

CS-400TM

MULTI-WAY PORTABLE TRAFFIC LIGHT CONTROLLER



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OPERATOR'S MANUAL

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The CS-400 Portable Traffic Lighter Controller complies with Australian Standards

AS 4191-2015 Portable Traffic Signal Systems

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SPECIFICATIONS

General

Supply voltage	12 – 16V DC
Current consumption	400mA plus LED lanterns
Operating temperature	-15°C to +60°C
Maximum lantern head current	4A

RF

Connector	BNC socket
Frequency	900MHz (unlicensed ISM band)
Transmit power	1W
Maximum operating distance	1000m (clear line-of-sight)

Battery Alarm levels

Low	< 11.5V alarm sounds
Critical	< 11.0V system selects FLASH YELLOW mode
Shutdown (fatal)	< 10.0V system turns OFF

Alarm times

Fault response	< 0.5 seconds
Communications failure	< 5 seconds
Audible alarm duration	300 seconds (5 minutes)

Dimensions

Length	275mm
Width	270mm
Height	100mm
Weight	4.2kg

FEATURES

- All operator controls are on the front panel.
- Configuration Selection:
 - Shuttle
 - 2 WAY HAUL ROAD
 - 3 WAY standard T-intersection
 - 3 WAY SHUTTLE T-intersection
 - 4 WAY standard intersection
 - 4 WAY SHUTTLE Road-1 only
 - 4 WAY SHUTTLE Road-2 only
 - 4 WAY SHUTTLE Road-1 & Road-2
 - Custom (SINGLE and DUAL LANTERN)
- Single unit design means there is no designated MASTER or SLAVE. Therefore:
 - All standard CS-400 units are the same and interchangeable.
 - Once operational, the system can be operated from ANY unit saving time and increasing efficiency.
 - Fewer units are required to cater for varying jobs.
- Menu-style operating system of functions that require frequent use:
 - No need to remember programming codes.
 - No need to have an operating manual on hand at all times.
- Radio uses frequency-hopping technology to reduce interference
- Once synchronised and operator verifications done (where applicable), the system can be fully controlled from any CS-400.
- The screen can be easily read in all light environments.
- Following on from the design of its predecessor, the CS-200, many operational aspects are the same.
- Multiple CS-400 systems can be operated in the same location.
- Two lantern heads may be connected to each unit.
- Options:
 - System Repeater
 - Overcome difficult radio environments.
 - CS-TRH4 wireless remote control
 - Hand-held convenience.
 - MC-400 wired remote control
 - Simple management.
 - Cable connection
 - Allows system use in certain environments.
 - Count Down Timer
 - Courtesy timer for traffic.

OPERATIONAL MATRIX

Some configurations have restrictions on MODE selection and remote control use.

Radio link	SHUTTLE	2 WAY HAUL ROAD	3 WAY	3 WAY SHUTTLE R1	4 WAY	4 WAY SHUTTLE R1	4 WAY SHUTTLE R2	4 WAY SHUTTLE R1 & R2	CUSTOM	
									SINGLE	DUAL LANTERN
VEHICLE SENSOR	Y	-	Y	Y	Y	Y	Y	Y	-	Y
AUTO	Y	-	Y	Y	Y	Y	Y	Y	-	Y
MANUAL	Y	Y	CS-TRH4 ONLY	CS-TRH4 ONLY	CS-TRH4 ONLY	CS-TRH4 ONLY	CS-TRH4 ONLY	CS-TRH4 ONLY	Y	Y
RP-1 REPEATER	Y	Y	-	-	-	-	-	-	-	-
MC-400 WIRED REMOTE CONTROL	Y	Y	-	-	-	-	-	-	Y	Y
CS-TRH4 WIRELESS REMOTE CONTROL	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CDT COUNT DOWN TIMER (AUTO ONLY)	Y	-	Y	Y	Y	Y	Y	Y	-	Y

Y = allowed

SUMMARY OF SYSTEM OPERATIONS

Ensure CONFIGURATION and UNIT switches are set correctly to suit the intersection.

Ensure the UNIT switch is correctly positioned (marker on U1, U2, U3 or U4.)

Ensure each CS-400 controller has a unique UNIT identity, starting with U1.
(For example, there should not be two 'U2' controllers.)

Press [MENU] for 1 second to access menu items.

Press [CLEAR] to silence alarms. (Otherwise, alarms will remain active for 5 minutes.)

Press SYNC button briefly on U1 to synchronise with U2, U3, U4, TRH4 and CDT.
Press SYNC button for 3+ seconds on U1 to synchronise to RP1 (press briefly on RP1)

When only one lantern head is used, it must be connected to the LANTERN 1 socket.

When VEHICLE SENSORS are used, they must be connected to *all* controllers in the system.

Not all functions can be used in every configuration.
Check the Operational Matrix (page 7) for details.

CS-TRH4 (wireless remote control)

- Used only in MANUAL mode.
- Can only be synchronised to U1.
- Must be switched ON to SYNC.
- Must be within range of U1.

MC-400 (wired remote control)

- Used only in MANUAL mode.
- Can not be used in 3 WAY or 4 WAY configurations.
- Does not require synchronising to U1.
- May be used with U1, U2 or both (requires two remotes).

CS-RP1 (Repeater)

- Can only be used in SHUTTLE and 2 WAY configurations.
- May allow operation of system in some difficult RF environments.
- All system components (CS400, TRH4, CDT) must be synchronised to U1 first *then* synchronise the REPEATER to U1.
- To add a REPEATER, press U1's SYNC button for 3 seconds (note prompt) then press the SYNC button on the REPEATER. U2 will automatically connect via the REPEATER.

CDT (Count Down Timer)

- Must be synchronised to U1.
- Can only be used in AUTO mode.
- Will not work in 2WAY HAUL or SINGLE mode.

FRONT PANEL

ON – SYNC – OFF buttons

Press to perform any of these functions

- ON: Turns the controller ON.
- SYNC: Synchronises the controller to another compatible device.
- OFF: Turns the controller OFF.

CONFIGURATION switch

Selects one of the 9 configurations available

- SHUTTLE
- 2-WAY - HAUL ROAD
- 3-WAY
- 3-WAY SHUTTLE ON ROAD 1
- 4-WAY
- 4-WAY SHUTTLE ON ROAD 1
- 4-WAY SHUTTLE ON ROAD 2
- 4-WAY SHUTTLE ON ROAD 1 & ROAD 2
- CUSTOM

UNIT switch

Selects the unit number of each CS-400 controller in a system

- U1 = Unit number 1
- U2 = Unit number 2
- U3 = Unit number 3
- U4 = Unit number 4

MODE Keypad

Selects the 4 main modes of operation

- VEHICLE SENSOR
- AUTO
- MANUAL
- FLASH YELLOW

SCREEN

This is a 40 column, 4 row text-only Liquid Crystal Display.
It is given basic protection by a panel of standard glass.

It is NOT a touch screen.

CONTROL Keypad

Used for numeric entry, time adjustments and MENU selection

Time Adjustments:

The Green times for each UNIT are adjusted by typing in the time (in seconds) then pressing the corresponding UNIT GREEN TIME button.

The RED CLEARANCE time(s) is set by typing in the time (in seconds) then pressing the U1 Red Time or U3 Red Time button for at least 3 seconds (or until the time on screen changes).

During normal operation, the RED CLEARANCE time is the minimum time the lantern head Red element stays on. Its purpose is to ensure traffic has enough time to clear the works area before the next flow of traffic is allowed.

The Green and Red times may also be changed through the MENU system.

CLEAR / MENU / YES Button

This button has 3 functions depending on the current operation:

CLEAR	Clears an incorrect data entry (use like a 'back space' key).
MENU	Press for 2 seconds to select the main menu.
YES	Answer YES to questions.

0 / HOME / NO Button

This button has 3 functions depending on the current operation:

0	Selects number 0
HOME	Closes the top-level MENU system and returns to the HOME screen
NO	Answer NO to questions

ENTER Button

Selects a chosen MENU option.

Additional information on the rotary switches (Configuration and Unit):

This is a rotary switch where the selection is indicated by the knob marker line. Each position has tactile feedback to indicate when it is correctly rotated.

Note:

Older models of controller had tactile positions between each of the marked positions. These are not recognised by the CS-400 and will generate an error if selected.

THE CONNECTOR PANEL

Contains the antenna socket and heavy-duty connectors for a power supply, lantern head(s), cable mode, cabled remote controller and vehicle detector sensor.

THE SIDE PANELS

Each side panel contains two M5 (5mm) integrated nuts for the convenience of securing to trailer hardware.

Note: - The maximum length of the mounting bolts must not exceed 25mm.

HOW TO UNDERSTAND THE SCREEN INFORMATION

This figure represents a 4 WAY configuration screen (shaded) and the case labelling adjacent to the screen:

	ROAD 1		ROAD 2	
RED	020 S	MODE : AUTO	040 S	RED
		COMMS : RX TX		
U1-G	035 S	UNIT 1 : 4 WAY R1R2	025 S	U3-G
U2-G	060 S	VOLTS : 13.1V	110 S	U4-G

The intersection it controls is represented by the following drawings and should be used to help understand the screen. It also shows the correct relative position for each controller for all configurations:

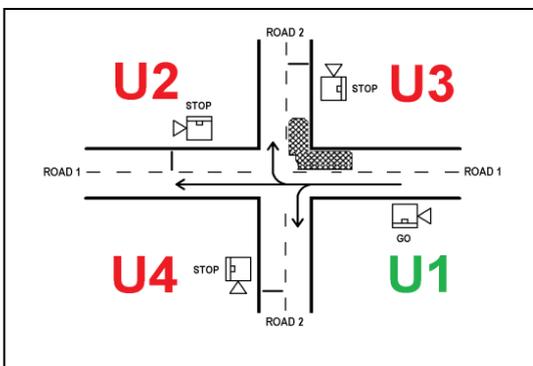


Diagram D1

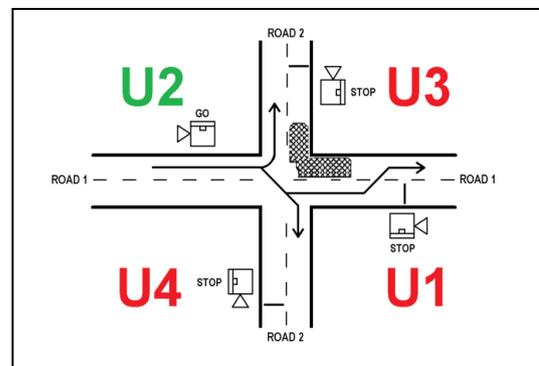


Diagram D2

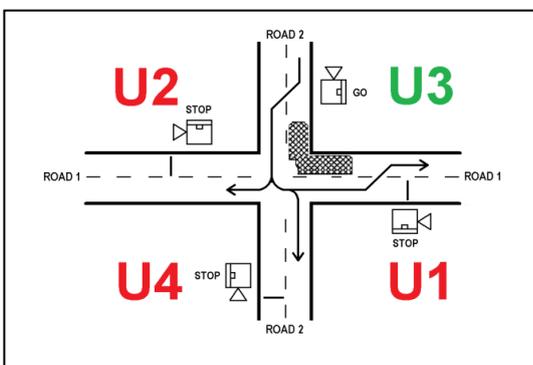


Diagram D3

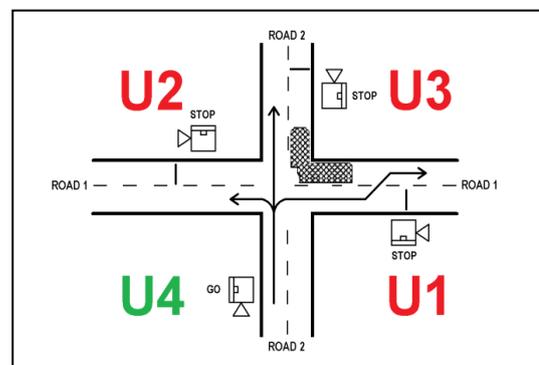


Diagram D4

Explanation:

- ROAD 1:** The times below ROAD 1 relate to Road 1
- ROAD 2:** The times below ROAD 2 relate to Road 2
- RED:** (Associated with ROAD 1). The RED CLEARANCE time for Road 1. This is the minimum time lanterns on Road 1 will remain in Red. It is the same in both directions. The example shows 20 seconds.
- RED:** (Associated with ROAD 2). The RED CLEARANCE time for Road 2. This is the minimum time lanterns on Road 2 will remain in Red. It is the same in both directions. The example shows 40 seconds.
- U1-G:** The Green time for traffic controlled by U1. The screen shows 35 seconds. Diagram 1 shows traffic movement direction along ROAD 1.
- U2-G:** The Green time for traffic controlled by U2. The screen shows 25 seconds. Diagram 2 shows traffic movement direction along ROAD 1.
- U3-G:** The Green time for traffic controlled by U3. The screen shows 60 seconds. Diagram 3 shows traffic movement direction along ROAD 2.
- U4-G:** The Green time for traffic controlled by U4. The screen shows 110 seconds. Diagram 4 shows traffic movement direction along ROAD 2.
- MODE** Current system MODE. The example shows AUTO (automatic). Other modes are MANUAL, FLASH YELLOW or VS (VEHICLE SENSOR)
- COMMS** (Communications) activity and link type.
When using the default Radio Frequency (RF) link, the screen shows: RX alternating with TX.
When using the optional wired link (cable between U1 and U2), 'CABLE' will appear after RX and TX.
'RX' and 'TX' indicate communications between controllers are being received and transmitted. Their appearance on screen may be together or separate.
- UNIT 1** Indicates that the controller is configured as UNIT 1
The text after 'UNIT 1' shows the configuration of the system.
The example shows 4 WAY (SHUTTLE) R1 & R2.
- VOLTS** The measured supply voltage at the power connector.
The example shows 13.1V.
This value is updated several times per second.

