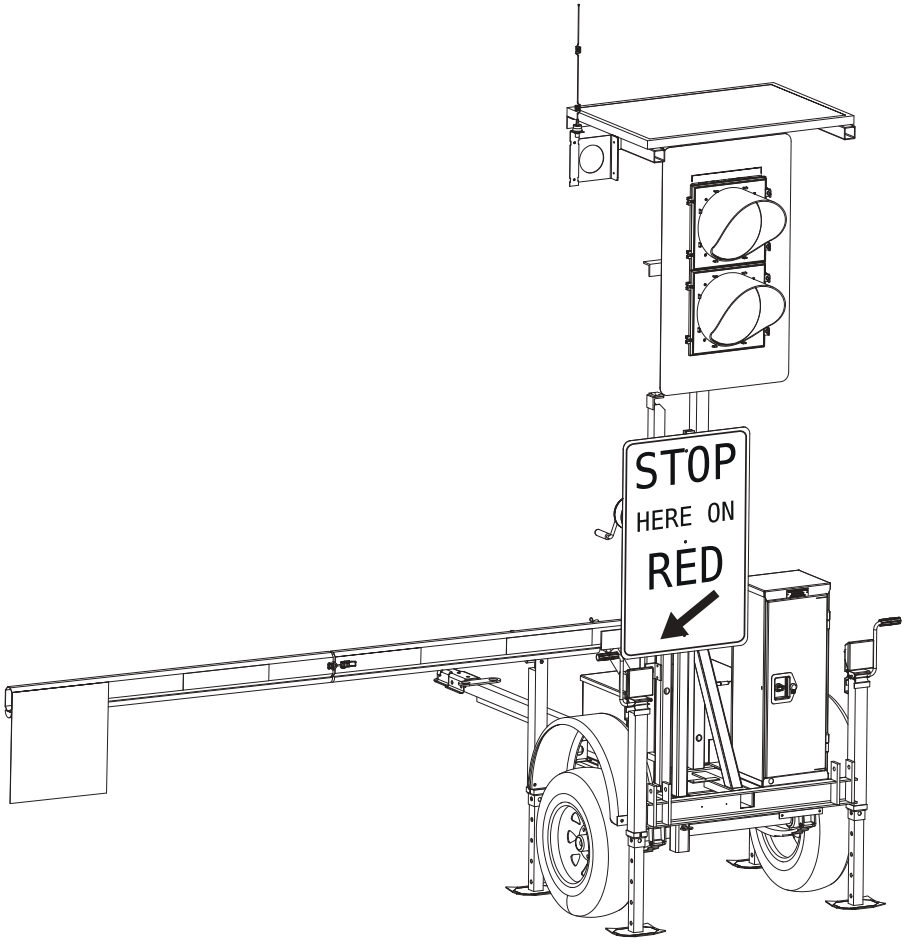
RCF 2.4

Automated Flagger Assistance Device Manual

Stinson
TRAFFIC SAFETY SPECIALISTS

NORTH AMERICA TRAFFIC™
THE LEADER IN TRAFFIC CONTROL SYSTEMS



ISO 9001:2015

REV 01 08.29.19

Introduction

The North America Traffic, Inc. Model RCF 2.4 Automated Flagger Assistance Device (AFAD) is used as an alternative to traditional flagging operations. The RCF 2.4 AFAD is designed to take Traffic Control Persons out of harm's way while continuing to maintain complete control over the construction/work zone by use of a wireless Hand Held Radio Remote Control.

To ensure safe passage within the work zone, the RCF 2.4 AFAD comes equipped with user friendly programming options and conflict monitoring. The 4 inch gate arm and 12 inch LED signal lamps provide positive information to the public, designating when to "Stop" (Red) and when to "Proceed with Caution" (Flashing Amber).

AFAD's are approved for use by the MUTCD in most situations where Traffic Control Persons are stationed. It is the users responsibility to ensure adherence with the local requirements and/or obtaining an engineer's approval for use. Primarily, the units are deployed when Traffic Control Persons are most at risk of injury or fatality including: high speed construction work zones, blind corners, inclement weather, emergency projects (slide repair, road/culvert washout) and controlling high volumes of traffic during festivals and/or events. Other opportunities to use RCF 2.4 AFAD units include: regular road maintenance programs, situations with limited manpower assigned to traffic control and other areas where the use of a mechanical device can help to save the lives of workers, both in the work zone and those controlling traffic.

DISCLAIMER

This manual is produced without any kind of warranty. Improvement and changes in this manual due to typographical errors, inaccuracies in current information or improvements to programs and/or equipment may be made at any time without notice. The user is responsible for verifying use of the latest version by contacting North America Traffic.

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If so, please let us know if you find any mistakes or if you know of a way to improve the content of this manual. Mail your letter or recommendation directly to:

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1 Safety Overview

1.1 Training

All personnel operating the North America Traffic RCF 2.4 must be fully trained.

1.2 Towing

Prior to transporting the RCF 2.4 (either individually and/or in tandem) complete the following checklist to ensure safety while in tow:

- All lock down points are secure including:
  - Tongue locking pin
  - The coupler pins
  - The coupling lock bar and locking plates (for nested/locked trailers)
- Make certain there are NO "loose" objects sitting on the unit (check solar panel, top of battery box, fenders, bumpers, tongue, etc.)
- The light post is fully lowered, with winch cable taut
- The batteries inside the battery box are secured correctly with the battery hold-downs and the battery box lid has been locked
- The jacks are fully retracted and locked into place
- The controller cabinet door has been shut and secured
- The hitch safety chains are secured
- All connections for the trailer lights has been secured and tested (check right/left turn signals, hazard lights and brake lights for correct function)

Drive ahead about 10 feet and do a final walk around to ensure that all lock down points are secure; safety chains are crossed under the tongue and latched securely; and no tools or parts are sitting on the machine.

Note: failure to ensure that all of the above precautions have been taken can result in injury and/or death.

1.3 Signage and Work Zone

It is the end user's responsibility to ensure that advanced warning signs and barricades are used in accordance with the local road authority guidelines.

1.4 Electrical Hazards

Before working on the electrical system, always disconnect the 24V DC batteries (main power supply) and the solar panel to avoid injury.

1.5 Battery Hazards

Safety Precautions

Always use eye protection, a face guard and rubber gloves when working with batteries. Have an eye wash kit available at all times or tap water to flush acid out of eyes. Always have water and baking soda available to wash off and neutralize acid when it comes in contact with skin. If acid is taken internally, drink large amounts of water and seek medical attention immediately.

Gas Explosion or Fire

Batteries release an explosive hydrogen gas while being charged. Keep cigarettes, sparks, flames, and any other ignition sources away at all times.

Acid Burns

Battery acid can cause burns if it comes in contact with exposed skin and can cause blindness when in contact with your eye(s). Always wear protective goggles and gloves when working with batteries.

Electrical Burns

An electrical short between the positive and negative terminals of the battery can cause severe burns and death, even though the voltage is low.

1.6 Overhead Hazards

Prior to setting up the machine, ensure there is sufficient clearance to raise and lower the mast safely.

2 Terms and Definitions

AFAD – defined as 'Automated Flagger Assistance Device'. An AFAD enables a flagger(s) to be positioned away from the lane of traffic and is used to control vehicle movements through temporary traffic control zones. An AFAD is designed to be remotely operated by either; a single flagger at one end of the TTC zone or at a central location, or by separate flaggers near each AFAD's location.

Cycle – the total time to complete one operation of all phases.

Gate Arm – also known as a boom, or boom gate. The gate arm lowers to block the lane of traffic when the AFAD displays a RED indication. When the indication is changed to FLASH YELLOW, the gate arm raises, permitting traffic to proceed accordingly.

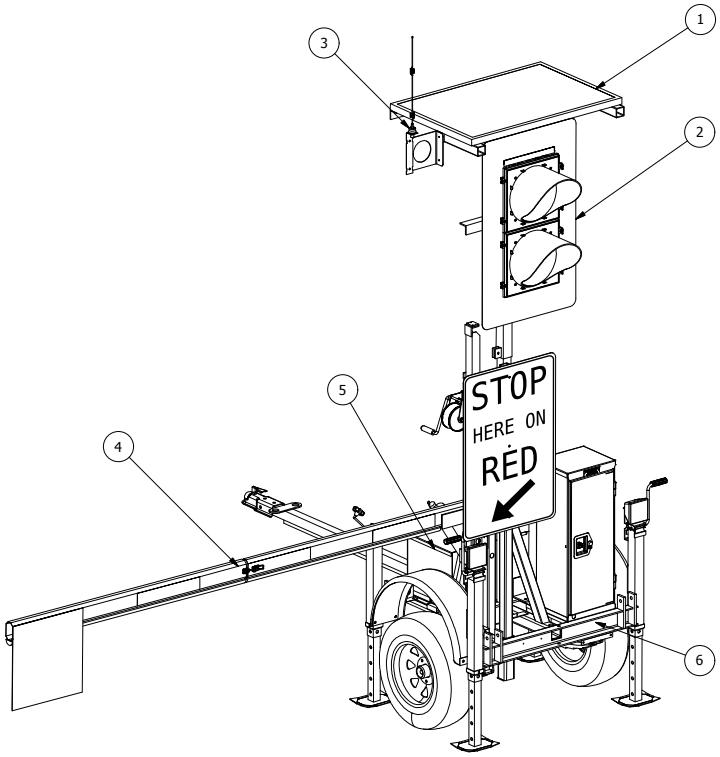
Radio Remote Control – sometimes referred to as a 'Hand Held Remote' or 'HHR'. This device permits the user to manually operate the AFAD unit(s) wirelessly from a safe distance.

