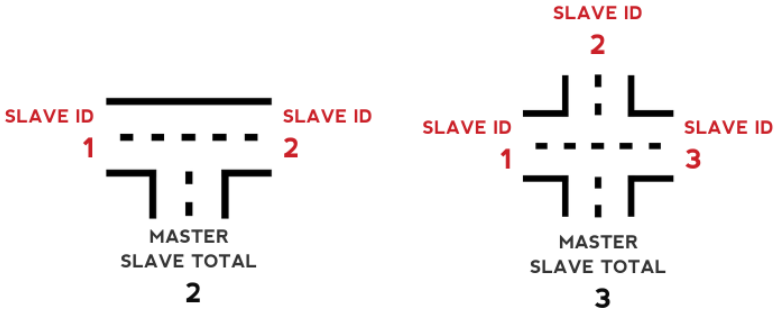
1. Move the MODE knob to the position SLAVE ID



2. On the amber light, the countdown timer will commence counting from 1 to 6 where each number represents the SLAVE ID number

3. When the desired SLAVE ID number is displayed on the amber light, move the MODE knob to the position DAISY CHAIN

E.g., if the total number of SLAVES is 2, then each SLAVE unit must have its own unique SLAVE ID number, and they must be assigned consecutively in ascending order. First slave unit must have its SLAVE ID number assigned at "1" and the second slave unit must have its SLAVE ID assigned at "2".



This procedure permanently stores the SLAVE ID number into the memory of the SLAVE unit. If you want to asign a different SLAVE ID number, repeat the above procedure.

4.3.3. SETTING UP THE DESIRED SIGNAL PHASES FOR THE DAISY CHAIN OPERATING MODE

Setting up the desired signal phases on the Daisy Chain Operating Mode is the same as setting up the signal phases on the 2-WAY RADAR MODE (chapter 4.1.7.)

4.3.4. SHUTDOWN PROCEDURE FOR DAISY CHAIN MODE

For safe shutdown procedure in a daisy chain mode, the operator must do the following on the MASTER unit:

1. Set the clearance time/all-red for 240 seconds. This should be enough time for all traffic to be cleared
2. Wait until all traffic has cleared the construction zone. If all traffic is not cleared, repeat step No. 1
3. Move the operating mode knob on the MASTER unit to the position STANDBY. This will activate FLASHING AMBER on all units
4. Move all portable traffic lights sideways so they no longer face the oncoming drivers
5. Turn OFF the portable traffic lights by pressing the ON/OFF key

4. OPERATING MODES

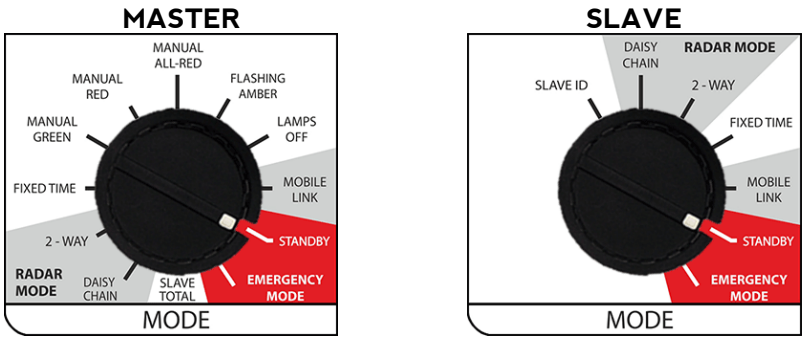
4.4. EMERGENCY MODE (NON-RADIO MODE)

When the radio transmission between Master and SLAVE units breaks down and is not reliable for a normal operation, you can use the portable traffic lights in EMERGENCY MODE, which uses QUARTZ control for traffic regulation.