SYNCHRONISING

The digital radio technology used to link two CS-400 system devices requires the operator to 'program' each radio to only communicate with another CS-400 system-based device. The process of programming is called synchronising and is a simple, two-button-push action.

The programming involves U1, the host CS-400 controller, sharing its operator-defined configuration data with all other devices to be used in the system.

The process.

Bring together the needed number of CS-400 controllers to suit the requirements of the work site.

On each CS-400 required, use the CONFIGURATION switch to select the configuration required:

- SHUTTLE
- 2 WAY HAUL ROAD
- 3 WAY
- 3 WAY SHUTTLE ON ROAD 1
- 4 WAY
- 4 WAY SHUTTLE ON ROAD 1
- 4 WAY SHUTTLE ON ROAD 2
- 4 WAY SHUTTLE ON ROAD 1 & ROAD 2
- CUSTOM (SINGLE, DUAL LANTERN)

The CONFIGURATION switch must be on the same position for all controllers in the system.

On each controller, use the UNIT switch to ensure each CS-400 controller has a unique identity, starting with U1, then U2, etc.

Synchronising two or more CS-400 controllers.

Each controller can only be synchronised to U1.

The process should be done one controller at a time.

Synchronising can only be done in FLASH YELLOW mode.

In systems with 3 or 4 controllers, the order of synchronisation is not important.

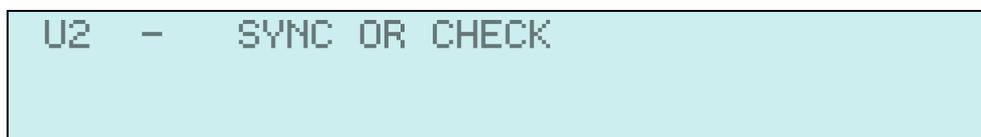
The following procedure refers to the SHUTTLE variant of a 2-way system.

The same process applies to synchronising with any configuration.

Where it is not important which of U2, U3 and/or U4 is being referred to, they are designated "Ux".

1. Ensure each controller has been configured the same and its UNIT number is unique.
2. Power on all controllers.

For SHUTTLE or 2 WAY (HAUL) configurations, U1's screen will show:



U2 - SYNC OR CHECK

For a 3 WAY configuration, U1's screen will show:

```

U2 - SYNC OR CHECK
U3 - SYNC OR CHECK
    
```

For a 4 WAY configuration, U1's screen will show:

```

U2 - SYNC OR CHECK
U3 - SYNC OR CHECK
U4 - SYNC OR CHECK
    
```

If not synchronised with U1's configuration, Ux will show:

```

                SYNC REQUIRED
    
```

If previously synchronised with U1 and while waiting for U1 to power up, Ux will show:

```

                WAITING FOR U1 OR RESYNC
    
```

3. Press the SYNC button *briefly* on U1.
The display indicates the system is in SYNC mode.

```

                SYNCING
PLEASE PRESS SYNC ON OTHER DEVICE
    
```

U1 will stay in this mode for 15 seconds or until the current synchronising process is successful.

4. Press the SYNC button on U2 *within 15 seconds of pressing U1's SYNC button*. When the sync' process has successfully finished, both U1 and U2 will show a similar display to the following:

```

050 S                MODE : FLASH YELLOW
                   COMMS : RX TX
040 S                UNIT 1 : SHUTTLE
040 S                VOLTS : 13.1V
    
```

Note: This would be the display for U1 ('UNIT 1').

This is the default 'HOME' screen.

MODES OF OPERATION

FLASH YELLOW

There are three ways the system enters this mode: -

1. When the CS-400 is turned ON
2. If a fault is detected
3. By pressing the FLASH YELLOW mode button

MANUAL

A handheld remote control can be connected to the system and is used to control all manual functions:



MC-400



CS-TRH4

The MC-400 is a wired device and may be connected to any CS-400 in a system. The default length of the cable is 25 metres. It can be extended to a maximum of 50 metres if required.

The CS-TRH4 is a wireless device and connects to U1 in a system.

AUTO

In this mode, preset timers are used to regulate RED and GREEN times. All times are shown on the display and are automatically stored in memory when the system is turned off.

VEHICLE SENSOR

This mode uses vehicle detectors in conjunction with preset timers to control traffic. When a moving vehicle is detected a demand is stored, shown on the display and then used to control traffic flow. See more details on next page.

Toggleing between MODES

If the system is in FLASH YELLOW mode when the AUTO button is pressed, all Units will go Red and traffic will be controlled in accordance with the preset times.

If the system is in MANUAL or VEHICLE SENSOR modes when the AUTO button is pressed, the current Unit will complete its minimum Green timing if it was in Green, then go Red. At the end of the RED CLEARANCE time, the system transfers to AUTO mode and traffic will be controlled in accordance with the preset times.

VEHICLE SENSOR operation

Vehicle sensors must be plugged into the CS-400 for every controller to be used in a system.

For example, if there are 3 controllers and only 2 sensors, the system will not enter VEHICLE SENSOR MODE.

When VEHICLE SENSOR MODE is selected, each controller reports to U1 whether it has a sensor attached. (The controller does not know if the sensor is faulty, only that it is present.)

If a sensor is not seen on a controller where it is expected, U1 reports the following:

```
***** WARNING *****
NOT ALL VEHICLE SENSORS ATTACHED
U1 [Y] U2 [Y] U3 [N] U4 [Y]
```

The system will then return to the MODE it was in before the VEHICLE SENSOR MODE attempt.

Notes:

This screen adjusts to suit the number of controllers in the system and shows which controller(s) did not detect a sensor.

In the above four-controller example, U3's detector is not seen as connected to U3.

Operation

When the VEHICLE SENSOR MODE button is first pressed, the system automatically registers an artificial demand for all controllers including RED CLEARANCE time.

Once this cycle has completed, all lanterns will go Red, wait for the RED CLEARANCE time to expire then wait for any sensor to trigger a Green time.

Notes:

In normal operation, all directions of a ROAD are Red if no vehicles are detected.

When a lantern goes Red, the RED CLEARANCE time must expire before any lantern goes Green. The GREEN EXTension time is the maximum allowable time between vehicle detections (ie: vehicle gap) in one direction, ranging from 3 to 6 seconds. Once exceeded, this direction of traffic goes Red.

Scenario 1. Light traffic in either direction.

As soon as a vehicle is detected in direction 'A', the corresponding lantern goes Green allowing the detected vehicle to proceed.

If no further vehicles are detected within the GREEN EXTension time, the lantern goes Red.

Scenario 2. Continuous traffic mainly in one direction.

Green Time = 50 seconds (all ROADS), GREEN EXTension time = 6 seconds.

Direction 'A' traffic is detected and goes Green. No traffic is detected, initially, in Direction 'B'. Vehicles are continuously detected in direction 'A' causing the GREEN EXTension timer to not expire so Direction 'A' remains Green.

Direction 'B' detects a vehicle.

Direction 'A' continues to be Green for a further 50 seconds.
 Direction 'A' then returns to Red.

After the RED CLEARANCE time expires, direction 'B' goes Green.

Scenario 1 or 2, above, then re-applies.

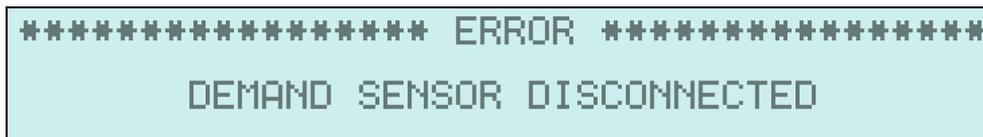
Notes:

The type of vehicle sensor used may detect movement only. It is therefore possible for a vehicle to be waiting and not have been detected. If this is deemed to be a problem, the sensor can be modified to produce a pulse every 2.5 minutes. Contact supplier for details.

Systems are supplied with detectors operating on a frequency of 10.525 GHz which do not require an individual licence.

Check at least once a year that frequencies and licences are still valid as some units will require calibration.

During VEHICLE SENSOR MODE, if a sensor is manually unplugged or a fault develops in the sensor such that the CS-400 fails to see it as connected, the following error appears on the relevant CS-400:



Pressing CLEAR will remove the error.
 The HOME screen is shown.

SETTING TIMES

GREEN

Green times are entered on the CONTROL keypad and assigned to the appropriate times using the UNIT GREEN TIME key.

To set GREEN times, enter the time (in seconds) then press the required UNIT GREEN TIME button.

Example: Enter a time of 35 seconds for U2.

In FLASH YELLOW mode, type '35' and press the  button.

The screen will show '035' next to 'U2-G'.

Notes:

Green times may be entered with an odd or even value.

**If an incorrect time is entered, the CS-400 will prompt the operator with the available range.
(CLEAR button acts as a back space)**

RED CLEARANCE

There are two ways to enter RED CLEARANCE times.

1. From the HOME screen:

Press the FLASH YELLOW key

Type in the time in seconds

Press and hold the  key for ROAD 1 or the  key for ROAD 2 until the time

on the screen under the respective ROAD label changes to the time entered.

This time is typically around 3 seconds.

Example: Enter a time of 20 seconds for ROAD 2:

Press the following keys: FLASH YELLOW, 1, 5,  key until the ROAD 2 RED time changes to '020'.

2. From the MENU system:

Press the FLASH YELLOW key
Press the MENU key for 2 seconds
Select 1 RED CLEARANCE TIME
Select 1 ROAD-1 RED CLEARANCE

or

2 ROAD-2 RED CLEARANCE

Type in the time in seconds (within the permitted range) and press ENTER.

Example: To enter a time of 50 seconds for ROAD 2:

Press the following keys: FLASH YELLOW, MENU (for 2 seconds) 1, 2, 5, 0, ENTER.

Press HOME to return to the HOME screen.

Notes:

If the entered time is outside of the permitted range, an error message will appear prompting the operator to press a key which will then take them back to the prior screen.

If ROAD 2 is not in use for the current configuration:

The Red ROAD 2 time will not be shown on the screen.

Any valid entry to the Red ROAD 2 time will be accepted but not stored in memory.

Red times may only be entered with an even value. They will be rounded down if an odd number is entered.

OPTIONS

MC-400

The MC-400 is wired remote control.

Note: The MC-400 can only be used in SHUTTLE, 2 WAY HAUL ROAD & CUSTOM configurations.

The MC-400 does not require synchronising before use, it is recognised immediately it is plugged in to a CS-400.

Where only one MC-400 is in use, it may be connected to either U1 or U2.

The system will also accept a MC-400 connected to both U1 and U2.

The MC-400 has three buttons: one Red (STOP) and two Green (one each for U1 and U2) and three status LEDs for each of U1 and U2 represent U1 and U2's lantern heads:



If the system is currently in a RED CLEARANCE time, the Red status LEDs on the MC-400 will flash.

This indicates to the operator that a Green phase will follow the RED CLEARANCE time.

Note: Only the Red status LEDs on the MC-400 will flash, not the lantern head Red element on the trailer.

If the system is in FLASH YELLOW mode and the STOP button is pressed, the system will immediately go Red.