MUTCD – the Manual on Uniform Traffic Control Devices. Contains regulatory information on the use of AFAD's in temporary traffic control situations on public roadways. Refer to MUTCD section 6E.06 Red/Yellow Lens Automated Flagger Assistance Devices for further information regarding the use of AFAD's.

Phase – a phase controls one or more signals within a work zone. The number of phases available and how many signals are controlled with each phase depends on the layout of the work zone.

3 Component Breakout

3.1 Trailer Deployed



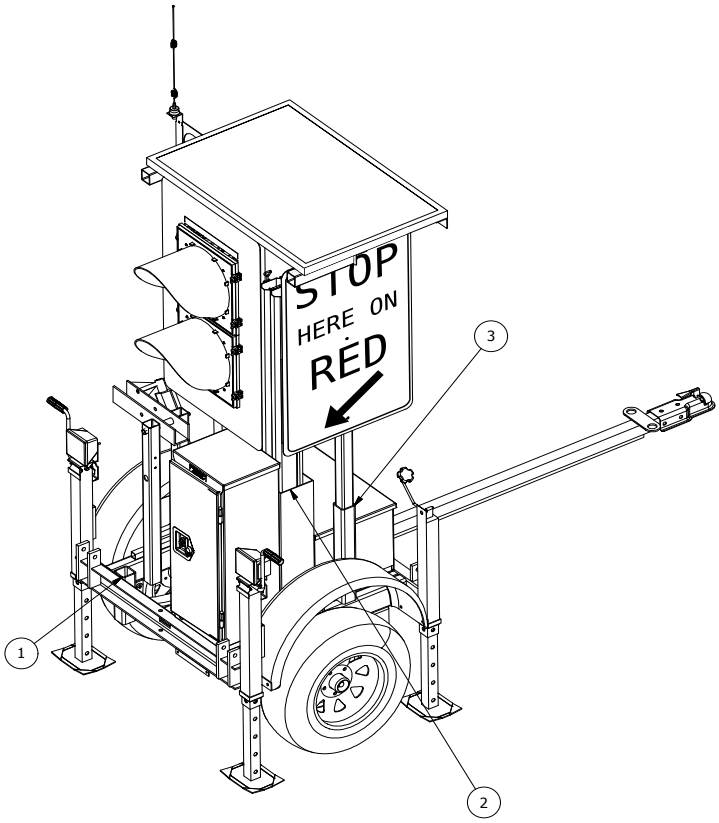
1. **Solar Panel**
   - The solar panel supplied with every RCF 2.4 provides 100 Watts of power and is housed in an anodized aluminum frame.
   - The solar energy is sent to the solar panel controller which then transfers the power to the battery bank.
   - The energy generated by the solar panel assists in extending the autonomy of the unit - not to charge the batteries to their maximum capacity; a full charge is achieved by using the 15 Amp smart charger.
2. **LED Signal Lamps and Housing**
   - The Signal Lamp is comprised of Light Emitting Diodes (LED).
   - 12″ diameter using a 24 VDC power supply and complies with ITE standards.
   - ITE certified polycarbonate housing with an aluminum backboard.
   - Standard ball cap visors extend over each LED lamp by 10″.
   - Back Lamp: 4″ amber LED lamp mounted on the signal head provides phase status to workers in the construction zone. Behavior is displayed as:
     - Flashing = Phase status is FLASH AMBER
     - Solid = Phase status is SOLID AMBER or RED

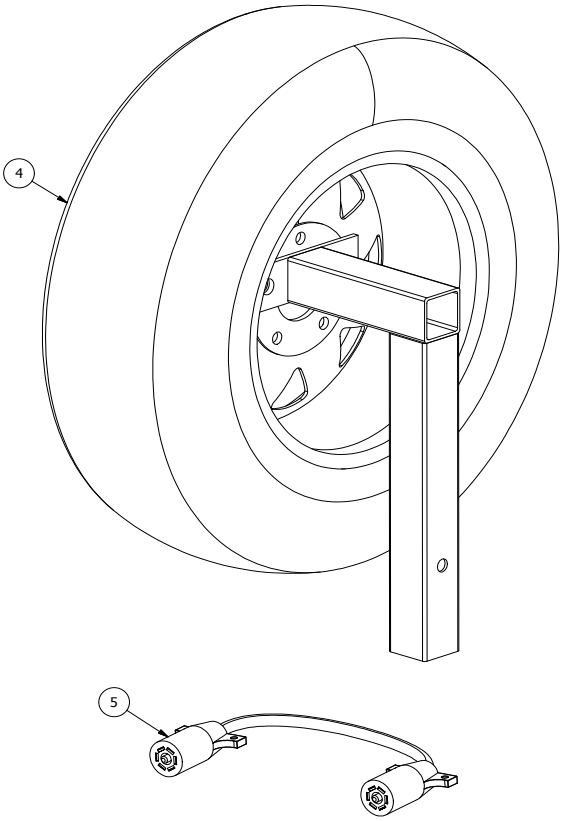
3. **Communication Link (Radio Transceiver)**
   - A Radio Transceiver is installed in each RCF 2.4 Unit in order for communication between trailers.
   - The Radio Transceiver is a 1 Watt system designed to communicate up to 1/2 mile (with line of sight).
   - The unit operates on the appoved frequency range as per the MUTCD/FCC Part 90.17 - (910 MHz-917 MHz spred spectrum, frequency hopping) - No FCC licensing required.
4. **Folding Gate Arm**
   - 10 ft total boom extension
   - Aluminum
   - 4" vertical aspect
   - 16" alternating red/white reflective sheeting
   - Hinged design for compact storage
   - 18" x 18" orange warning flag
5. **Power Supply**
   - Power is supplied by four (4) – 6 Volt deep cycle batteries, in series to generate 24 VDC.
   - Batteries are charged using the 15 Amp smart charger (external plug provided near cabinet door providing easy access for connection to a 120 VAC source).
   - Batteries receive some assisted energy supplied by the Solar Panel attached – for more information see: **Solar Panel** feature in this section.

Note: For more detailed information pertaining to batteries, charger and solar array, refer to POWER SYSTEM INFORMATION SECTION 13.

6. **Trailer Section Components**
   - The Trailer Section for the RCF 2.4 is approved for use on highways including the following features:
     - Leaf spring axle, rated at 2200 lbs
     - ST175/80R13 tires
     - Removeable tongue with one (1) locking pin
     - Four flat-mount screw jacks to level and stabilize
     - All electrical and lighting requirements for highway driving
     - 2" Hitch Ball Coupler on tongue
     - Three points of locking contact for locked, unified towing
   - The frame structure and all supports are welded and inspected by certified welders, implemented under ISO 9001:2015 guidelines.

3.2 Trailer in Transport



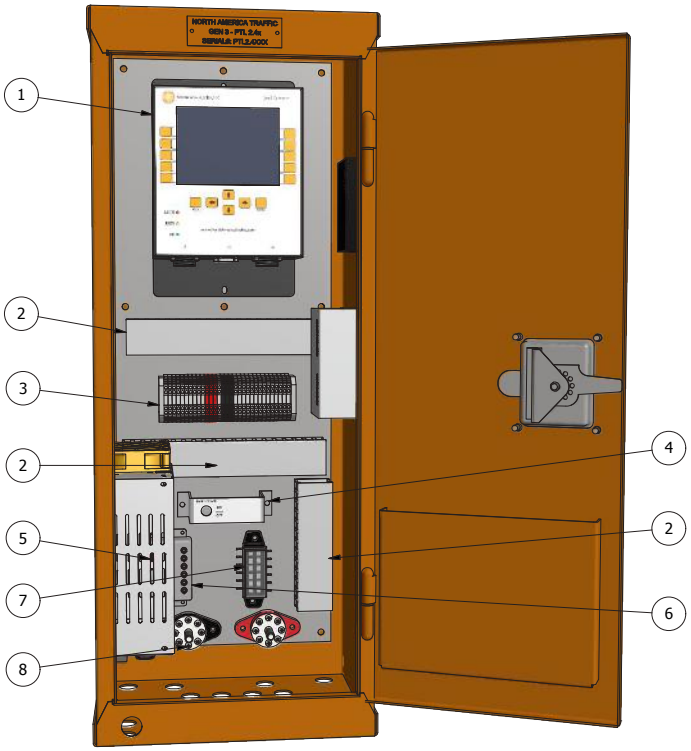


1. **Auxiliary Holder:** used for storage of the tongue or spare tire mount. Holds the STOP HERE ON RED sign when the unit is in operation.

   Note: spare tire mount and spare tire are optional extras.