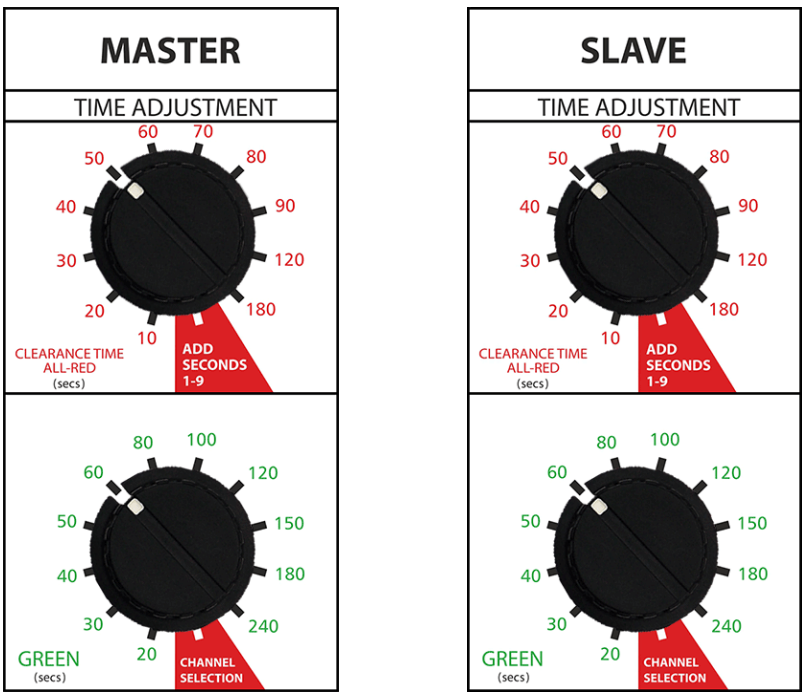
4.4.1. SETTING UP THE MASTER AND SLAVE UNITS FOR EMERGENCY OPERATING MODE

To set up MASTER and SLAVE units to operate in an Emergency Mode (Non-Radio Mode), you must first enter the desired duration of CLEARANCE TIME/ALL RED and GREEN phase.

1. Move the operating mode knob on the MASTER and SLAVE units to the position STANDBY

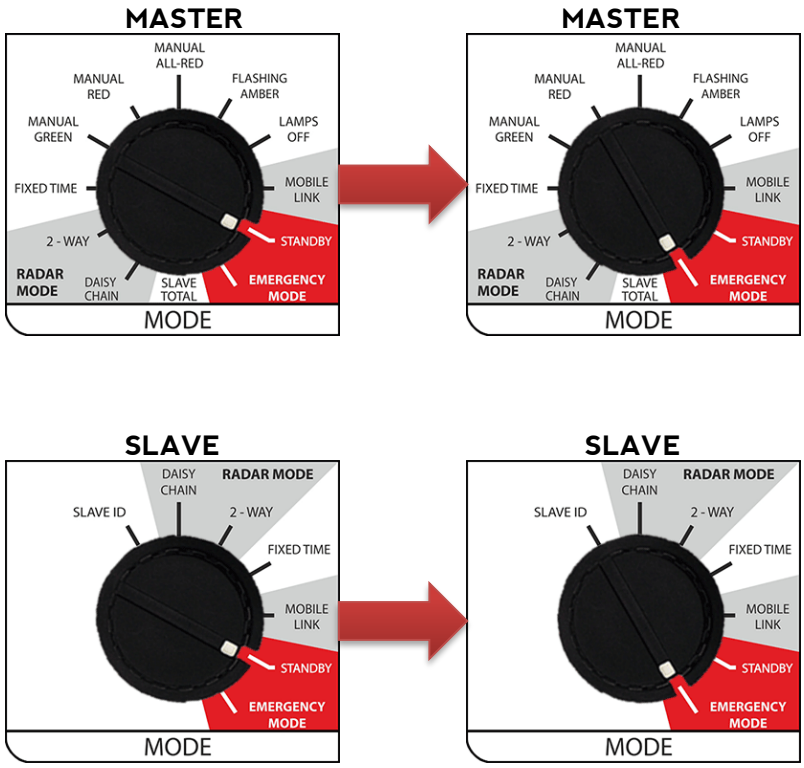


2. Set the identical time phases on both MASTER and SLAVE unit (select the same clearance time/all-red and fixed green time phases) prior to synchronization



CLEARANCE TIME and GREEN timings on MASTER and SLAVE units must be set IDENTICAL prior to moving the operating knobs to the EMERGENCY MODE position

3. To complete the QUARTZ SYNCHRONIZATION, move the MODE knobes on MASTER and SLAVE both AT THE SAME TIME from the position STANDBY to the position EMERGENCY MODE



Move the MODE knobs on MASTER and SLAVE units at the same time to the position EMERGENCY MODE

This operation synchronizes the quartz timers on MASTER and SLAVE units and the synchronization process is completed.