If the system is in FLASH YELLOW mode and a GREEN button is pressed, the system immediately goes Red and enters the RED CLEARANCE time. When this expires, the selected (U1 or U2) controller will go Green.

If the system is Green, pressing the STOP button will immediately terminate the system's Green phase. The lanterns will go Yellow then Red. U1 and U2 will remain Red until either GREEN button is pressed.

If the system is U1-Green and the U2-Green button is pressed, the system will:
immediately go Red if the U1-Green time has expired; or
remain on U1-Green until its time expires.

Then, while on Red, the Red status LEDs will flash indicating a Green phase will follow the RED CLEARANCE time.

The process is the same if the system is U2-Green and the U1-Green button is pressed.

CS-TRH4

The CS-TRH4 ('TRH4') wireless remote control provides a versatile way of controlling all configurations.

A TRH4 may be synchronised at any time while in FLASH YELLOW mode.

Turn the TRH4 on. If it has not been synchronised to the current configuration, only a single Red LED will be flashing evenly ON and OFF. This is the U1 position indicator. If the LED is not flashing, the battery may be discharged.

This LED will continue to flash until either:

- (a) the TRH-4 automatically shuts down after 5 minutes; or
- (b) the SYNC button is pushed.

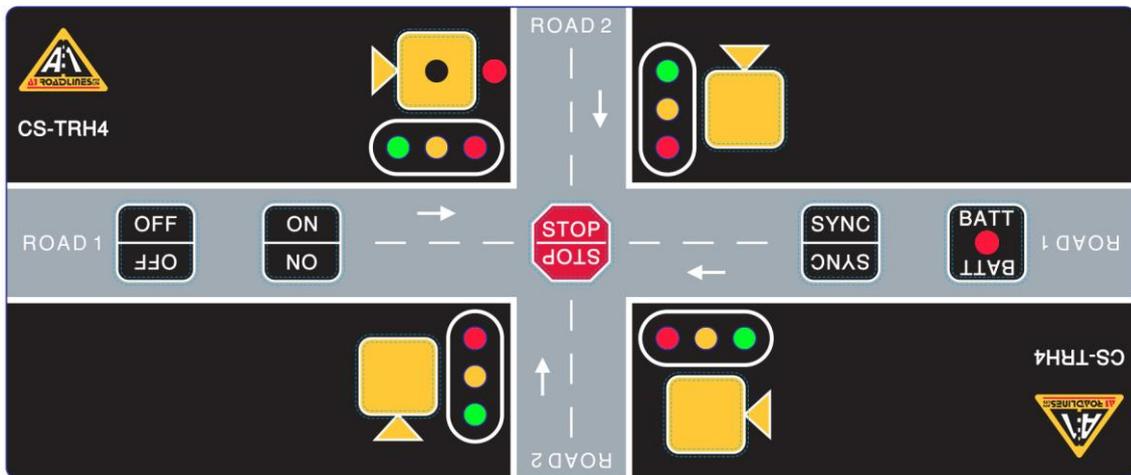
Synchronising the TRH4 to U1

Ensure U1 is in FLASH YELLOW mode

On the TRH4, connect the antenna and press the ON button.

Press SYNC *briefly* on U1

Press SYNC on the TRH4



All GREEN LED's will flash indicating that the remote is in SYNC mode. Within a few seconds of successfully synchronising to U1, it will echo the status of U1.

The number of controllers in the system is reflected by the number of Yellow status LEDs flashing. For example, in a SHUTTLE configuration, the only status LEDs flashing will be those on 'ROAD 1'. For example, in a 3 WAY configuration, there will be three status LEDs flashing.

There is no limit to the number of TRH4 remotes synchronised to a system.

Note: The TRH4 can be used in any configuration.

There are eight buttons on the TRH4:

- OFF: Manually turns OFF the device.
(It will also turn off automatically if no button is pressed for 5 minutes.)
- ON: Turns ON the device.
- STOP: Forces the system to Red.
- SYNC: Synchronises the device to U1.

The remaining four are 'Go Green' buttons for each of U1, U2, U3 and U4, as per the intersection simulation, Diagram D1 on page 11.

There are 13 status LEDs, 3 for each controller (Red, Yellow, Green) and 1 U1 indicator LED.

U1 indicator.

If this LED is not flashing when powered-on, the batteries may require charging.

The simulated road intersection on the TRH4 button panel assists the operator in controlling the traffic on the correct road.

In real-life, U1 identifies itself with a fixed light on the top of the lantern head. While this light exists for U2, U3 and U4, only U1's light will be ON.

After ensuring all controllers are correctly located on the intersection, the operator orients the TRH4 so the U1 symbol  echoes the location of U1, relative to the operator's position.

This will assist in selecting the correct traffic signal for control

Note: On the TRH4, if the U1 indicator LED is the only LED visible, the TRH4 has lost comm's (or has not been synchronised) with U1.

Green control.

The 'Go Green' buttons control which controller goes Green.
Ensure the TRH4 is powered on and the antenna is connected before pressing a 'Go Green' button. (Check for status LEDs.)

If the system is in FLASH YELLOW mode and a 'Go Green' button is pressed, the system will go Red and commence the RED CLEARANCE time. The Red status LEDs will flash.

Note: The Red element of the lantern heads will not be flashing.

If the system is in a STOP condition and a 'Go Green' button is pressed, the RED CLEARANCE time must expire before the corresponding controller goes Green.
During the RED CLEARANCE time, the Red status LEDs will flash.

If the system is in a Green condition and a different 'Go Green' button is pressed, minimum GREEN TIME will expire first, then yellow, then the RED CLEARANCE time will occur.
Once this expires, the requested controller's lantern head will go Green.

STOP control.

Ensure the TRH4 is powered on and the antenna is connected before pressing the STOP button. (Check for status LEDs.)

If the STOP button is pressed, the system will immediately go Yellow, then Red. This occurs whether the controller is in FLASH YELLOW mode or Green.

If the CS-400 is in VEHICLE SENSOR or AUTO mode when MANUAL mode is selected, all demands are cancelled and both Units go RED and stay RED until a GREEN request is received.

Then, by pressing the corresponding 'go green' button: the desired line of road users.



the operator can select

End panel.



The internal batteries are charged by inserting the correct charger plug in to the end panel 'POWER' socket. During this time, the charge LED will turn ON. The LED turns OFF when batteries are fully charged.

Depending on discharge of the batteries, time to charge will vary between minutes to hours.

With typical use, the operator should get 7 day's work from the TRH4 before a recharge is required.

Count Down Timer

The Count Down Timer (CDT) is a useful addition to most configurations to inform the road user how long before the traffic signal they are stopped at will remain Red.

The CDT is only functional in AUTO mode.
It has a display range of 3 to 1999 seconds.

Each CDT must be associated with the Unit number of the CS400 it is connected to.



Synchronising the CDT to U1

1. Ensure the CDT is securely plugged into the Vehicle Sensor socket at the top of the lantern head and the Vehicle Sensor plug is securely plugged into the Vehicle Sensor socket on the front of the CS400.
2. When the connected CS400 is powered on, the CDT will perform a full LED test which lasts about 5 seconds.

Leave the CS-400 in FLASH YELLOW mode.

3. Press the SYNC button on the side of the CDT (see highlight in above image) and within 15 seconds, *briefly* press the SYNC button on U1.

Although associations refer to U2, U3 & U4, all synchronisation is done using U1. The CDT digits will alternate between 'Ξ – Ξ' and '– Ξ –' while the synchronising process occurs.

4. When a link has been established the CDT shows 'U – Ξ' and U1's screen will show:

```

SELECT UNIT TO ASSOCIATE THE CDT TO
  1 - U1                      2 - U2
CLEAR TO CLEAR          ENTER TO ACCEPT

```

The CS-400 is now requesting which CS-400 controller this CDT is to be associated with.

Note: The choices are: 2 WAY = U1 or U2; 3 WAY = U1, U2 or U3; 4 WAY = U1, U2, U3 or U4.

5. Press '1' and the CDT will immediately update and show 'U - 1'. Press '2' and the CDT will immediately update and show 'U - 2', etc.
6. Press 'ENTER' to create the association. U1 will return to the HOME screen. The CDT will continue to show 'U - x', where x is the Unit number selected.

Note: Pressing 'CLEAR' before 'ENTER' will delete the association.

7. Repeat from step 3 until all required CDTs are associated.

Note: The operator may choose not to utilise a specific CDT in a system. They should either unplug the CDT or clear the association. In AUTO mode, the CDT display will remain blank.

As soon as AUTO mode is selected, the CDTs commence their count down sequence.

Leading zeroes are included in the sequence.

For safety reasons, the display is turned off when the count down value is less than 3 seconds.

If MANUAL mode is selected, the CDTs are blanked.

Disabling all CDTs:

The CDTs can be disabled/ enabled through the MENU system. (Lantern Times > Allow CDT?) If NO is selected, all CDTs will immediately show 'OFF'.

While in FLASH YELLOW mode, the CDTs will show 'OFF'. This is a prompt for the operator they are disabled.

The CDTs will now blank in any mode, except FLASH YELLOW.

Notes:

CDTs can only be used in AUTO mode.

This is the only mode where the system can calculate when Lantern X will go Green.

On power-on, the CDT may now show 'U - ☐' or 'c c c'.

If 'U - ☐', then it has already been synchronised with the CS400 system, but its association has been cleared. To use, the association must be programmed.

If 'c c c', the CDT has a communications issue with U1. Re-try synchronisation and association.

Repeater

A REPEATER is used where clear line of sight is not possible. This may arise when road works are carried out in hilly terrain or where the road curves around the side of a hill.

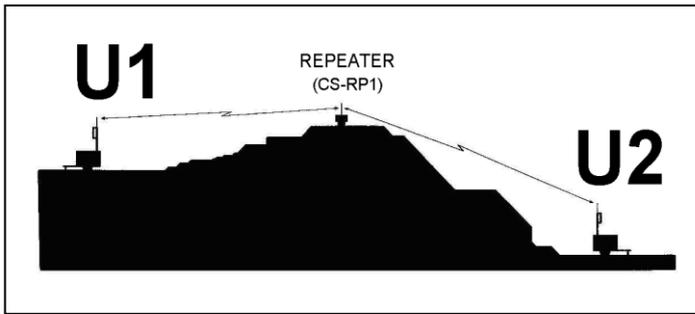


Diagram D6.1

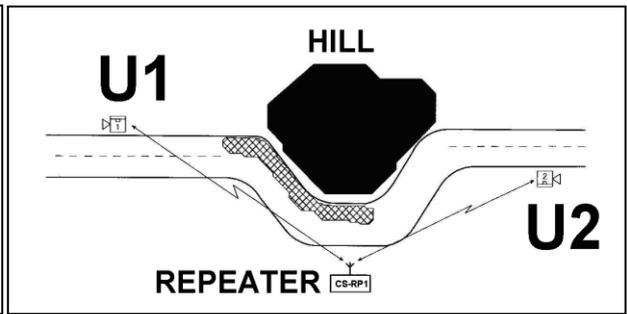


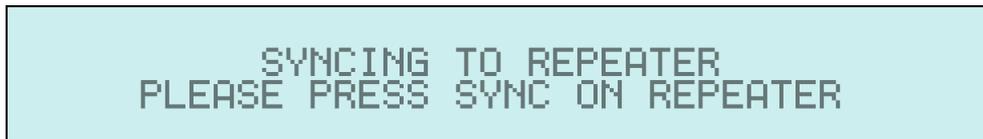
Diagram D6.2

To install in a Shuttle system:

1. Obtain two CS-400 controllers, one CS-RP1 REPEATER and any TRH4 radio remotes if they are to be used.
2. Select SHUTTLE configuration on U1 and U2 and synchronise CS-400s controllers.
3. Synchronise any TRH4 remotes.

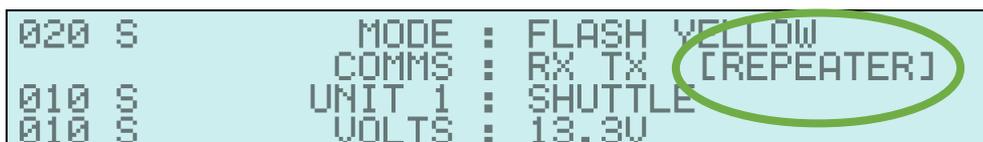
Synchronising the CS-RP1 to U1

4. Press and hold the SYNC button on U1 for 5 seconds or until the screen shows:



5. Within 10 seconds, briefly press the SYNC button on the REPEATER.

When synchronised, the HOME screen on U1 will show the word 'REPEATER':



This shows U1 and U2 are communicating via the REPEATER.