2. **Gate Arm Holder:** gate arm is stored in this holder for transport. It is a gravity fit; no locking pin is required.
3. **STOP HERE ON RED Sign Holder:** the sign is stored in this location for transport. It is a gravity fit; no locking pin is required.
4. **Spare Tire Mount (Optional add-on item):** the spare tire assembly is secured for transport in the Auxiliary Holder, using the hitch pin. When the trailer is deployed, the spare tire assembly can be move to the STOP HERE ON RED Sign Holder.
5. **Running Light Cable:** used to connect the running lights between the lead and rear trailer when towing them as a unified system.

3.3 Cabinet Internals



1. **Controller** – controls all functions of the RCF 2.4.
2. **Wiring Conduit** – protected channel through which wires are routed.
3. **Terminal Block** – all electrical inputs and outputs are applied here.
4. **Main Power On/Off Switch**
5. **Battery Charger** – 15 amp used to charge the batteries when unit is plugged into a 120 VAC power source.
6. **Solar Controller/Regulator** – stabilizes and transmits the energy collected by the solar panel to the battery bank.
7. **Fuse Block** – fuses for all electrical functions.
8. **Isolated Power Distribution Studs** – the distribution point to which power from the batteries, solar array, and battery charger is connected to the signal control system and peripheral hardware.

4 Physical Setup/Takedown

4.1 Trailer Separation

Note: If towing only a single trailer, go to Section 4.2.

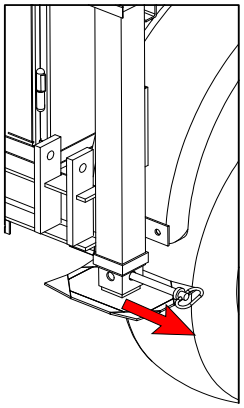
1. Before disconnecting the units, drop the two front jacks (top wind) on the rear unit in tow. Also lower the two rear jacks (side wind) about three quarters of the way down. Follow the instructions below for all four jacks.

⚠WARNING

The jacks must be lowered as outlined above. Failure to do so will result in the trailer tipping.

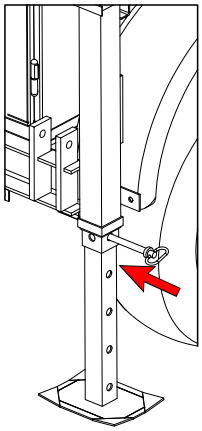
   a. Remove the cotter pin from the locking pin.

   b. While holding the base of the jack, remove the locking pin.



   c. Place the base of the jack on the ground.

   d. Line up the nearest holes and put the locking pin through. Secure with the cotter pin.



   e. Turn the crank until the jack is firmly on the ground.

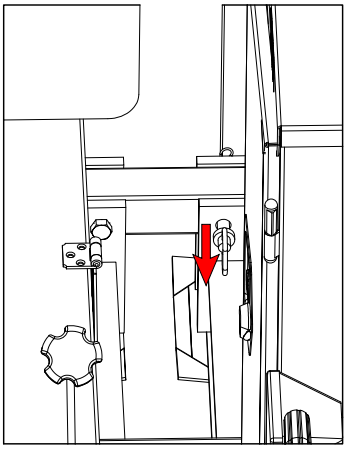
   f. Repeat for the other top wind and side wind jacks on the rear trailer. Ensure all jacks are dropped before separating the two trailers.

2. Proceed to the connection point between the two trailers and disconnect the running light coupling cable from both trailers. Place it inside the control cabinet of the rear trailer for safe keeping.

3. Return to the connection point between the two trailers. Fully remove the hitch pin from the bumper plates to release one end of the locking bars. Rotate the released lock bar back so its out of the way. Repeat these actions for the lock bar on the opposite side of the trailer. *Note: If the locking bars are difficult to remove due to binding, slightly raise or lower the jacks as needed to until the bars freely move.*

⚠CAUTION

BE CAREFUL NOT TO PINCH YOUR FINGERS.



4. Locate the central ball coupler. Remove the coupler lock pin and release the ball coupler latch to make the final disconnect of the units.

5. Raise the front of the rear unit using the front jacks (top wind) until the coupler clears the ball hitch. Double check that all three connection points are fully disconnected.

6. Slowly pull the lead trailer forward with the towing vehicle to fully separate the two trailers.

7. Position each trailer on the side of the road, as required.

8. Fully level and stabilize each unit with the four stabilizing jacks.

9. Proceed to the unit attached to the towing vehicle.

4.2 Disconnect from Towing Vehicle

1. Before disconnecting the unit from the towing vehicle, drop the two front jacks (top wind). Also lower to two rear jacks (side wind) about three quarters of the way down. Refer to steps 1a. through 1e. in section 4.1 for detailed instruction on deploying and lowering the jacks.

   ⚠WARNING

   The jacks must be lowered as outlined above. Failure to do so will result in the trailer tipping.

2. Disconnect the running light plug from the towing vehicle.
3. Disconnect the safety chains from the towing vehicle.
4. Remove the coupler lock pin and release the ball coupler latch.
5. Use one of the front jacks to raise the trailer tongue until it completely clears the ball hitch of the towing vehicle.
6. Pull the towing vehicle ahead.
7. Position the trailer on the side of the road, as required.
8. Fully level and stabilize the unit with the four stabilizing jacks.
9. Proceed to the front of the trailer and disconnect the running light plug that connects the tongue to the frame. Excess length of cable can be wrapped around the tongue to prevent damage to the wires or plug.
10. Locate the hitch pin that secures the tongue to the trailer. Remove the cotter pin and slide the hitch pin out; set aside.
11. Position yourself parallel to the tongue and stand roughly in the middle of the length of the tongue.

    ⚠CAUTION

    Use care when removing the tongue as it is long and can tip/fall to the side easily. Lift using your knees and not your back.

12. Grasp the tongue and slide it out to fully remove it from the trailer. Place it in a secure location (i.e. back of towing vehicle).
13. Insert the hitch pin back in the corresponding hole in the bumper for safe keeping.

4.3 Deployment Onsite

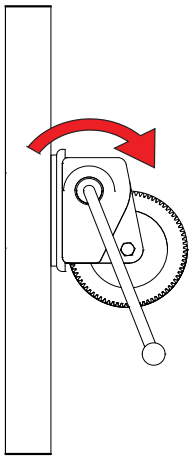
⚠CAUTION

Ensure all jacks are deployed and the unit is level before raising the light post. Failure to do so may lead to tipping of the trailer.

⚠WARNING

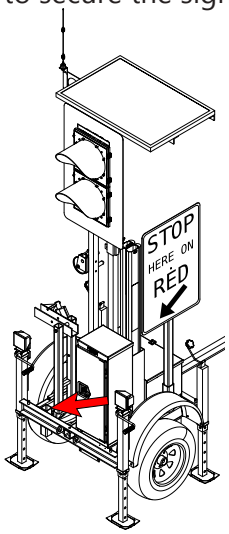
ALWAYS check for overhead power lines or utility lines in the immediate area to avoid contact with the light post. Move the unit to another location if necessary.

1. Proceed to the front of the trailer and locate the hand winch.
2. Firmly grasp the handle of the winch and turn it clockwise to raise the light post. *Note: ensure that a "clicking" noise is heard while cranking the winch.*
3. Reference the two arrow decals (one located on the light post, the other on the winch mast) for proper deployment height. When the two arrows are aligned, the signal housing will be deployed to the MUTCD recommended height of 7 feet (as measured to the underside of the signal housing). *Note: The winch has a built-in brake to prevent the light post from lowering automatically. Turn the winch handle counter-clockwise to lower the light post, as necessary.*



4. Proceed to the shoulder side of the trailer and remove the "STOP HERE ON RED" sign from the transport position.
5. Proceed to the rear of the trailer and install the sign in the deployed position (receiving tube located in corner between rear bumper and roadside side rail).

6. Insert the locking pin in the sign receiver tube to secure the sign in place.

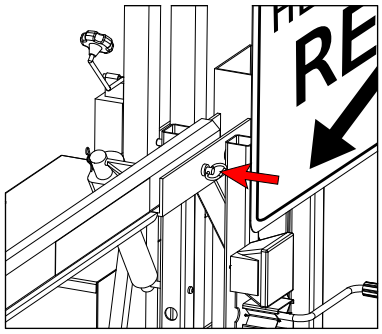


7. Proceed to the shoulder-side of the trailer and remove the gate arm from the gate arm holder.
8. Proceed to the roadside of the trailer with the gate arm in hand.

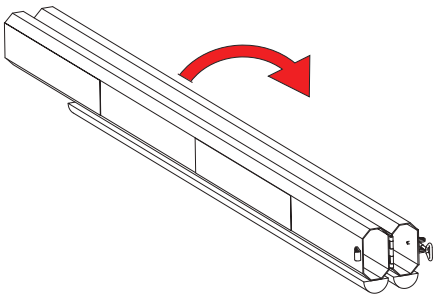
⚠WARNING

Ensure temporary traffic control is operating prior to stepping onto the roadway. Failure to do so may result in injury or death due to vehicular impact.