Any subsequent changes in timings of ALL RED/CLEARANCE TIME and GREEN will require a repeat of the above procedure.

4.4.2. SHUTDOWN PROCEDURE FOR EMERGENCY MODE

For safe shutdown procedure in emergency mode, one operator is needed on the MASTER unit and one operator is needed on the SLAVE unit. The shutdown procedure is identical for both units.

The operators must do the following:

1. Wait until the portable traffic lights reach the CLEARANCE TIME/ALL-RED phase
2. 5 seconds before the CLEARANCE TIME/ALL-RED phase is over, move the operating mode knob on MASTER and SLAVE units to the position STANDBY. This will activate the FLASHING AMBER. Leave the operating knob on position STANDBY for 10 secs
3. Move the portable traffic lights sideways so they no longer face the oncoming drivers
4. Turn OFF the portable traffic lights by pressing the ON/OFF key to the position OFF

5. BIOS SETTINGS

If there is a need to change or modify the default system configuration or activate some of the system features, you can use portable traffic lights BIOS to save or enter new system parameters.

5.1. ENTERING THE BIOS SETTINGS

To enter the BIOS setup of the portable traffic lights:

1. Turn OFF the portable traffic lights either by pressing the ON/OFF switch or by disconnecting the portable traffic lights from the battery
2. Move all 3 rotary knobs on the user interface to the far-right end position (MODE knob to EMERGENCY MODE, CLEARANCE TIME/ALL-RED knob to ADD SECONDS 1-9 and GREEN knob to CHANNEL SELECTION)
3. Turn ON the the portable traffic lights either by pressing the ON/OFF switch or by connecting the portable traffic lights to the battery
4. On the amber light, the BIOS will start displaying the prestored factory settings ranging from A to H, where each letter represents one of the settings, while ON, OFF or a number on the amber display will let you know if that setting is activated or not, or which value it represents
5. When the BIOS setup is completed, again turn OFF the portable traffic lights either by pressing the ON/OFF switch or by disconnecting the portable traffic lights from the battery and move the rotary knobs to the desired positions

5.2. BIOS SETTINGS

BIOS Settings	Value	Name	Description
A	ON/OFF	Automatic Emergency Mode	When an existing radio communication breaks down and the automatic emergency mode is activated, the system automatically changes over to synchronised emergency mode for both portable traffic lights. That way the portable traffic lights continue to operate without any noticeable interruptions for vehicle traffic. During the automatic emergency mode, in the background portable traffic lights constantly try to restore the radio communication and they switch automatically back to the previously entered operating mode when the conditions for a good radio communication have been restored (MASTER only).
B	6-18 (secs)	Minimum Green	Duration of minimum green phase for 2-way Radar and Daisy Chain operating modes (MASTER only).
C	2-7 (secs)	Green Extension	The Green Extension time is the interval of Green phase that will be extended on each occurrence of vehicle detection (an actuation) while the Green phase is active (MASTER only).
D	2-5 (secs)	Green Amber Delay	Duration of amber phase followed by red phase.
E	0-5 (secs)	Red Amber Delay	Duration of amber phase followed by green phase.
F	ON/OFF	Red Phase Countdown Timer	Activation of green phase countdown timer.
G	ON/OFF	Green Phase Countdown Timer	Activation of red phase countdown timer.
H	ON/OFF	New Zealand Initial Startup Sequence	Activation of start-up sequence comprimising of 5 seconds flashing amber, 4 seconds steady amber and 10 seconds all-red prior to entering the Daisy Chain, 2-Way Radar or RF Fixed Time operating modes.
J	ON/OFF	Green on Demand	Activation of Green on Demand for 2-way radar and Daisy Chain operating modes (MASTER only).
L	OFF/2.5-5.0 (mins)	Nudge Activation Time	Activation of Nudge on Green on Demand (MASTER only).