On the REPEATER, after power-on, there are several initialisation screens.

After successfully connecting with U1 and U2, the HOME screen will show:



```
U1 [OK]                                U2 [OK]
                                     COMMS : RX TX
                                     VOLTS : 13.20
```

This shows U1 and U2 are being received (OK), the REPEATER is receiving (RX) and transmitting (TX) data. The detected supply voltage is 13.2V.

If the REPEATER loses either U1 or U2, the 'OK' is replaced with 'BAD'. There is about 15 seconds delay between loss of Ux and the REPEATER reporting 'BAD'.

When the REPEATER re-connects with U1 or U2, it immediately reports 'OK'.

Placement of controllers

Position the REPEATER at the top of the hill or on the corner of a bend so that both U1 and U2 have clear line of site of the REPEATER.

Position U1 and U2 at either end of the road works as per Diagrams D6.1 and D6.2 on page 26.

All modes are available in this configuration:

- Flash Yellow
- Manual
- Auto
- Vehicle Sensor

The system can be controlled from either U1 or U2.

Notes:

A REPEATER can only be added to a 2 WAY configuration (SHUTTLE or 2 WAY HAUL ROAD).

Only ONE repeater can be added to a system.

All desired devices (U2 / TRH4 / CDT) must be synchronised to U1 before the REPEATER is synchronised to U1.

If this same U1 and U2 are required to be used at another site not requiring a Repeater it should be treated as a new intersection and the synchronising started again.

When a Repeater is used in a system, it becomes a virtual "U1", taking control of the system. Therefore, if a TRH4 has been synchronised to the system, it must be within 1000m of the Repeater rather than U1.

Cable connection

Also known as 'cable mode', this option is designed for use where the physical environment makes it unsuitable to use the normal radio link between two CS-400 controllers.

It can only be used with SHUTTLE or 2 WAY HAUL ROAD configuration.

Process:

Place the controllers in the desired location allowing for the length of the cable.

Power off both controllers.

Connect them using the linking cable.

Power on both controllers.

They will automatically begin communicating with each other.

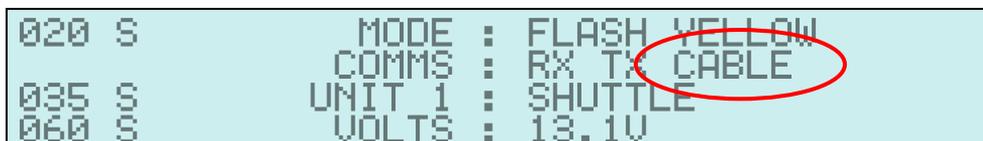
Notes:

It is not possible to use a TRH4 wireless remote control when a linking cable is in use.

A wired link can only be used in SHUTTLE or 2-WAY configuration.

There is no synchronisation required for a cable connection.

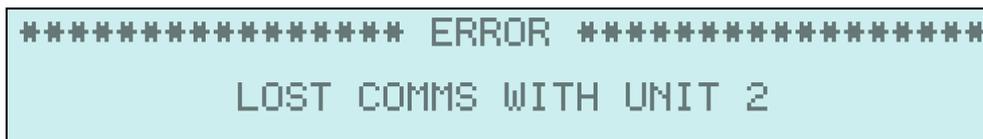
Both U1 and U2's screen will show 'CABLE' after 'RX TX', indicating a successful link between U1 and U2:



If the cable is removed from U1, the following is immediately shown on U1's screen:



If the cable remains unplugged for more than 5 seconds, U1's screen will show the error:



Similar error messages will appear if the cable is removed from U2.

CONFIGURATION

SHUTTLE

In SHUTTLE configuration, traffic flow is alternated from each direction through a single, bi-directional lane. Traffic from one direction must stop while the traffic from the opposite direction is permitted to use the lane for a set period of time and then they swap.

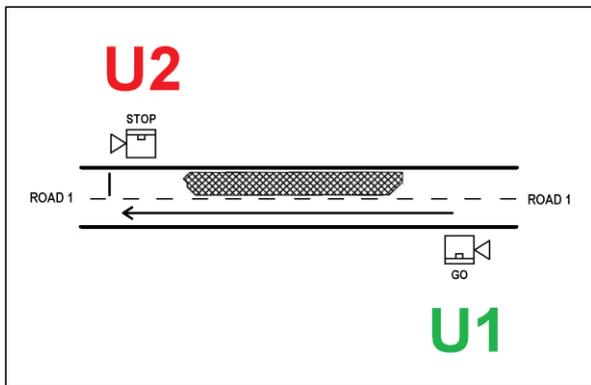


Diagram D1.1

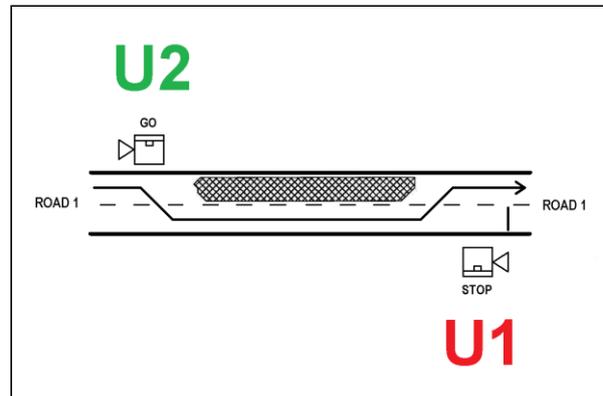


Diagram D1.2

To configure:

1. Bring together two CS-400 controllers.
2. With their power off, set each controller's CONFIGURATION switch to SHUTTLE.
3. Ensure one controller is set to U1, the other to U2.
4. Turn both controllers on.
5. Synchronise the controllers. When this is complete, U1's screen shows:

```

050 S      MODE : FLASH YELLOW
           COMMS : RX TX
040 S      UNIT 1 : SHUTTLE
040 S      VOLTS : 13.1V
    
```

6. Power off the controllers.
7. Place the controllers at the work site as per Diagram D1.1
8. Power on the controllers. They will connect and show the HOME screen.

Notes:

VEHICLE SENSOR, AUTO, MANUAL and FLASH YELLOW modes are all available
Control of the system is possible from either U1 or U2.
A REPEATER can be used in this mode.
CS-TRH4 wireless remote can be used.
CS-MC400 wired remotes can be used.

2 WAY – HAUL ROAD (Vehicle access)

Note: This Configuration can ONLY be operated in MANUAL mode

In 2 WAY HAUL ROAD configuration, both directions of traffic are stopped at the same time and both are allowed to move at the same time.

The lanterns at either end follow the same control sequence.

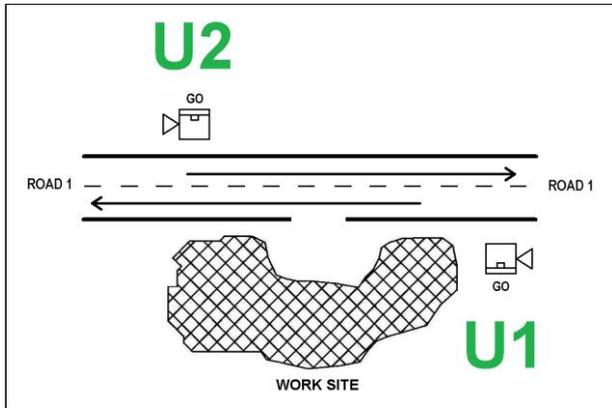


Diagram D2.1

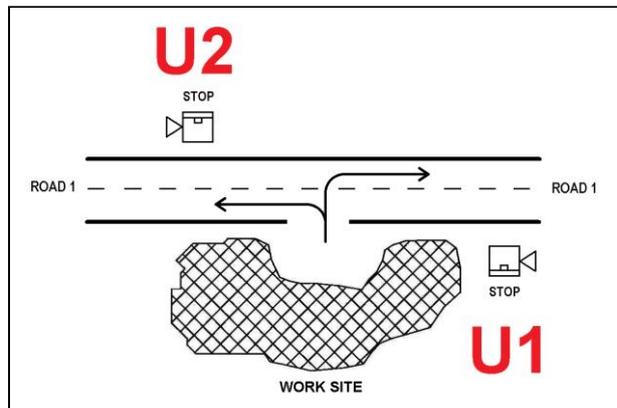


Diagram D2.2

To configure:

1. Obtain two CS-400 controllers.
2. With their power off, set each controller's CONFIGURATION switch to 2 WAY.
3. Select controller Unit identity:
 - Select U1 for the first controller
 - Select U2 for the second controller
4. Turn both controllers on
5. Synchronise the controllers
6. Once synchronising is complete, the screen will show the following:



7. Turn the controllers off
8. Place the controllers at either side of the road works as per Diagram D2.1
9. Power on the controllers
10. The screen shown at step 6 will re-appear. Select YES to confirm

The operator is taken to the HOME screen:

```
050 S      MODE : FLASH YELLOW
           COMMS : RX TX
           UNIT 1 : 2 WAY (HAUL)
           VOLTS : 13.1V
```

If NO is selected, the following screen appears:

```
***** ERROR *****
          TURN OFF AND CHANGE CONFIG
```

The operator should now power-cycle the controller and either select YES to the prompt at step 10 or select a different configuration for the system.

Notes:

'Re-start' means to power OFF the controller, wait a few seconds then power ON the controller.

Any CS-TRH4 wireless remote controllers must be synchronised to U1 before selecting the only possible mode, MANUAL.

One or two MC-400 wired remote controls may be used. Where only one is used, it may be attached to either U1 or U2.

Once remote controllers are synchronised and/or connected into the system, MANUAL mode can be selected.

The system is now under operator control.

Any attempt to operate in AUTO or VEHICLE SENSOR modes will generate one of the following error messages:

```
***** WARNING *****
          AUTO MODE NOT ALLOWED
```

```
***** WARNING *****
          VEHICLE SENSOR MODE NOT ALLOWED
```

3 WAY (T - Intersection)

There are 2 configurations available for 3 WAY: 3 WAY and 3 WAY (SHUTTLE R1).
The configuration procedure is the same for both.

3 WAY (standard)

The standard 3 WAY configuration alternates traffic flow between Road 1 and Road 2.
Road 1 is Green in both directions while Road 2 is Red.
Road 1 goes Red, then Road 2 goes Green.

The sequence repeats.

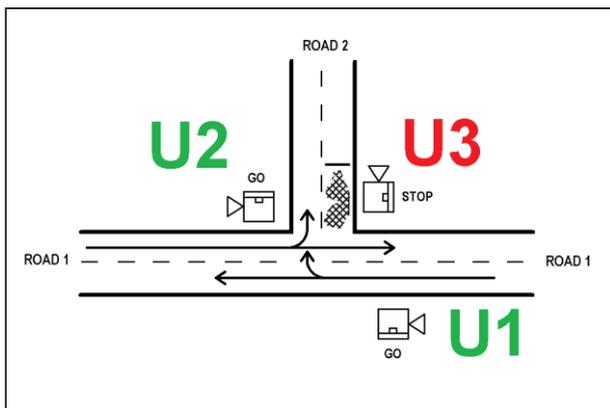


Diagram D3.1

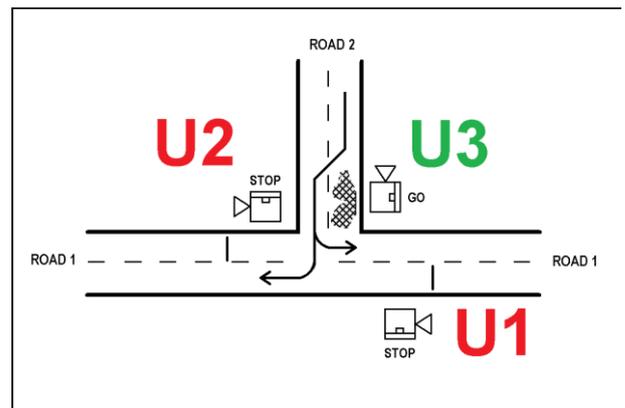


Diagram D3.2

3 WAY (SHUTTLE R1)

The 3 WAY (SHUTTLE R1) configuration allows traffic to flow in one direction only ('shuttled') along Road 1 with the direction alternating. Traffic on Road 2 is Red. This is followed by Road 2 being Green while both directions of Road 1 are Red.

The sequence repeats.