9. Keep the gate arm partially folded and place the appropriate end in the gate arm sleeve.
10. Align the holes of the gate arm and sleeve and insert the hitch pin to secure in place.



11. Swing open the gate arm and use the toggle latch to secure in the fully deployed position. Ensure the flag is fully unraveled.

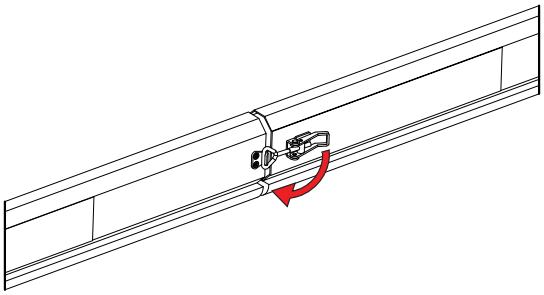


4.4 TAKEDOWN ONSITE

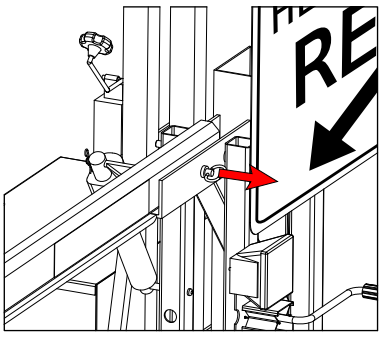
⚠WARNING

Ensure temporary traffic control is operating prior to stepping onto the roadway. Failure to do so may result in injury or death due to vehicular impact.

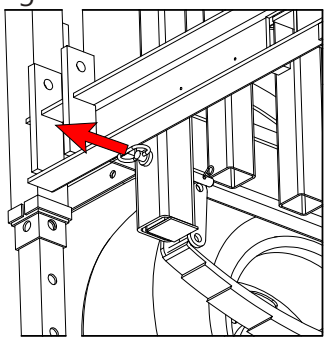
1. Put all units into ALL STOP or power them off.
2. Proceed to the roadside of the trailer and unlatch the gate arm and swing closed.



3. Remove the hitch pin securing the gate arm and remove the gate arm from the sleeve.

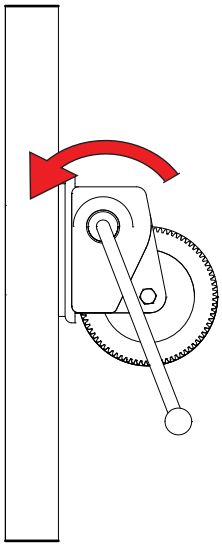


4. Proceed to the shoulder-side with the gate arm in hand and place it in the gate arm holder.
5. Proceed to the rear of the trailer and remove the locking pin from the "STOP HERE ON RED" sign receiver tube.



6. Remove the sign from the tube and proceed to the shoulder-side of the trailer to install the sign in the transport position.
7. Proceed to the front of the trailer and locate the hand winch.

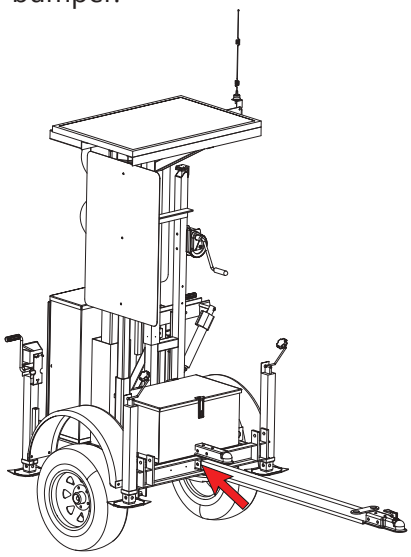
8. Firmly grasp the handle of the winch and turn it counterclockwise to lower the light post. *Note: there will be no clicking "noise" when cranking the winch.*



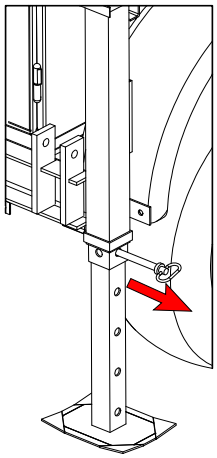
9. Lower the light post until it reaches the stop.

4.5 Connection to Towing Vehicle

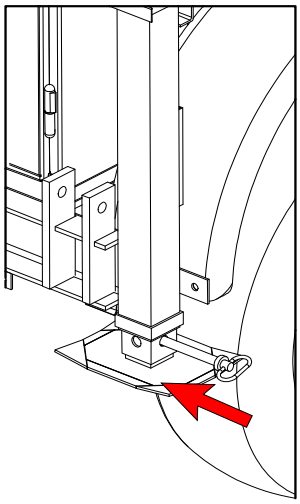
1. Retrieve the tongue and remove the hitch pin in the bumper.
2. Slide the tongue fully into the hole in the bumper.



3. Secure the tongue with the hitch pin. Install the cotter pin into the hitch pin.
4. Plug the running light cable from the tongue into the outlet on the frame.
5. Pull the towing vehicle in front of the trailer.
6. Raise the front of the unit using the two front jacks (top wind) enough for the tongue to clear the ball hitch on the towing vehicle.
7. Reverse the towing vehicle so the ball hitch is underneath the tongue coupler.
8. Lower the front jacks to connect the coupler to the ball hitch, lock the coupler latch, and secure the coupler lock pin.
9. Connect the safety chains and the running light plug to the towing vehicle.
10. Retract all jacks.
    a. Remove the cotter pin.
    b. While holding the base of the jack, remove the locking pin.



    c. Raise the base until the bottom hole is lined up with the main locking hole.
    d. Put the locking pin in the locking hole.



    e. Put the cotter pin in the locking pin.
    f. Repeat for all jacks.

4.6 Trailer Connection

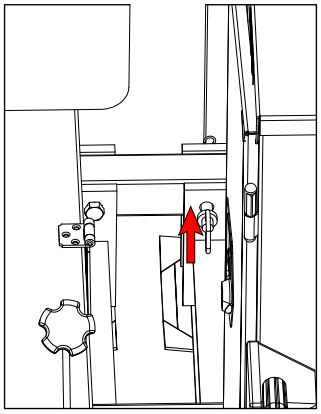
1. Before connecting the units, raise the two rear jacks (side wind) on the rear unit in tow so they

remain deployed roughly three quarters of the way down.

2. Reverse the trailer connected to the towing vehicle just in front of the rear trailer to be connected.
3. Raise the rear unit using the front jacks (top wind) enough for the coupler on the rear unit to clear the ball hitch on the front unit.
4. Slowly reverse the front unit until the coupler is above the ball hitch.
5. Ensure the latch on the coupler is released, then lower to two front jacks on the rear unit until the connection is made with the ball hitch.
6. Secure the latch and install the coupler lock pin.
7. Connect the outer lock bars by rotating them down between the bumper plates. Install the hitch pin to secure in place. *Note: If the locking bars are difficult to connect due to binding, slightly raise or lower the jacks as needed to until the bars freely move.*

⚠ CAUTION

BE CAREFUL NOT TO PINCH YOUR FINGERS.