5.2.1. AUTOMATIC EMERGENCY MODE (BIOS Settings "A")

When the automatic emergency mode is active:

- the RADIO ERROR or WRONG CHANNEL SELECTED red LED is lit on the user interface
- during the FIXED TIME operating mode, the clearance time and green phase is user defined on the Master operating interface
- during the 2-WAY RADAR operating mode, the clearance time is user defined on the Master operating interface, while the duration of green phase is fixed at 60 seconds
- The maximum allowed full cycles of automatic emergency mode is 3, after which if no radio communication is established, the lights will switch to flashing amber
- Only available on 2-Way Radar and Fixed Time operating modes.

5.2.2. GREEN ON DEMAND (BIOS Settings "J")

When the Green on Demand function is activated, Master and Slave(s) will rest on the All-Red signal phase until a vehicle is detected on either the Master or Slave, at which point the signal will change to green signal phase for that unit.

The Green on Demand works on first come first serve basis where the lights automatically change to green to service the demand.

5.2.3. NUDGE ACTIVATION TIME (BIOS Settings "L")

For the situation where a vehicle is waiting on either side, but it has not been detected by the radar detector, we have implemented a failsafe "Nudge" demand. Nudge is an artificial demand which will be generated automatically on either Master or Slave if no vehicles have been detected after a period of time. This ensures that the phase is serviced to clear any stationary or undetected vehicle that may happen if the radar detector is incorrectly adjusted or defect.

The Nudge Activation Time is the trigger time which activates the Nudge (artificial demand). The Nudge Activation Time is introduced every 2.5 minutes (150 secs), by default. You can turn OFF or modify the time interval of Nudge Activation Time using the BIOS.

BIOS Settings	Value	Nudge Activation Time	Description
L	**OFF**	**DISABLED**	The Nudge Activation Time is DISABLED.
L	**25**	**2.5 minutes/150 secs**	If no vehicle has been detected by the radar detector, the artificial demand will be introduced every 2.5 minutes or 150 secs.
L	**30**	**3 minutes/180 secs**	If no vehicle has been detected by the radar detector, the artificial demand will be introduced every 3 minutes or 180 secs.
L	**35**	**3.5 minutes/210 secs**	If no vehicle has been detected by the radar detector, the artificial demand will be introduced every 3.5 minutes or 210 secs.
L	**40**	**4 minutes/240 secs**	If no vehicle has been detected by the radar detector, the artificial demand will be introduced every 4 minutes or 240 secs.
L	**45**	**4.5 minutes/270 secs**	If no vehicle has been detected by the radar detector, the artificial demand will be introduced every 4.5 minutes or 270 secs.
L	**50**	**5 minutes/300 secs**	If no vehicle has been detected by the radar detector, the artificial demand will be introduced every 5 minutes or 300 secs.

6. TROUBLESHOOTING

This section contains tips on handling some of the issues that may arise from using the Portable Traffic Lights. If you cannot resolve the issue you are experiencing using the information below, please contact SPHERE or one of our Branches or Service Agents for assistance.

6.1. RADIO COMMUNICATION FAILURE

If the radio communication between the MASTER and a SLAVE unit is faulty, the RADIO ERROR or WRONG CHANNEL SELECTED RED LED will start flashing on the OPERATOR INTERFACE. This results in all units reverting to FLASHING AMBER mode until the radio communication between MASTER and SLAVE unit is re-established. The radio communication failure can be either temporary or permanent.

6.1.1. TEMPORARY LOSS OF RADIO COMMUNICATION BETWEEN MASTER AND SLAVE

If the radio communication between MASTER and a SLAVE unit is disrupted only temporary, then as soon as the radio communication is re-established, the units will resume with the normal operation. Red and Green times may be extended until radio communication has been regained.

The radio link can be disrupted temporary because of the following reasons:

- Unreliable or poor signal due to interference on the operating channel
- Transmission path is obstructed
- The distance between MASTER and SLAVE unit is too great
- Some interference may be occurring on the operating channel

SOLUTION:

1. **Look for sources of persistent radio interference or radio communication failure**
2. **Move the units closer to each other or**
3. **Change the operating channel**

6.1.2. PERMANENT LOSS OF RADIO COMMUNICATION BETWEEN MASTER AND SLAVE

If the radio communication between MASTER and a SLAVE unit is disrupted for a period longer than 5 seconds, the RADIO ERROR or WRONG CHANNEL SELECTED fault on the OPERATOR INTERFACE will be displayed, and all units will immediately transition to FLASHING AMBER condition.