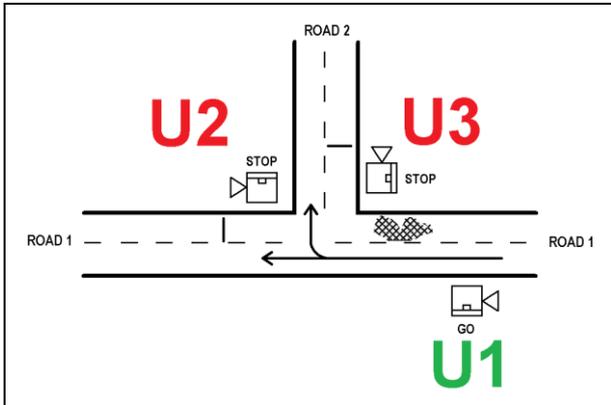


Diagram D3.3

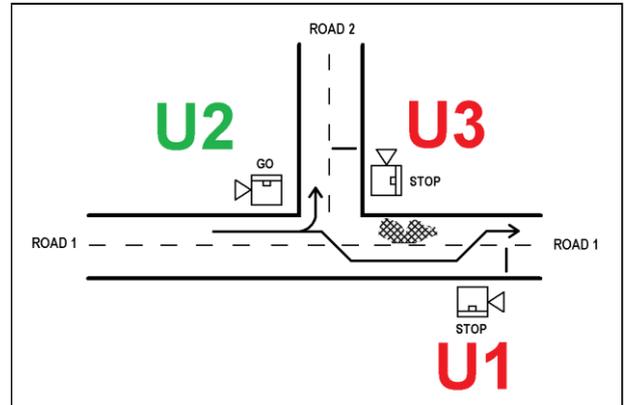


Diagram D3.4

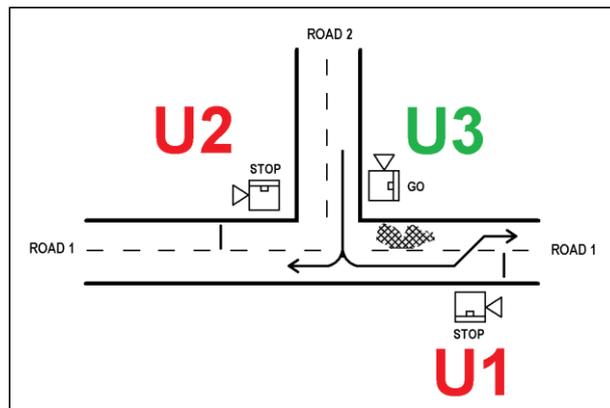
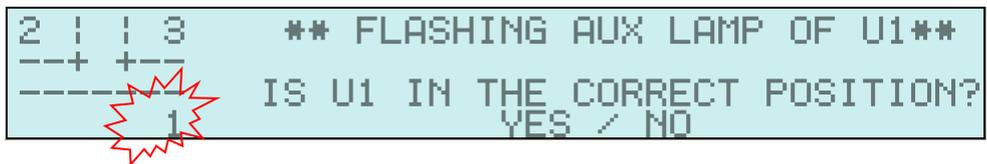


Diagram D3.5

To configure:

1. Obtain three CS-400 controllers.
2. With their power off, set each controller's CONFIGURATION switch to:
3 WAY or
3-WAY (\$HUTTLE R1)
(Ensure it is the same on each controller.)
3. Select U1 for the first controller
Select U2 for the second controller
Select U3 for the third controller
4. Turn all controllers on.
5. Synchronise the controllers.
6. Once synchronising is complete, the screen on U1 will show the following:



This is a prompt to the operator to confirm that each controller is correctly located on the intersection, as represented by the simulated intersection on the left side of the screen.

7. Power off all controllers
8. Place controllers as per diagram D3.1
9. Power on all controllers
U1 will again show the screen as per step 6., above.

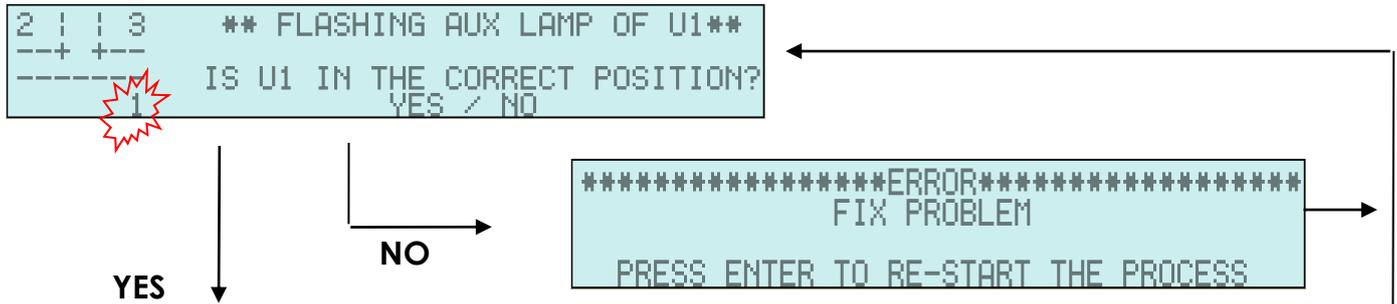
Until the above screen is confirmed, the following screen will appear on U2 and U3:



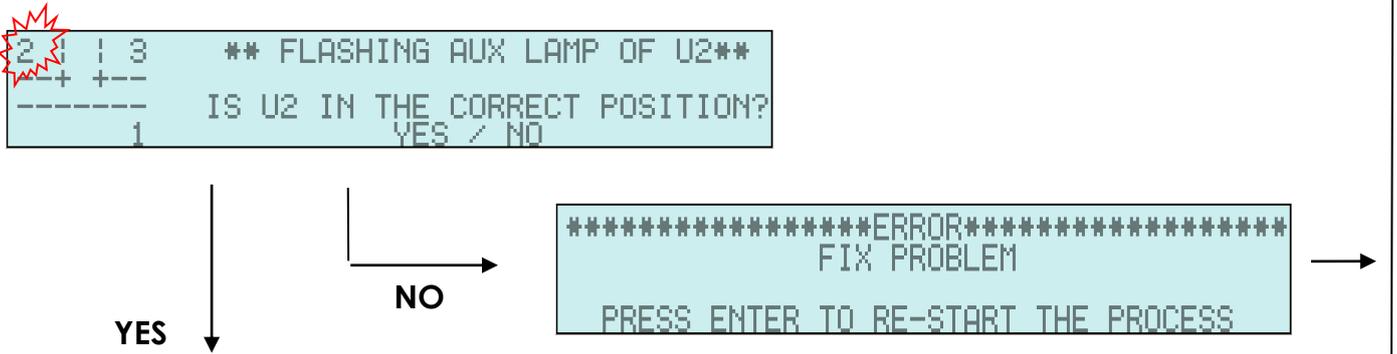
This directs the operator to go to U1 to confirm the setup.

The operator must now answer a series of questions to make sure all controllers are in the correct position **BEFORE** traffic control is enabled. Please refer to the following page for full example.

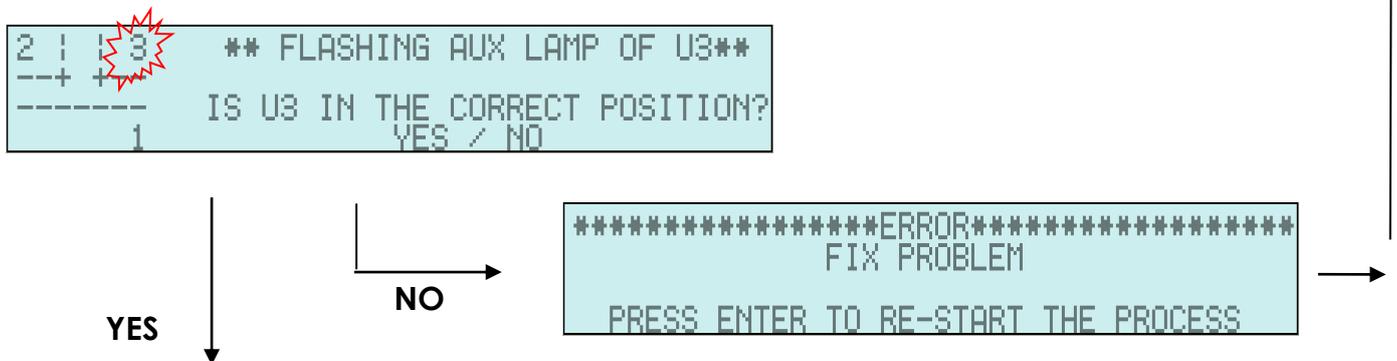
The AUX lamp will begin flashing *only* on U1 and the '1' digit in the simulated intersection on the left side of the screen will begin flashing:



If YES is pressed, the AUX lamp will begin flashing *only* on U2 and the '2' digit in the simulated intersection on the screen will begin flashing:



If YES is pressed, the AUX lamp will begin flashing *only* on U3 and the '3' digit in the simulated intersection on the screen will begin flashing:



When you have answered YES to all 3 questions (without a 'NO'), the following HOME screen will appear:

```

045 S      MODE : FLASH YELLOW    045 S
          COMMS : RX TX
035 S      UNIT 1 : 3 WAY          035 S
035 S      VOLTS : 13.1V
  
```

Notes:

VEHICLE SENSOR, AUTO, MANUAL and FLASH YELLOW modes are all available
MANUAL mode is ONLY available with the use of a CS-TRH4 wireless remote.

4 WAY

There are four configurations available for roadworks at a four way intersection. The configuration procedure is the same for all four.

- 4 WAY
- 4 WAY – SHUTTLE R1
- 4 WAY – SHUTTLE R2
- 4 WAY – SHUTTLE R1 & R2

4 WAY (standard)

The standard 4 WAY configuration alternates traffic flow between Road 1 and Road 2. Traffic is allowed to flow in both directions in each case.

The sequence repeats.

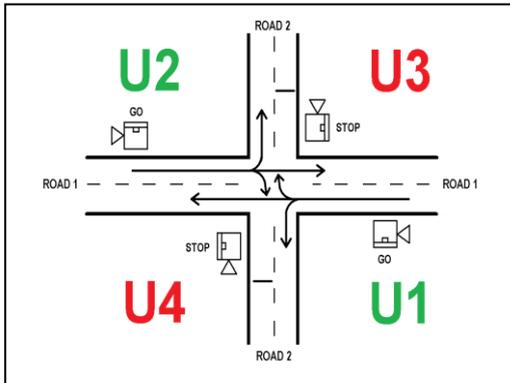


Diagram D4.1

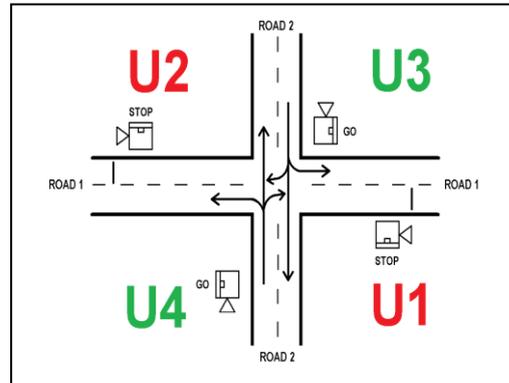


Diagram D4.2

4 WAY (SHUTTLE R1)

In 4 WAY (SHUTTLE R1) configuration, traffic is allowed to flow in one direction only ('shuttled') along Road 1 with the direction alternating. Traffic on Road 2 is Red. Then, Road 1 goes Red in both directions and Road 2 is Green in both directions. The sequence repeats.

The sequence repeats.