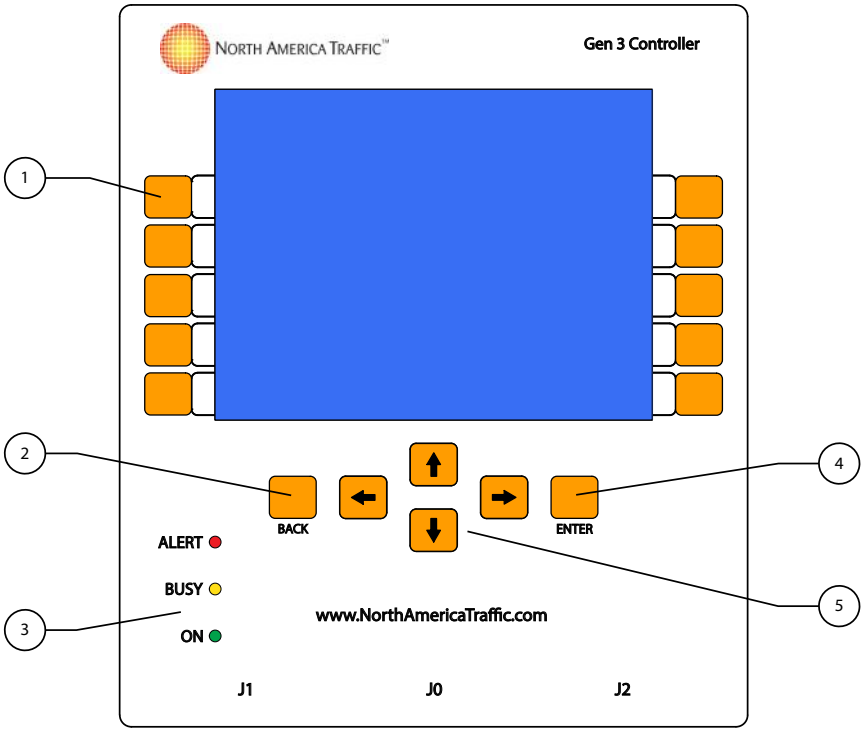


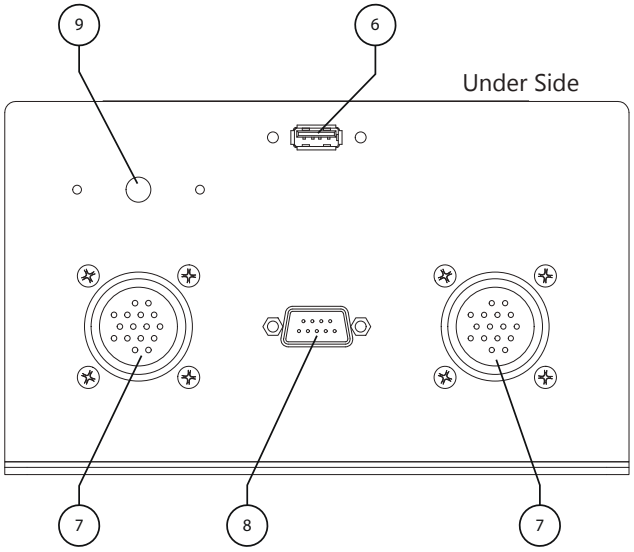
8. Retrieve the running light coupling cable and connect it to both trailers.
9. Retract all jacks. (Refer to Section 4.5, step 10 for detailed instruction).
10. Turn on the towing vehicle's hazard lights and do a walk around to ensure all running lights are in proper working order. Also inspect all trailers for:

- any loose objects
- light post fully lowered
- cabinet door closed and secure
- sign and gate arm secure
- all locking points have proper hitch pins and locking pins in place.

5 CONTROLLER NAVIGATION

5.1 CONTROLLER HARDWARE





1. **Soft Buttons** – these 10 buttons have no specific assigned values. They will have a different value on each screen.
2. **BACK Button** – returns to the previous menu screen.
3. **L.E.D. Status Lights**:

ALERT ● - indicates whether there is a fault or error message.

Note: Alert light will be illuminated for 15 seconds following power down of the system.

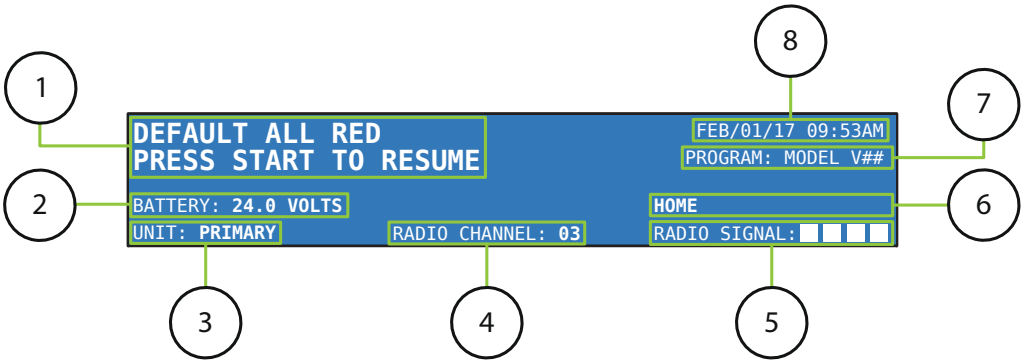
BUSY ● - USB in use, settings being saved or copied, unit warming up.

ON ● - power indication.

4. **ENTER Button** – used to confirm a selected value or open a paramater for editing.
5. **Directional Buttons** – allows the user to toggle through menus, various screens and cycling through paramaters open for editing.
6. **USB Port** – used to import/export software files, traffic control plans and fault/data logs.
7. **J-Plugs (J1/J2)** – I/O connections to the terminal block by means of wire harnesses.
8. **Serial Port (J0)** – connection to radio transciever.
9. **Speaker** – emits audible notification to user when buttons are pressed. Also emits loud beeping when batteries are low.

5.2 CONTROLLER SOFTWARE

The systems tray will display pertinent information that is always visible.



1. **System Feedback** – this will display any instructions, faults or error messages that occur.
2. **Battery Voltage** – displays the current battery voltage.
3. **Unit Identifier** – displays the machine designation, either Primary or Secondary X.
4. **Radio Channel** – will display the current radio channel or show if the machine is hardwired.
5. **Radio Signal Strength** – displays the signal strength percentage in 25% increments. This is a combination of radio signal strength and rate of data transfer within the network.
6. **Menu Path** – this section displays where the user is located in the software.
7. **Program Version** – will display the model of the unit and software version number.
8. **Date and Time** – in the OPTIONS menu, the date and time can be set (HOME>OPTIONS PG 3).

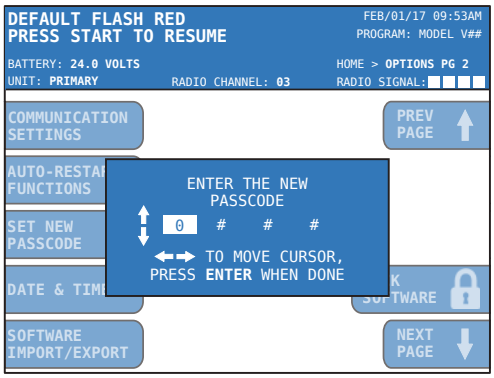
5.3 SYSTEM PASSCODE

To create a new passcode, go into options and scroll down to SET NEW PASSCODE. A prompt will appear to enter the current passcode. From factory, this passcode is:

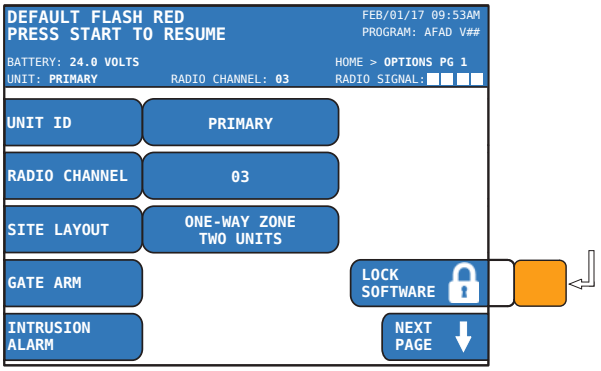
0 – 8 – 0 – 0

Once this is entered, a prompt will appear to enter a new passcode. If your custom passcode is ever forgotten, call North America Traffic: 1-877-352-4626.

After a new passcode is set, in order to alter any settings, the software will need to be unlocked. This can be accomplished either by unlocking the software via the OPTIONS menu or by selecting any option to edit. Once selected, a prompt will appear to enter the passcode.



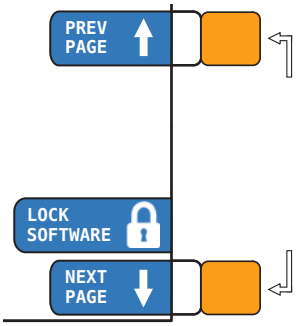
Once unlocked, the only way to lock the software again is to go back to the OPTIONS menu and select the corresponding soft button.



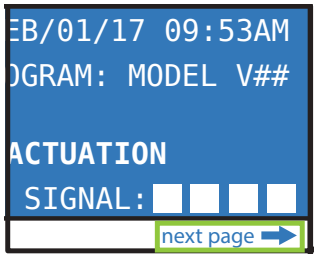
5.4 INTERNAL SOFTWARE NAVIGATION

Navigating menu pages:

1.



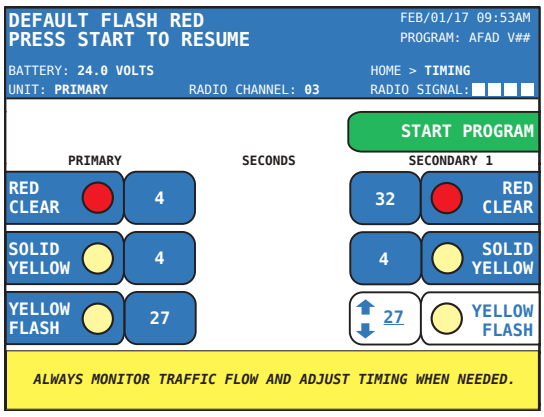
2.



1. In this case, the corresponding soft buttons will be used to toggle through pages.

2. When "next page" is displayed, the ← and → directional buttons will be used to toggle through pages.

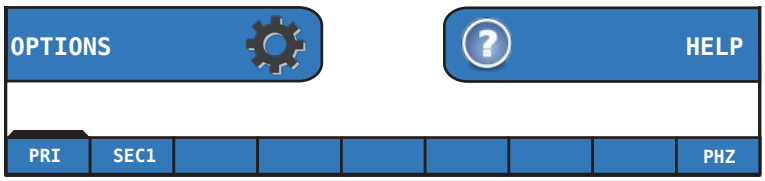
Editing Parameters:



Once a soft button is selected (i.e. Secondary 1 YELLOW FLASH):

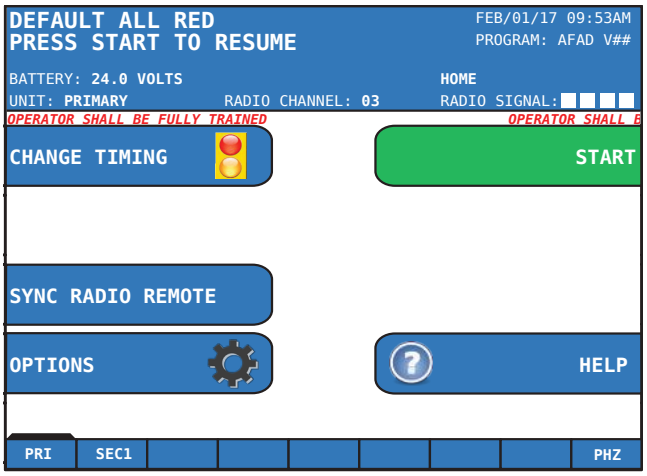
- Use the ↓ or ↑ directional buttons to increase or decrease the highlighted integer.
- Lock parameters in memory by pressing ENTER, pressing any other soft button, or by shifting the selection to the opposing timing input.