The radio link can be disrupted permanently because of the following reasons:

- MASTER or SLAVE unit have not yet established radio link communication between them
- MASTER or SLAVE unit have established radio link communication between them, but the communication is still faulty

SOLUTION:

1. **Turn ON all units**
2. **Move all units within range**
3. **Program the same channel on all units**
4. **Enter the correct operating mode**
5. **Check the battery status**
6. **Reset all units (reconnect their batteries)**
7. **Possible SYSTEM FAULT**
8. **Possible broken antenna or faulty radio module**

TEMPORARY FIX – Use EMERGENCY MODE until the fault can be identified and resolved.

CALL SUPPORT - If not resolved by the above.

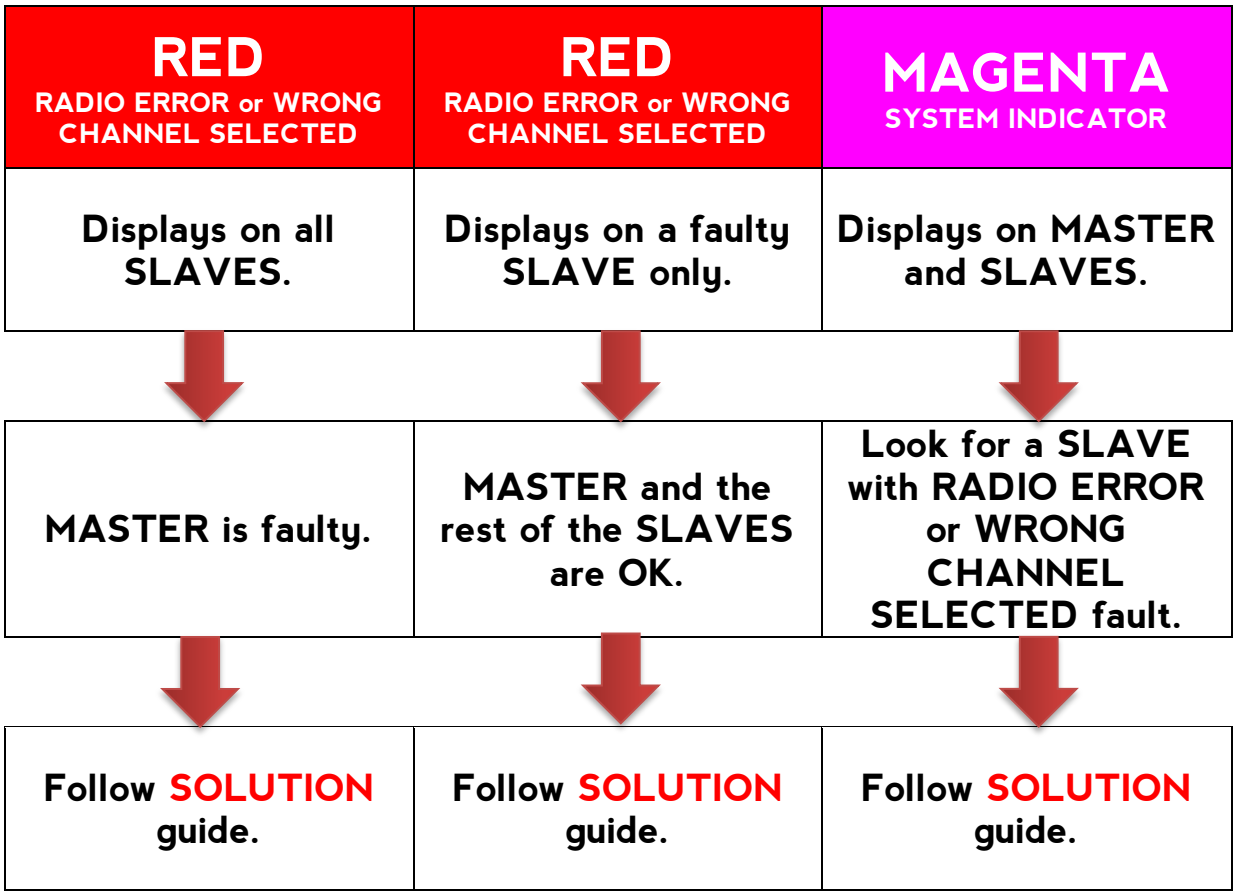
6.1.3. PERMANENT LOSS OF COMMUNICATION BETWEEN MASTER AND SLAVES IN A DAISY CHAIN