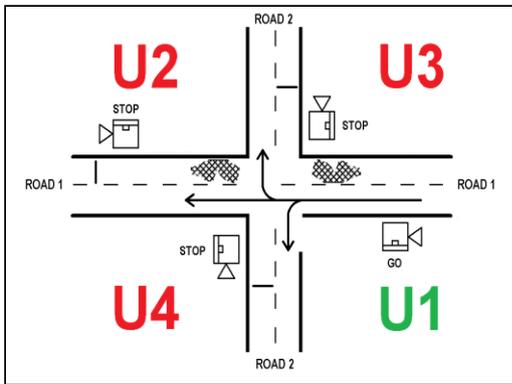


Diagram D4.3

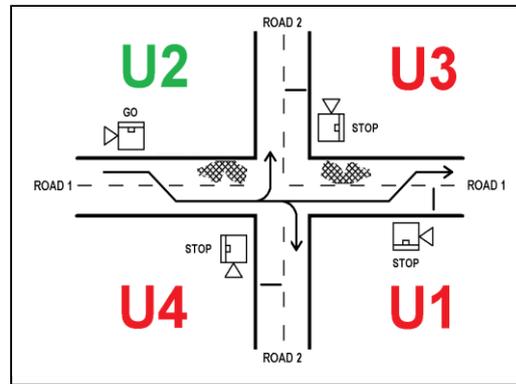


Diagram D4.4

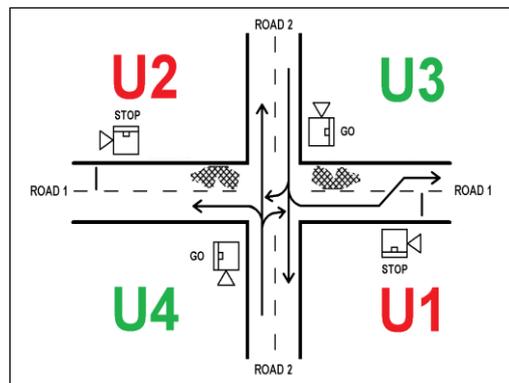


Diagram D4.5

4 WAY (SHUTTLE R2)

4 WAY (SHUTTLE R2) configuration is similar to 4 WAY (SHUTTLE R1).

Road 1 has traffic flow in both directions while Road 2 is Red.

Then, Road 1 goes Red and Road 2 flows in one direction only ('shuttled') with the direction alternating.

The sequence repeats.

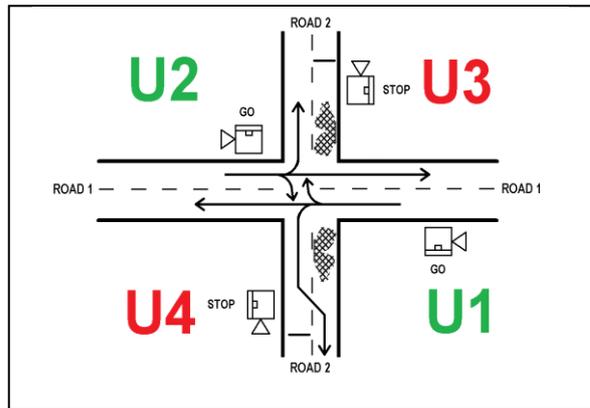


Diagram D4.6

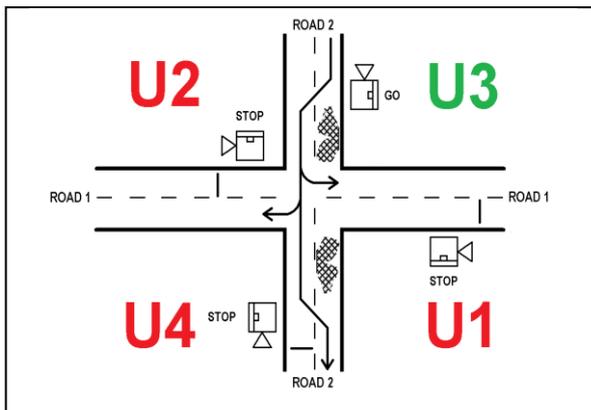


Diagram D4.7

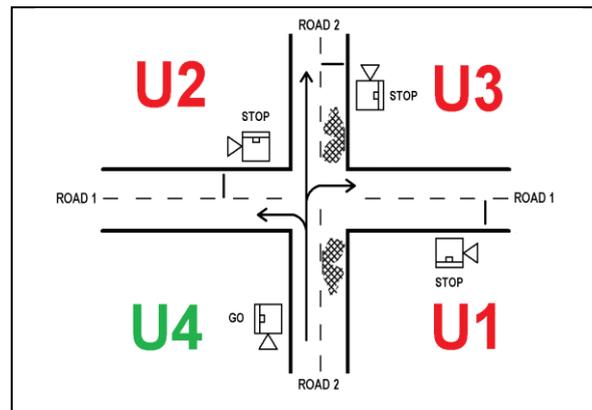


Diagram D4.8

4 WAY (SHUTTLE R1 & R2)

This configuration allows traffic to flow in one direction only along each road alternating in direction, sequentially:

Road 1 in one direction goes Green while the other direction is Red. Road 2 is Red in both directions.

Road 1 in this direction then goes Red, while the other direction goes Green.

Road 1 in this direction then goes Red.

Then, Road 2 goes Green in one direction while the other direction is Red. Road 1 is Red in both directions.

Road 2 in this direction then goes Red, while the other direction goes Green.

Road 2 in this direction then goes Red.

The sequence repeats.

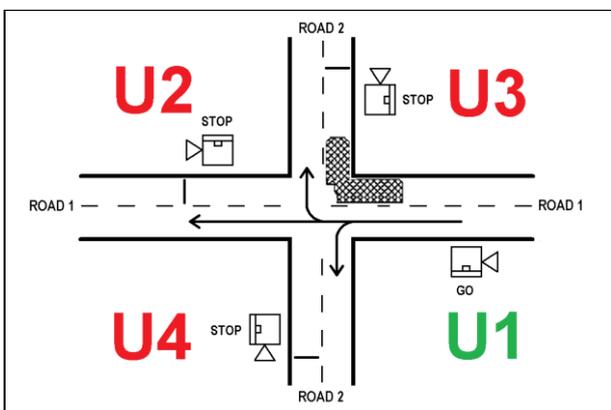


Diagram D4.9

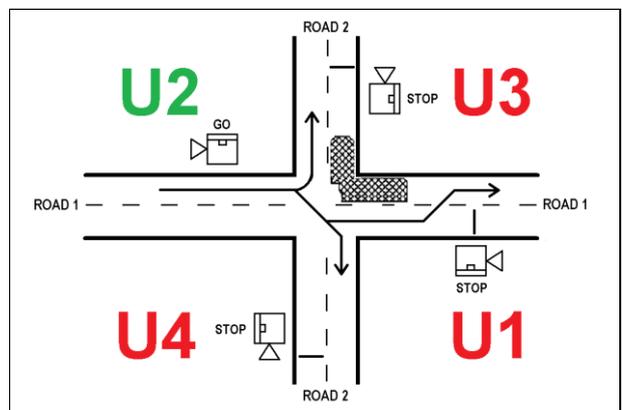


Diagram D4.10

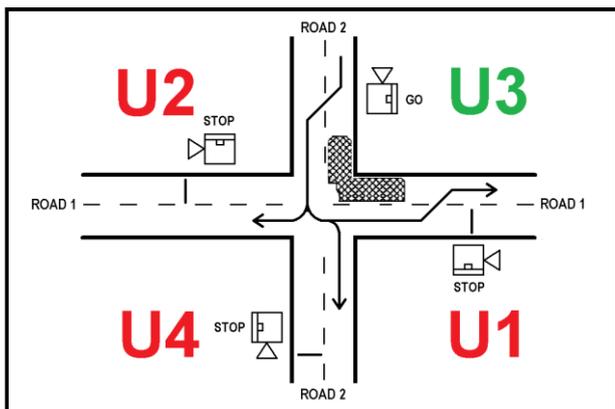


Diagram D4.11

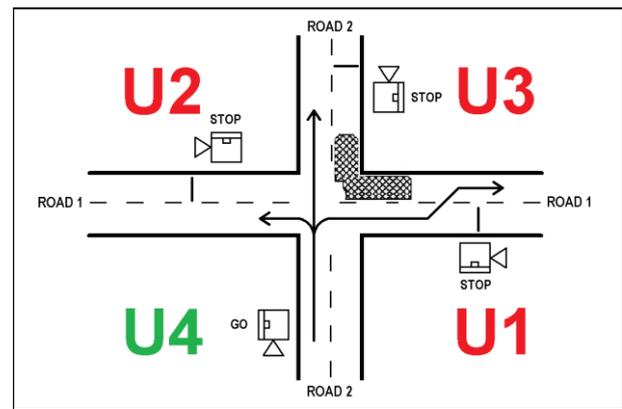
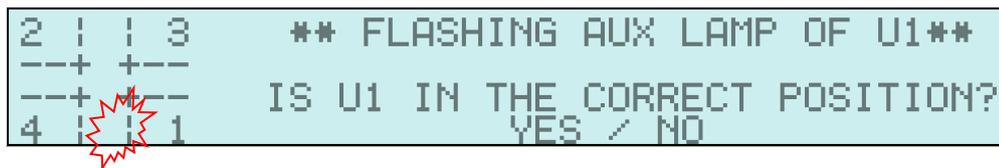


Diagram D4.12

To configure:

1. Obtain four CS-400 controllers.
2. With their power off, set each controller's CONFIGURATION switch to:
4 WAY or
4 WAY (SHUTTLE R1) or
4 WAY (SHUTTLE R2) or
4 WAY (SHUTTLE R1 & R2)
(Ensure it is the same on each controller)
3. Select U1 for the first controller;
Select U2 for the second controller;
Select U3 for the third controller;
Select U4 for the fourth controller.
4. Turn all controllers on.
5. Synchronise the controllers.
6. Once synchronising is complete, the screen on U1 will show the following:



```

2 | | 3      ** FLASHING AUX LAMP OF U1**
---+ +---
---+ +---    IS U1 IN THE CORRECT POSITION?
4 | | 1      YES / NO
  
```

7. Power off all controllers.
8. Place controllers as per diagram D4.1
9. Power on all controllers
U1 will again show the screen as per step 6., above.

Until the above screen is confirmed, the following screen will appear on U2, U3 and U4:



```

GO TO UNIT 1
FOR SETUP
  
```

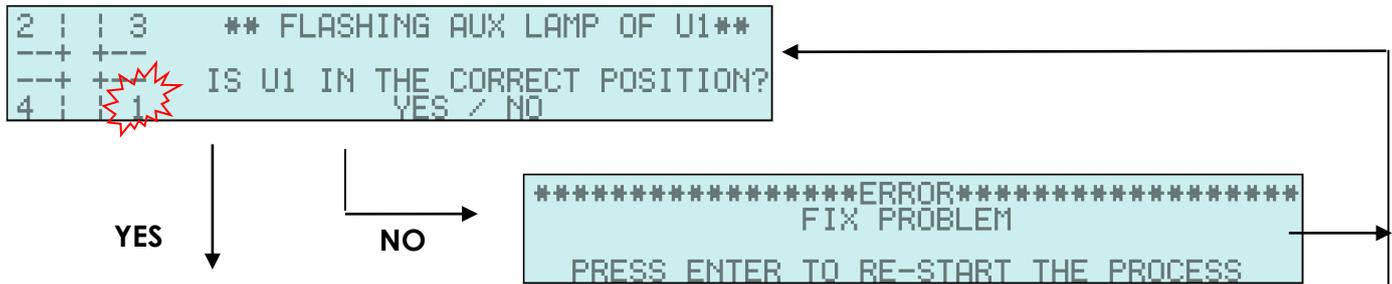
This directs the operator to go to U1 to confirm the setup.

Note:

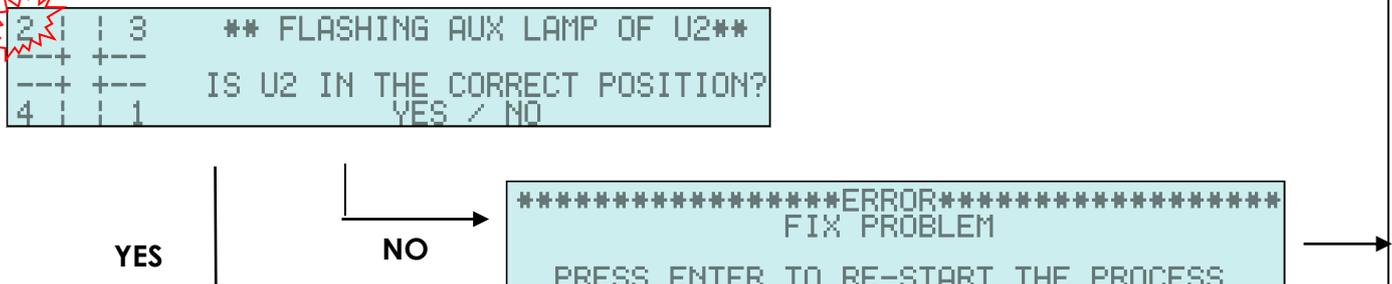
The operator must now answer a series of questions to make sure all controllers are in the correct position BEFORE traffic control is enabled.