Toggling Through the Unit Diagnostic Tab:

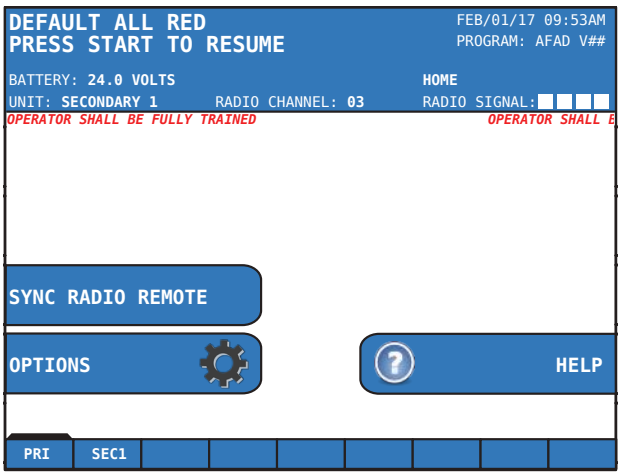


Using the ← and → directional buttons from the home screen will allow you to view the Phase Status and diagnostics for each unit in the network. Press ENTER to view the selected tab.

6 MENU SCREENS



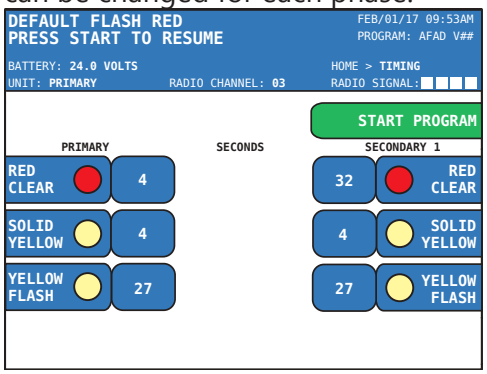
Home Screen: Primary



Home Screen: Secondary 1

6.1 CHANGE TIMING

CHANGE TIMING – the menu where the timing can be changed for each phase.

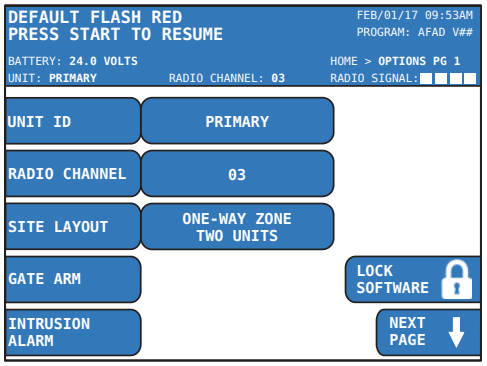


Red Clear – Allows the user to set the red time required for vehicles to safely clear the work zone before the next green phase is served.

Solid Yellow – Allows the user to set the solid yellow time for the signal when it transitions from flash yellow to red.

Yellow Flash – Allows the user to set the maximum flash yellow time for the signal.

6.2 OPTIONS



Unit ID – used to designate each unit as either a primary or secondary machine. Each unit will have a different designation. Only 1 primary machine is needed per work zone.

Radio Channel – there are 10 radio channels and 1 hardwire setting available. Every machine in the work zone must be on the same radio channel in order to work together.

Site Layout – the site layout tab allows the user to select a predefined layout to suit the work zone. There are up to 20 layouts to choose from.

Gate Arm

Enable/Disable – allows the user to turn on or off the gate arm function.

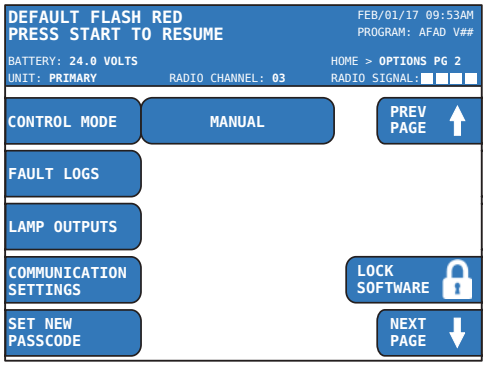
Delay – allows the user to input the delay time (0-10sec) that will occur between when the RED indication is lit, and when the gate arm begins to lower.

Intrusion Alarm

Enable/Disable – allows the user to turn on or off the intrusion alarm systems (requires additional hardware).

Gate Arm Retract – allows the user to enable or disable the retract feature. If enabled, this will stop the gate arm from lowering if an instrusion event occurs as the gate arm

lowering, the gate arm will stop and return to the vertical position.



Control Mode – five different modes can be used to operate the system.

Automatic – in automatic mode, the machines will communicate automatically with one another based on how the site layout has been assigned. It also allows for a manual override using the radio remote. *Note: Automatic operation is not compliant with the MUTCD requirements for AFAD's. This function requires a passcode to access, and should only be used for private applications.*

Manual – in manual mode, the radio remote is required. The red button on the radio remote will initiate an ALL STOP command, the green button will turn the Primary signal green (flash amber), and the black button will turn the Secondary signal green (flash amber). Manual mode can only be used with site layouts that consist of up to two phases. *Note: An ALL STOP must be initiated prior to changing green signals.*

Pilot Car Mode – a pilot car equipped with a radio remote can control the work zone without the need for a flagger. A hardwired remote can also be employed.

Single Unit - Manual – in single unit manual, the unit will be controlled solely by the radio remote.

Single Unit - Auto – in single unit auto, the unit will run automatically based on the timing settings.

Fault Logs – used to log each fault that occurs with the date and time, and type of fault. Up to 10,000 faults are held in memory.

Clear Fault – a fault can only be cleared once it has been resolved.

Export All Logs – fault logs and data logs can be exported via USB as a .csv file.

Lamp Outputs – additional lamps to notify workers of the signal lamp(s) status.

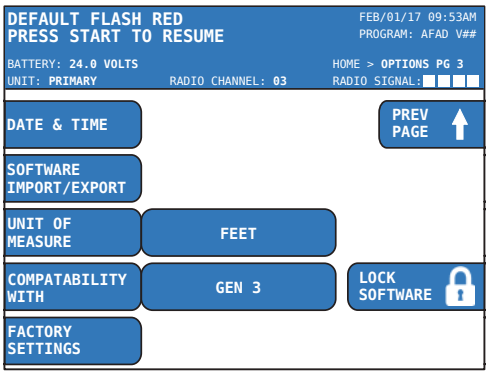
Back Lamp – a 4" amber lamp used to notify the workers within the work zone. When the corresponding signal head is in its green or "yellow flash" phase, the back lamp displays flashing amber. When the corresponding signal head is in its yellow change or red clearance phase, the back lamp displays a solid amber indication.

Green Lamp – enabling the green lamp will add a corresponding timing field in CHANGE TIMING. *Note: This requires the hardware addition of a green lamp, signal housing, etc.*

Communication Settings – used for radio communication setup.

Drop Out Time – the machine will go into default mode if radio communication is lost for more than the specified time.

Set New Passcode – user selectable passcode used to unlock the software settings (see SECTION 5.3 SYSTEM PASSCODE).



Date & Time – the date and time can be set by using the up and down arrow buttons to select the value and the right and left arrow buttons to toggle horizontally.

Software Import/Export – software updates and preprogrammed traffic plans can be imported via flash drive. Exporting can be used to save plans. This will save all settings to the USB flash drive.

Compatibility With – allows the Gen 3 system to operate with older Gen 1 controllers. If compatibility with an older Gen controller is selected, some programming options within the Gen 3 software will be inaccessible (grayed out) in order to comply with the older versions (see SECTION 9 COMPATIBILTY MODE).

Note: When operating in Gen 1 AFAD compatibility mode, the Gen 3 system must ALWAYS be the PRIMARY unit. The Gen 1 units

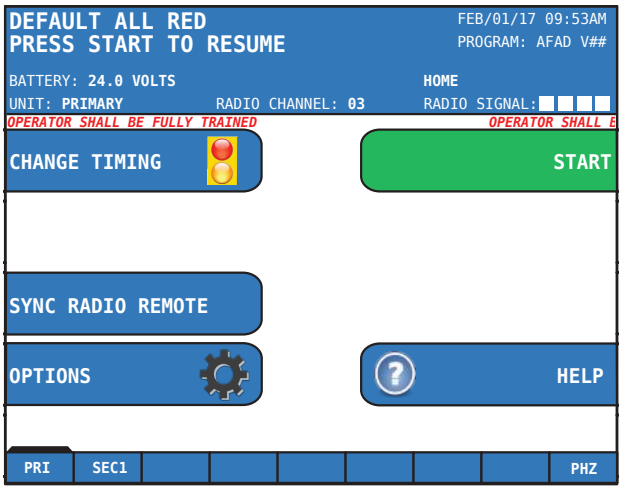
shall all be set as SECONDARY units.