The radio link in Daisy Chain operating mode can be disrupted permanently because of the following reasons:

- MASTER or SLAVE units have not yet established radio link communication between them
- MASTER or SLAVE units have established radio link communication between them, but the communication is still faulty

If the radio link between MASTER and SLAVE units is disrupted for a period longer than 15 seconds:

- The healthy units will display a MAGENTA LED on the SYSTEM INDICATOR/OPERATOR INTERFACE and all units will immediately transition to FLASHING AMBER condition
- The faulty unit will display a RED LED RADIO ERROR or WRONG CHANNEL SELECTED fault on the OPERATOR INTERFACE and the unit will immediately transition to FLASHING AMBER condition



SOLUTION:

1. **Turn ON all units**
2. **Move all units within range**
3. **Make sure that the MASTER unit has SLAVE TOTAL programmed**
4. **Make sure that the SLAVE units have SLAVE IDs programmed in a correct order from ID.1 to the last unit (e.g. ID.1, ID. 2 and ID. 3 if the total number of SLAVEs is 3)**
5. **Program the same channel on all units**
6. **Enter the correct operating mode (Daisy Chain on MASTER and Daisy Chain on SLAVES)**
7. **Check the battery status**
8. **Reset all units (reconnect their batteries)**
9. **Possible SYSTEM FAULT**
10. **Possible broken antenna or faulty radio module**

CALL SUPPORT: If not resolved by the above.

6. TROUBLESHOOTING

6.2. RADAR FAILURE

If the green timings are not extended in a radar operating mode (2-way or daisy chain), a faulty radar may be a cause of the problem.

SOLUTION:

1. **Check if the connector is loose on the radar**
2. **Adjust the angle of the radar horizontally and vertically so that it faces the direction of the oncoming vehicles**
3. **Check if the RED LED on the front side of the radar illuminates when approached by the oncoming vehicle - if not, replace the radar.**
4. **On the MASTER unit, check the system indicator for red/green demand or blue demand LEDs to illuminate. Red/green LED represents demand for slave unit, while blue LED represents demand for master unit. If the oncoming vehicles don't trigger the radar i.e. the red/green demand or blue demand LEDs don't blink at all – replace the radar**
5. **On the MASTER unit, if the system indicator is continuously blinking in red/green or blue colour even if there are no approaching vehicles - replace the radar**

RED *(Displays on Master unit only)*	GREEN *(Displays on Master unit only)*	BLUE *(Displays on Master unit only)*
Vehicle detected SLAVE	Vehicle detected SLAVE	Vehicle detected MASTER

TEMPORARY FIX: **Use FIXED TIME until the fault can be identified and resolved.**

CALL SUPPORT: **If not resolved by the above.**

6.3. LOW BATTERY ERROR

BATTERY AT LESS THAN 20% OPERATING CAPACITY	BATTERY LOW Recharge ASAP.	BATTERY DEPLETED. Signal heads OFF. Recharge immediately.
12 V – 11.5 V	11.5 V – 11.0 V	< 11.0 V

6.4. LIGHTS OFF OR 2 LIGHTS ON AT THE SAME TIME - HAZARD CONDITION

If one of the aspects on the signal is not illuminated, or if one of the aspects on the signal head is permanently illuminated, the SYSTEM STATUS INDICATOR LED will transition to flashing BLUE /RED/MAGENTA colours on the controller and the signal head will immediately transition to FLASHING AMBER condition.

SOLUTION: **Replace the faulty signal aspect.**

6.5. RED AND GREEN ALTERNATE AT THE SAME TIME ON SLAVE UNIT

If the red and green phase alternate at the same time on SLAVE unit, that means that the SLAVE unit is receiving orders from 2 MASTER units at the same time.

SOLUTION: Change the radio communication channel on both MASTER and SLAVE so they would not interfere anymore with another nearby portable traffic lights set.