Please refer to the following page for a full example.

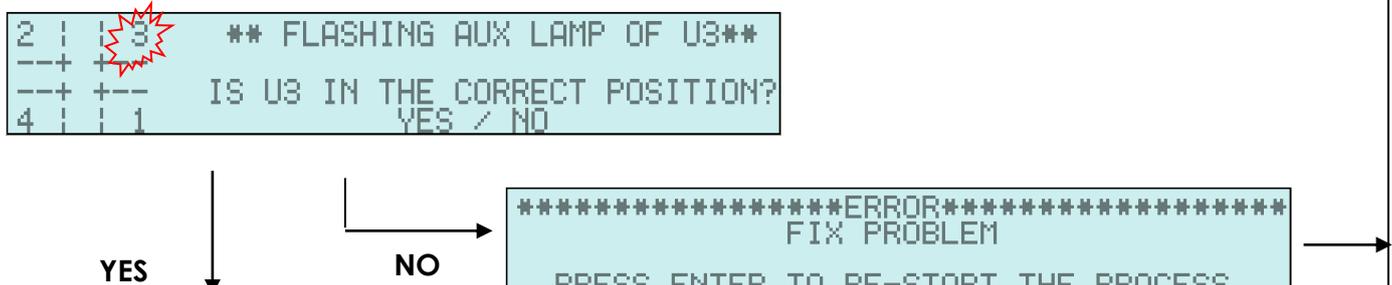
The AUX lamp will begin flashing *only* on U1 and the '1' digit in the simulated intersection on the left side of the screen will begin flashing:



If YES is pressed, the AUX lamp will begin flashing *only* on U2 and the '2' digit in the simulated intersection on the screen will begin flashing:



If YES is pressed, the AUX lamp will begin flashing *only* on U3 and the '3' digit in the simulated intersection on the screen will begin flashing:



If YES is pressed, the AUX lamp will begin flashing *only* on U4 and the '4' digit in the simulated intersection on the screen will begin flashing:



When you have answered YES to all 4 questions, the HOME screen will appear:

```

045 S      MODE : FLASH YELLOW      045 S
035 S      COMMS : RX TX
035 S      UNIT 1 : 4 WAY            035 S
035 S      VOLTS : 13.1V             035 S
    
```

VEHICLE SENSOR, AUTO or MANUAL modes can now be selected.

CUSTOM

This configuration option enables either SINGLE controller operation (for a one way road); or a variation of the SHUTTLE operation but with two controllers facing each direction of traffic on one road.

SINGLE

Used on one road, where traffic is flowing in one direction only.

This configuration can ONLY be operated in MANUAL mode

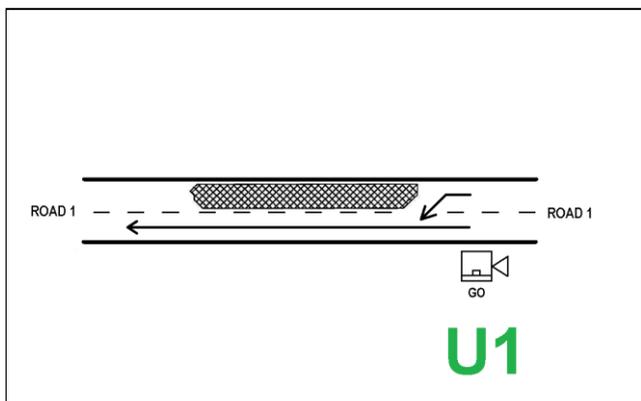


Diagram D5.1

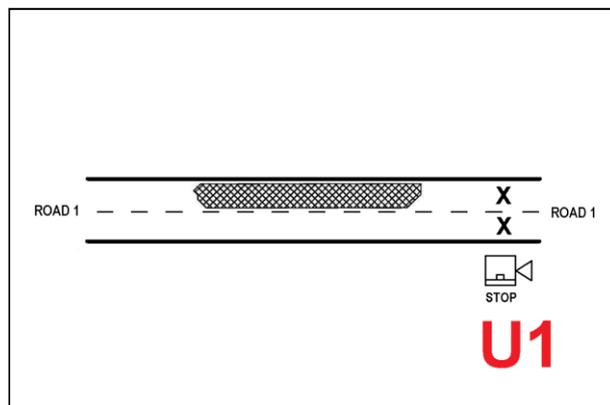


Diagram D5.2

See page 44 for setup information.

DUAL LANTERN

This configuration allows for two controllers in each road direction with each pair of controllers in the one direction showing the same Red / Green signal. The purpose for two lanterns per direction is to assist road users seeing the main (U1 or U2) lantern.

The controllers are setup as if it was a 4 WAY intersection, but with only one road.

In this mode, U3 duplicates U1's signal and U4 duplicates U2's signal.

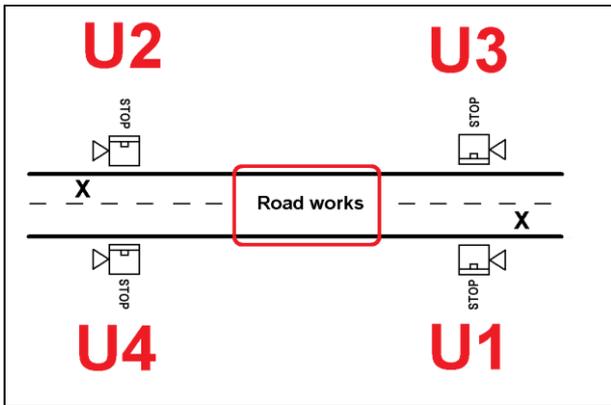


Diagram D5.3

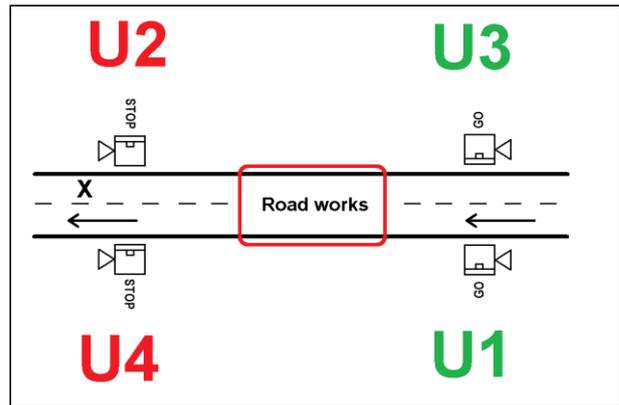


Diagram D5.4

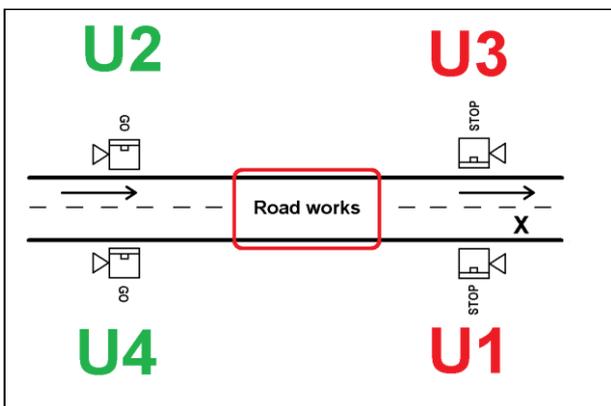


Diagram D5.5

Note: The SHUTTLE version accessed directly via the CONFIGURATION switch allows for only one controller facing each direction of traffic on one road.

See page 45 for setup information.

SETUP (SINGLE)

With the power off, set the CONFIGURATION switch to CUSTOM and the UNIT switch to U1. Power on and the screen will show:

```
SELECT MODE
  1 - SINGLE MODE
  2 - DUAL LANTERN MODE
```

Press '1' and the HOME screen will appear:

```
020 S          MODE : FLASH YELLOW
              COMMS : RX TX
              UNIT 1 : SINGLE
              VOLTS  : 13.1V
```

This configuration must be controlled manually, so a MC-400 wired controller or TRH4 wireless controller will need to be connected.

Once connected, select MANUAL mode or press the MC-400's RED button / TRH4's STOP button. The signal will go Red and is now under the control of the wired/ wireless controller.

Notes:

In SINGLE configuration, only one controller is used.

This configuration can ONLY be used in MANUAL mode.

Using a TRH4, only U1's 'Go Green' is functional.

Using a MC-400, pressing *either* Green button will enable the Green signal. The status LEDs will only appear on the side of 'U1'.

SETUP (DUAL LANTERN)

The setup for DUAL LANTERN is similar to normal SHUTTLE configuration, combined with the requirements of setting up a 4 WAY intersection.

Note:

If it is desired to use DUAL LANTERN configuration immediately after SINGLE configuration (or vice-versa), the operator must:

1. Power off;
2. Select another configuration;
3. Power on;
4. Power off;
5. Select CUSTOM again;
6. Continue as usual.

To configure:

1. Obtain four CS-400 controllers.
2. With their power off, set each controller's CONFIGURATION switch to CUSTOM
3. Select U1 for the first controller;
Select U2 for the second controller;
Select U3 for the third controller;
Select U4 for the fourth controller.
5. Turn all controllers on and select option 2. "DUAL LANTERN MODE"
6. Synchronise the controllers.
7. Once synchronising is complete, U1's screen will show:

```

2      3    ** FLASHING "U1" LAMP OF U1 **
-----
-----  IS U1 IN THE CORRECT POSITION?
4      1    YES / NO

```

Note the slightly different representation of the Road on the left side of the screen.

This follows the same approach as any of the 4 WAY configurations.

8. Power off all controllers and re-position to their correct location.
9. Power on all controllers and go to U1.
10. Confirm all screen questions. (As per 4 WAY.)

During this verification procedure, U2, U3 & U4 will show:

```

GO TO UNIT 1
FOR SETUP

```

Once U4's position has been verified, all controllers will show the HOME screen:

```
010 S          MODE : FLASH YELLOW
              COMMS : RX TX
020 S          UNIT 1 : 2 WAY DUAL
020 S          VOLTS : 13.2V
```

The system may now be controlled using all MODES.

MC-400 wired remote controls may be plugged in to any or all CS-400 controllers.
CS-TRH4 wireless remote controls may now be synchronised to U1.

Notes:

Although four controllers are in use, this configuration is equivalent to normal SHUTTLE. As a result, only one RED TIME and two GREEN TIMES are shown.

Although equivalent to SHUTTLE configuration, the REPEATER option is not usable in this configuration.

MENU OPTIONS

The MENU system provides access to less-used features of the CS-400.

To select the MENU system, press the MENU button for 2 seconds.

To correct an entry error or go back to a previous screen press the CLEAR button.

To exit the MENU system and return to the main operating screen, press the HOME button.

Main MENU screen:

```
1 RED CLEARANCE TIME 5 HOUR METER
2 ERROR LOG          6 PHONE REPORTING
3 VOLTAGES           7 AUX LAMP [SOLID]
4 LANTERN TIMES      8 MISC
```

1. RED CLEARANCE TIME

Pressing '1' brings up the RED CLEARANCE time sub-menu:

```
1 ROAD-1 RED CLEARANCE 004
2 ROAD-2 RED CLEARANCE 004
```

The operator then chooses from either Road 1 or Road 2. The times are independent. Selecting either will show:

```
TIME 000
(RANGE 004 TO 100)
TYPE IN TIME & PRESS ENTER
```

Enter the time in seconds within the specified range for the new RED CLEARANCE time. A correct time will update the RED CLEARANCE time menu screen with the newly-entered value.

An incorrect entry displays an error with the permitted range of values, then after a short time, allows a re-entry of the time.

2. ERROR LOG

Pressing '2' brings up the error log:

```

01 - U1 HAS NO ERROR
02 - U1 HAS NO ERROR
03 - U1 HAS NO ERROR
04 - U1 HAS NO ERROR
    
```

The 12 last errors are recorded. By default, the most recent error is shown. Press '2' to scroll UP and '8' to scroll DOWN to reveal any of the additional 8 entries.

Note: The asterisk “ * ” next to any fault number “01” “02”, etc, indicates a fault that occurred on another controller in the system. Faults descriptions should be self-explanatory.

3. VOLTAGES

On U1, pressing '3' shows the voltage detected on all CS-400s in system. On U2, U3 and U4, pressing '3' only shows the voltage on that controller.