Factory Settings – gives you the option to enable or disable display dimming and set the product model.

Display Dimming – When enabled, if no button on the controller is pressed for 10 minutes, the screen will go black. Press any button to illuminate the screen.

Set Model – Manufacturer access only. Contact NAT for further details.

6.3 STARTING OPERATIONS

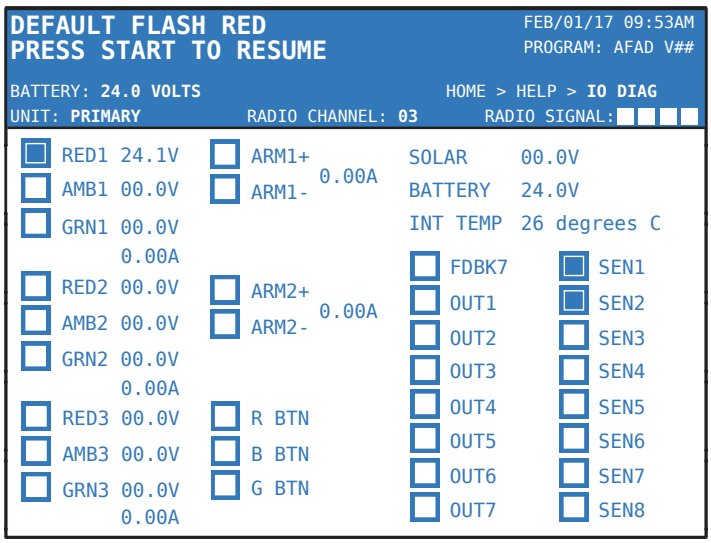


Start Program – can be selected on the HOME screen or CHANGE TIMING screen at any point after the timing has been set. It is recommended that timing is reviewed to ensure correct settings.

Sync Radio Remote – the radio remote can be programmed to the same radio channel as the unit(s) by selecting SYNC RADIO REMOTE in the software and following the instructions on the screen.

6.4 HELP

The HELP feature is currently in development. This section will be populated with the most common trouble shooting tips. Currently, all the input and output (I/O) diagnostics can be viewed here.



7 SETTING UP A WORK ZONE

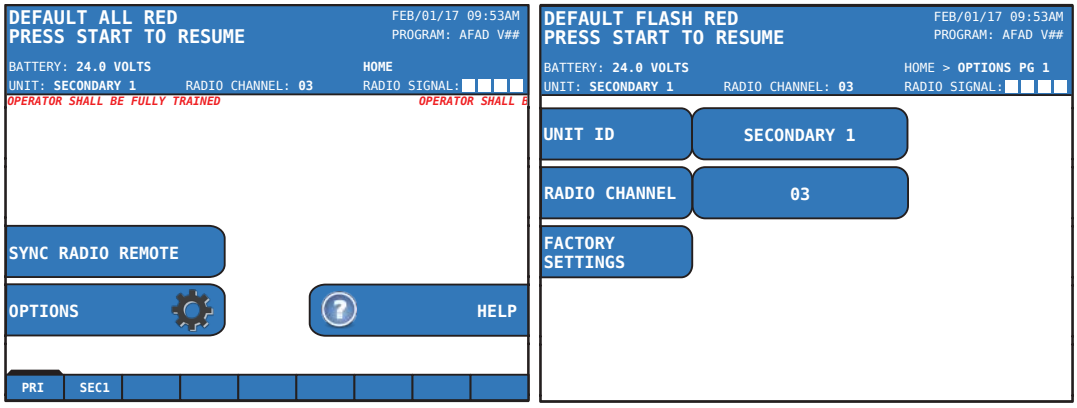
When setting up a work zone, one unit must be set as the Primary Unit. If more than one unit is needed, the other unit will be setup as Secondary 1. The Secondary Units should be powered on first. Edit the OPTIONS menu settings as shown below on the Primary and Secondary controllers; starting with the Secondary Unit (as applicable).

Secondary Setup

1. Proceed to a secondary unit and turn the power on.
2. Select OPTIONS.
3. Select UNIT ID and proceed to change the unit ID to the required Secondary ID.
4. Select RADIO CHANNEL and select the desired channel number.

Note: All units to be networked must be on the same RADIO CHANNEL.

Hardwired connection can be selected (requires additional hardware and wiring)



5. Press the BACK button to return to the HOME screen.
6. Proceed to primary unit to continue setup.

Primary Setup

1. Proceed to Primary unit.
   a. Select OPTIONS.
   b. Set the UNIT ID to Primary.
   c. Choose the RADIO CHANNEL that was chosen on the secondary units.
   d. Select the SITE LAYOUT based on your work zone. Refer to SECTION 7.1 LAYOUTS for a detailed list of all available layouts.
   e. Press the BACK button to return to the HOME screen and select TIMING.
      i. Edit Unit (Phase) timing; RED CLEAR, SOLID YELLOW, YELLOW FLASH.
   f. Ensure the GATE ARM is enabled and appropriate delay time entered. See OPTIONS PAGE 1.
   g. Ensure the INTRUSION ALARM is enabled only if the applicable hardware is in place. See SECTION 11 OPTIONAL EQUIPMENT.
   h. Ensure unit is set to desired CONTROL MODE (MANUAL). See OPTIONS PAGE 1>CONTROL MODE.
   i. Select START PROGRAM (program can be started from the CHANGE TIMING screen or the HOME screen).

7.1 Layouts

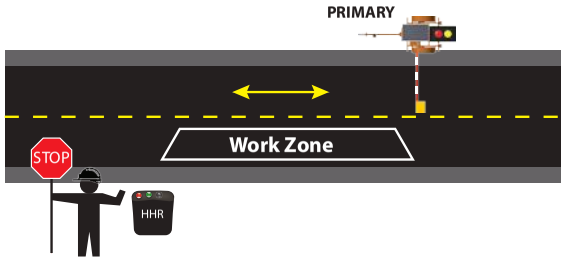
Layout	Units Required	Control Mode
One-Way Zone - Single Unit	Primary	Manual
One-Way Zone - Two Unit	Primary, Secondary 1	Manual/Pilot Car
Two-Way Zone (Manual Mode)	Primary, Secondary 1	Manual

Disclaimer

Please consult the presiding traffic control manual to ensure proper work zone setup. The following illustrations are not drawn to scale and are meant to be used as a guide in determining the proper setup of the signals. In no way do these illustrations reflect the appropriate signal setup for all work zones. Signal position and timing should be approved by the presiding authority or project engineer prior to use.

MUTCD Compliant Layouts/Setups

ONE-WAY ZONE - SINGLE UNIT



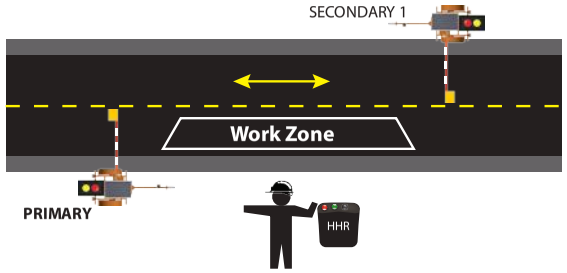
PRIMARY

OPTIONS	SETTINGS
UNIT ID	PRIMARY
RADIO CHANNEL	0-9, HARDWIRED
SITE LAYOUT	ONE-WAY ZONE - SINGLE UNIT
GATE ARM	
GATE ARM	ENABLE
GATE ARM DELAY	0-10 (seconds)
CONTROL MODE	Choose: MANUAL

CHANGE TIMING	SETTINGS
RED CLEAR	1-600 (seconds)
SOLID YELLOW	1-15 (seconds)
YELLOW FLASH	MIN: 1-300 MAX: 1-300

HOME SCREEN	
SYNC RADIO REMOTE	Follow instructions on screen

ONE-WAY ZONE - TWO UNITS



SECONDARY 1

OPTIONS	SETTINGS
UNIT ID	SECONDARY 1
RADIO CHANNEL	0-9, HARDWIRED

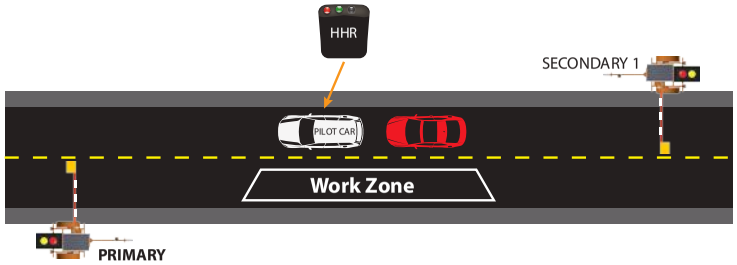
PRIMARY

OPTIONS	SETTINGS
UNIT ID	PRIMARY
RADIO CHANNEL	0-9, HARDWIRED
SITE LAYOUT	ONE-WAY ZONE - TWO UNITS
GATE ARM	
GATE ARM	ENABLE
GATE ARM DELAY	0-10 (seconds)
CONTROL MODE	Choose: MANUAL