7. WARRANTY CARD

7.1. WARRANTY CARD

SPHERE d.o.o.
Varazdinska ulica 140 Gornji Kucan
HR-42000 Varaždin
Tel +385 42 444 660
Fax +385 42 444 664

WARRANTY CARD

Device: **PORTABLE TRAFFIC LIGHTS ST-PS5**

Serial Number: .....

The Date of Sale: .....

Signature & Stamp

WEB: **www.sphere.hr**

E-MAIL: **info@sphere.hr**

SPHERE

CE

8. TERMS AND CONDITIONS

8.1. APPLICATION

You accept these Terms and Conditions by purchasing the product from Sphere d.o.o. (hereinafter "The Seller") or from one of "The Seller's" product dealers.

8.2. COPYRIGHT

All pictures, text, artwork, images and informations that are contained in this manual are the intellectual property of, and copyrighted material of "The Seller". All rights are reserved. You may not use, access, copy, display, sell, modify, publish, distribute, or allow any third parties access to, any graphics, content, information or data in this manual without prior written permision from "The Seller" and may only use such information for the care and operation of your product. You may request permission to use the copyright materials by writing to info@Sphere.hr.

8.3. TRADEMARKS

Sphere, Portable Traffic Lights ST-PS5, are trademarks or registered trademarks of the Sphere d.o.o..

8.4. SAFETY

Improper use of the product can lead to death or injury to persons, damage to property and/or malfunction of the product.

8.5. LIMITED WARRANTY

"The Seller" warrants that the components in the Portable Traffic Lights ST-PS5 which are manufactured by "The Seller" shall be free of defects in materials and workmanship for a period of two years under normal use from the date-of-purchase.

During the warranty period "The Seller's" sole obligation is to either repair or replace a defective product as may be elected at "The Seller's" sole discretion.

If during the Warrany Period, product or part of the product proves to be defective in material or workmanship, "The Seller" will repair or replace, at no charge, under normal use and maintenance, the discovered defect within two years from the original date-of-purchase, returned to "The Seller" within 30 days after such defect is discovered with dated proof-of-purchase. Written authorization for such return must first be obtained. Any alteration or repair of the product or part of the product by a party not specifically authorized in writing by "The Seller" shall automatically void the warranty. All transportation and handling costs are at the buyer's expense.

This Limited Warranty does NOT cover any problem that is caused by conditions, malfunctions, modifications, abuse, maintenance, improper use or damage not resulting from defects in material or workmanship.

Other than for the above warranties or warranties in an appendix or a warranty card accompanying the product, this manual and the product are provided 'as is'.

There are no other warranties and to the extent allowed by law "The Seller" excludes all implied terms, conditions and warranties in respect of the manual and the product (including any implied warranty or merchantability or fitness for any particular use or purpose).

8.6. LIABILITY LIMIT AND INDEMNITY

In no event shall "The Seller", its dealers, agents and representatives be liable for any incidental, consequential or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with agreement or items sold hereunder, whether alleged to arise from breach of contract, express or implied warranty, or in tort, including without limitation, negligence, failure to warn or strict liability.

This warranty shall be rendered null and void when, in the judgment of "The Seller", if the equipment has been subject to abnormal or abusive use or lack of proper care and maintenance by the buyer, or when it has been determined that environmental or application conditions have exceeded those specified for normal use of a specific product.

Notwithstanding the foregoing, warranties for item's built wholly or partially to buyer's design or specifications are limited to dimensional conformity to engineering drawings supplied by "The Seller" or Buyer.

Finished materials and accessories purchased from other manufacturers are warranty only to the extent of the manufacturers'warranty to "The Seller".

"The Seller" makes no warranty of any kind whatsoever, expressed or implied, other than as specifically stated herein; and there are no warranties of merchantability and/or fitness for a particular purpose which exceed the obligations and warranties specifically state herein. Parts furnished without charge as replacements for original parts under warranty are warranted for the remainder of the original warranty period.

Force Majeure: "The Seller" does not assume the risk of and shall not be liable for delay or failure to perform any of "The Seller's" obligations by reason of circumstances beyond the reasonable control of "The Seller" (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation, accidents, act of God, strikes of labour, disputes, acts, laws, rules or regulations of any government of government agency, fires, floods, delays or failures, in delivery of carriers or suppliers, shortages of materials and any other cause beyond "The Seller's" control.