4. LANTERN TIMES

Pressing '4' provides the option for adjusting times. The main LANTERN TIMES screen shows:

```

1 STATE CODES-VIC      5 MIN RED      004
2 ALLOW CDT? [Y]      6 MAX RED      100
3 YELLOW 004          7 MIN GREEN    010
4 GREEN EXT 005      8 MAX GREEN    150
    
```

4.1 STATE CODES

The main LANTERN TIMES screen shows the last-set State (Default = Victoria).

Press '1' to change the system's default Australian State. (Each state has their minimum and maximum times for Red and Green.)

To change, press '1'. The screen will now show:

```

1 ACT      5 SA      SELECTED STATE
2 NSW      6 TAS      VIC
3 NT       7 VIC
4 QLD      8 WA
    
```

Select the digit next to the State required.

The screen will prompt the operator for a password. By default, this is the serial number of the controller.

After correctly entering the password, the state selected will automatically appear in the main LANTERN TIMES menu along with all time changes relevant to that state.

Example:

From the LANTERN TIMES menu, to change from the default VIC state to QLD enter the following button sequence:

1, 4, {password}, ENTER

NOTE:

If the number entered is wrong, consult your supplier.

If the State code is changed, the minimum and maximum Red and Green times are reset to the default values of that State.

4.2 ALLOW CDT?

When Count Down Timers are connected to the system, this option allows for disabling of their display.

The current status is shown as [Y]es or [N]o.
Pressing '2' shows:

```

ALLOW COUNTDOWN TIMERS?
      1 - YES
      2 - NO
  
```

Pressing '1' or '2' will immediately be accepted and reflected on the main LANTERN TIMES screen.

4.3 YELLOW (time)

This allows for changing the time the controller spends illuminating the Yellow element in the lantern head when transitioning from Green to Red. The default is 4 seconds. The option is 5 seconds.

The main LANTERN TIMES screen shows the current value.

Pressing '3' shows:

```

YELLOW TIME 000
(RANGE 004 TO 005)
TYPE IN TIME & PRESS ENTER
  
```

Press '4' or '5' and press ENTER.

The operator is then returned to the main LANTERN TIMES screen with the updated YELLOW TIME displayed.

Note:

If a time other than '4' or '5' is entered, an error will be generated.

4.4 GREEN EXTENSION (time)

This time refers to the VEHICLE SENSOR MODE extension time. The current time is shown on the LANTERN TIMES screen. The default is 5 seconds and can be adjusted between 3 and 6 seconds.

Pressing menu option '4' will show this screen:

```

GREEN EXTENSION TIME 000
(RANGE 003 TO 006)
TYPE IN TIME & PRESS ENTER
  
```

Enter a value within the range specified and press ENTER.

The operator will then be returned to the main LANTERN TIMES screen with the updated GREEN EXTension time displayed.

Note:

If an incorrect value is entered, an error will be generated.

Refer to VEHICLE SENSOR mode for details on how this time is used.

4.5 MIN RED time

Notes:

The changing of minimum or maximum Red or Green times for a given State code is not recommended as it may mean the system is operating outside of the State's legal requirements.

Changing these times require contact with A1 Roadlines so that a temporary password may be issued to allow these changes to take place.

Changing all four times requires 4 passwords.

They will all be different and are single-use.

A1 Roadlines accept no responsibility for any outcome as a result of this change.

The procedure for changing either of these times is the same.

Select '5' to change the MINIMUM RED time in any other menu that the Red lantern can be set to.

The current value for the State code selected is shown on the main LANTERN TIMES screen.

Pressing menu option '5' will show this screen:



```
MIN RED TIME 000
(RANGE 002 TO 100)
TYPE IN TIME & PRESS ENTER
```

Enter a value within the range specified and press ENTER.

The operator is presented with a "Forticode Code" which he/she must take a photo of the display and send it to A1 Roadlines to obtain a deciphered code which is entered. This is a one-time use code. If not entered correctly, A1 Roadlines will need to be contacted again.

Upon a successful change, the operator will then be returned to the main LANTERN TIMES screen with the updated MIN RED time displayed.

Note:

If an incorrect value is entered, the operator will be presented with an error message.

4.6 MAX RED time

To change the maximum Red time, refer to section 4.5
The approach is similar.

4.7 MIN GREEN time

To change the minimum Green time, refer to section 4.5
The approach is similar.

4.8 MAX GREEN time

To change the maximum Green time, refer to section 4.5
The approach is similar.

5. HOUR METER

Displays the total operating hours of the controller:



```
HOUR METER:      154.2 HOURS
```

Note: It is not possible for the operator to reset / clear this meter.

6. PHONE REPORTING

This option is no longer in use.

7. AUX LAMP

The auxiliary lamp is enabled when the attached lantern head is Red.
The operator can choose whether the lamp stays on 'SOLID' or pulses about once per second 'PULSE'.

The current setting is displayed on the main MENU screen.
Press '7' to display the options screen:



```
SELECT AUX MODE  
1 SOLID OUTPUT  
2 PULSE OUTPUT
```

Pressing '1' or '2' results in an immediate change, reflected on the main MENU screen.

8. MISC

Selecting '8' brings up the miscellaneous screen:

```
(C) A1 ROADLINES
S/N : 1111 CH: 53 NET: 229
6 TESTS 7 INFO 8 A1
```

This screen provides the serial number 'S/N' of the controller. The 'CH' and 'NET' values are for manufacturer diagnostic purposes only.

These are a range of screens used by the manufacturer during manufacturing, with two being accessible by customers.

8.1 TESTS

Pressing '6' provides the operator with a way to test lantern head lights in addition to the AUX and U1 lights. These tests are only available in FLASH YELLOW mode. The controller's status LEDs are independent of this test.

```
1 LANTERN 1 - RYG ON 5 SECS
2 LANTERN 2 - RYG ON 5 SECS
3 LANTERN 1 - AUX/U1 IND ON 5 SECS
4 LANTERN 2 - AUX IND ON 5 SECS
```

Pressing '1' turns on all Lantern 1 elements (Red, Yellow and Green) for 5 seconds. Pressing '2' turns on all Lantern 2 elements (Red, Yellow and Green) for 5 seconds. Pressing '3' turns on Lantern 1's AUX and U1 lights.

Note: If test '3' is performed on U2, U3 or U4, the U1 light will not turn on.

Pressing '4' turns on Lantern 2's AUX light.

8.2 INFO

Provides manufacturer contact information.

8.3 A1

A restricted access area for use by A1 Roadlines personnel only.

TROUBLESHOOTING

Change radio communication channel

Where two or more CS-400 systems exists within a 1000 metre radius, there is a very small possibility they will interfere with each other.

The symptom for this is Lost communications.

One possible solution is to change the radio 'CHANNEL' on one system.

Select FLASH YELLOW

Ensure any TRH4 remotes are powered on.

Ensure U2, U3 and U4 are on their HOME screen.

On U1, hold down the ENTER key for 5 seconds

The screen will show:



The system will automatically update all devices and return to the HOME screen.

In the unlikely event that a device no longer communicates with U1, repeat the synchronising process for that device.

Faults and remedies

As a courtesy, we have compiled a list of the most common faults / errors encountered and a corresponding remedy.

FAULT	REMEDY
Ux lost comm's with Uy	Is distance < 1000m? Is line-of-sight? Check for interference, check antenna systems, check power supplies. Replace Ux. Replace Uy,
CS400 will not turn ON	Is power supply at least 12v? Swap with another controller. Does second controller not turn on?
Lantern X [colour] fail	Check lantern head, install Ux in known good trailer.
Screen blank after power ON	Is temperature very cold? If yes, wait a few minutes and re-check. Are status LEDs working? If no, check power supply...
Screen missing characters or lines of text	Enter MENU. Does list fill screen?

	If yes, MANUAL mode does not show Green times.
Audible alarm won't stop after 5 minutes	Is the alarm related to low voltage? If yes, resolve power supply issue. Is the alarm related to comm's? If yes, check distance between U1 and other device less than 1000m. Is alarm still present when controllers are within a few metres of each other? If yes, attempt re-sync.
Can't sync two devices.	Check Configuration / Unit number. Try another device with U1. Try another U1.
Comm's error when cable is removed between U1 & U2.	Re-attach cable. If RF operation possible, remove cable from both U1 & U2, power-cycle both units, re-SYNC them.
Can't sync in cable mode	Cable mode does not require sync.
TRH4: System does not respond to key presses.	Is TRH4 powered on? Is it synchronised to U1? Do all Red-Yellow-Green status LEDs flash slowly? Yes = radio faulty. No = Re-SYNC CS-TRH4 to U1.
System does not respond to MC-400 button presses	Valid CONFIGURATION?, valid MODE? Check operational matrix.
Can't SYNC other device to U1	Is system in FLASH YELLOW mode? Check CONFIGURATION is the same as U1, check UNIT numbers start from 1 and is appropriate for the Configuration.
Can't SYNC other device to U1 after REPEATER synchronised.	Must SYNC all required devices (U2, TRH4, CDT) to U1 <u>before</u> Synchronising to the REPEATER.
TIMES are not shown on screen	TIMES are not shown in MANUAL mode. (Green times are under operator control.)
CDT digits not counting down	Synchronised to U1? Enabled in Menu? Ensure AUTO mode.
CDT shows 'r r r' on power-on.	Radio fault in CDT.
CDT shows 'c c c'.	Not synchronised to system or communications problem. Is antenna intact? Ensure distance to U1 does not exceed 1000m and is line-of-sight.
Error 'System Unreliable'.	An operational error has occurred 5 or more times in 20 minutes. Check error log to assist further.

GLOSSARY

UNIT / CONTROLLER	The CS-400 device drives a lantern head. On a roadway with two or more controllers, each CS-400 must be uniquely identified. From an operator's perspective, this is done using a 'U' (Unit) number. To simplify this guide, we use 'U1' to mean Unit 1, 'U2' to mean Unit 2, etc.
SYNC	Synchronise, to enable two CS-400 compatible devices to communicate with each other.
REPEATER	A device that may allow two CS-400s to communicate with each other when 'line-of-sight' is not possible.
RED CLEARANCE TIME	The time after a signal goes RED which allows traffic to clear an area before conflicting traffic is given a GREEN signal
GREEN PHASE	The allocated time the GREEN lantern is turned on to allow traffic to flow through the road works.
RF	Radio Frequency / Wireless. The primary method two CS-400 devices communicate with each other.
CABLE	An alternative method for two CS-400 devices to communicate. This is a wired connection of 25 metres (default) length.
SYSTEM	A collective of CS-400-based devices intended to be used on one work site. This may be as few as one or as many as four controllers. It may include wired and wireless remote controls.
HOME screen	The normal operating screen on the controller.
MENU	A selectable set of options used to preset the operational characteristics of the controller.

DOCUMENT HISTORY

Version	Date	Comments
14.4	11.2020	Brought up to date, including all possible options.
14.3	07.11.2018	Changed all references for the Configuration position "OTHER" to "CUSTOM".
14.2	04.10.2018	<ul style="list-style-type: none">• Updated RP1_note to clarify Repeater synchronising process.• Updated Operation Matrix to include Repeater in 2 Way mode.
14.1	31.08.2018	Initial published document

WARRANTY

A1 Roadlines Pty Ltd warrants the equipment to be free from defects in material and workmanship on the date of delivery to customer.

As the customer's sole remedy for breach of this warranty, A1 Roadlines Pty Ltd will, for a period of twelve (12) months from the date of delivery, repair or replace any part of the equipment proven defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with instructions and recommendations.

This warranty does not cover, and we shall not be liable for, any malfunction, damage or wear caused by inappropriate use, corrosion, inadequate maintenance, negligence, accident, tampering or substitution of non-compatible component parts. Nor shall we be liable for malfunction, damage or wear caused by the incompatibility with the manufacturer's equipment of structures, accessories, equipment or materials not supplied by A1 Roadlines Pty Ltd.

A1 Roadlines will not recognise a warranty claim under the following circumstances:

1. If a defect to this product resulted from repair attempts by personnel other than A1 Roadlines.
2. If a defect has occurred as a result of connection to incompatible equipment.
3. If a defect occurs where the product has been modified.
4. If any defect, failure or damage caused is by improper use, improper or inadequate maintenance or improper care.

This warranty is conditioned upon the pre-paid return of the equipment claimed to be defective for examination by A1 Roadlines Pty Ltd to verify the claimed defect. If the claimed defect is verified, A1 Roadlines Pty Ltd will repair or replace, free of charge, and defective parts. The equipment will be returned to the Customer, transport pre-paid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at reasonable charge, such charges may include the cost of parts, labour and transport.

To arrange warranty service please contact:

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