CHANGE TIMING	SETTINGS
RED CLEAR	1-600 (seconds)
SOLID YELLOW	1-15 (seconds)
YELLOW FLASH	MIN: 1-300 MAX: 1-300

HOME SCREEN	
SYNC RADIO REMOTE	Follow instructions on screen

PILOT CAR MODE



SECONDARY 1

OPTIONS	SETTINGS
UNIT ID	SECONDARY 1
RADIO CHANNEL	0-9, HARDWIRED

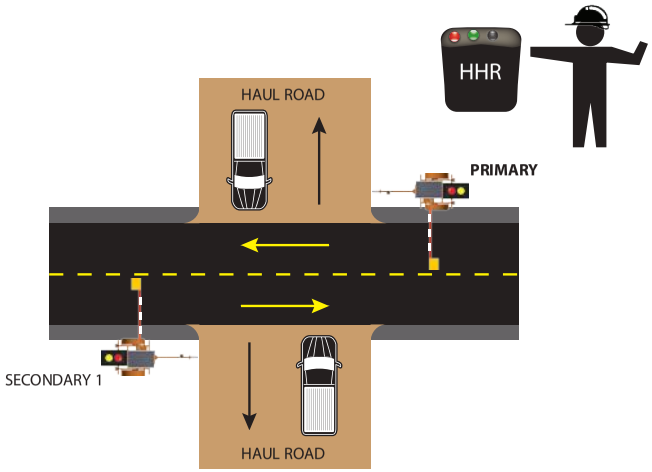
PRIMARY

OPTIONS	SETTINGS
UNIT ID	PRIMARY
RADIO CHANNEL	0-9, HARDWIRED
SITE LAYOUT	ONE-WAY ZONE - TWO UNITS
GATE ARM	
GATE ARM	ENABLE
GATE ARM DELAY	0-10 (seconds)
CONTROL MODE	Choose: PILOT CAR MODE

CHANGE TIMING	SETTINGS
RED CLEAR	1-600 (seconds)
SOLID YELLOW	1-15 (seconds)
YELLOW FLASH	MIN: 1-300 MAX: 1-300

HOME SCREEN	
SYNC RADIO REMOTE	Follow instructions on screen

TWO-WAY ZONE (MANUAL MODE)



SECONDARY 1

OPTIONS	SETTINGS
UNIT ID	SECONDARY 1
RADIO CHANNEL	0-9, HARDWIRED

PRIMARY

OPTIONS	SETTINGS
UNIT ID	PRIMARY
RADIO CHANNEL	0-9, HARDWIRED
SITE LAYOUT	TWO-WAY ZONE (MANUAL)
GATE ARM	
GATE ARM	ENABLE
GATE ARM DELAY	0-10 (seconds)
CONTROL MODE	Choose: MANUAL

CHANGE TIMING	SETTINGS
RED CLEAR	1-600 (seconds)
SOLID YELLOW	1-15 (seconds)
YELLOW FLASH	MIN: 1-300 MAX: 1-300

HOME SCREEN	
SYNC RADIO REMOTE	Follow instructions on screen

8 Radio Remote

The radio remote does not have an on/off switch. Pressing and holding any button will turn the radio on. The radio will automatically turn off after releasing a button. The radio frequency range is 910 MHz - 917 MHz (spread spectrum, frequency hopping) and operates at less than 1 watt of power. There is no FCC license required and the radio complies with all FCC regulations.

Radio Remote Push Buttons:

There are three buttons located at the top of the remote, a Red, Green, and Black button. Upon pressing any button an LED light near the button will light up confirming a valid command has been received by the RCF 2.4. You must press and hold the button for 3 seconds until the LED illuminates.

Radio Remote Push Buttons Functions:

(Manual Mode)

- Pressing the Red button initiates ALL STOP.
- Pressing the Green button will turn the Primary signal to YELLOW FLASH.
- Pressing the Black button will turn the Secondary signal to YELLOW FLASH.
- An ALL STOP must be performed prior to changing from a YELLOW FLASH at one unit to another.

Note:

a. Keep the remote control in the nylon case at all times in case it is dropped.

b. Keep remote control dry at all times to prevent water damage.

c. Keep 4 spare AA batteries on hand at all times.

Radio Remote Power supply:

The radio remote control is powered by 4 AA batteries which will last up to several months, depending on usage.

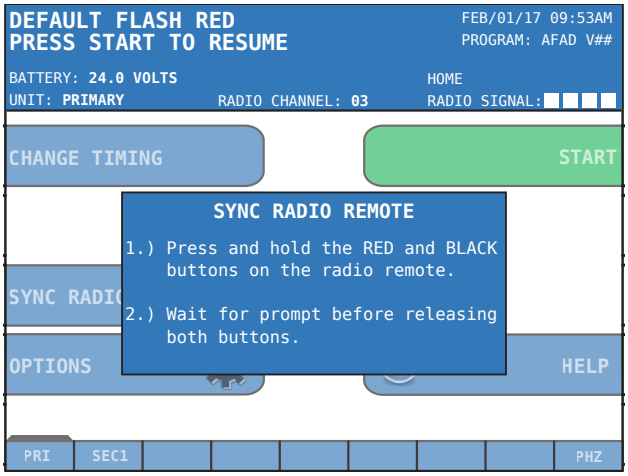
Weak Battery Indicator:

A chirping sound indicates the remote batteries are dead when a button is pressed.

Setting the Radio Channel:

Note: Setting the radio channel of the remote can be done at either the Primary or Secondary unit.

1. From the HOME screen, select SYNC RADIO REMOTE.
2. Pressing and holding the black and red buttons at the same time after selecting SYNC RADIO REMOTE on the controller will configure the controller radio channel to the radio remote.
3. A prompt will appear that will inform the user when sync is complete.



Generations of Radio Remote:

1/4 Watt Radio
(WHITE-WHITE)

1 Watt REV 1 Radio
(BLACK-WHITE)

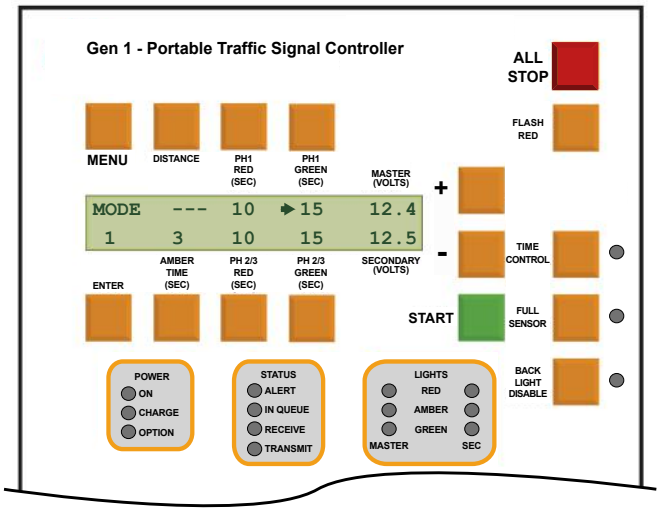
1 Watt Radio
(BLACK-BLUE)

1 WATT (BLACK-WHITE) is blank here

Radio Remote Type:	Compatible with systems: Gen 1	Gen 2	Gen 3	Channel Set Method	Qty. of Channels
1/4 Watt (WHITE-WHITE)	✓			Dip Switches	7
1 Watt (BLACK-WHITE)	✓	✓	✓	Dip Switches	7
1 Watt REV1 (BLACK-WHITE)	✓	✓	✓	Dip Switches	10
1 Watt (BLACK-BLUE)	✓	✓	✓	Sync to Gen 3 controller	10

9 COMPATIBILITY MODE

The Gen 3 CU has the capability of interfacing and operating with North America Traffic's previous generation of AFAD signal controller, known as Gen 1.



Note: If operating Gen 3 with the previous generation of control units (CU), the Gen 3 CU must always be the PRIMARY unit within the network.

Be aware that not all Gen 3 functions are available when operating in compatibility mode. Differences and limitations of compatibility mode are outlined below:

Note: Gen 3 AFAD's will only operate with the Gen 1 AFAD's that have the Digi XTend 1 Watt transceiver. Contact North America Traffic if another radio model is present.

Function:	GEN 1	GEN 3
Max quantity of secondary units	5	
Radio channel quantity	7 (0-6)	10 (0-9)
Emergency Vehicle Preemption	✗	✓
Railroad Preemption	✗	✓

9.1 SETTING COMPATIBILITY MODE ON GEN 3

As with all generations of CU, all the secondary units to be used in the network should be:

- powered before the primary unit
- proper unit ID assigned (refer to SECTION 9.2 OPERATING WITH GEN 1 for designation of proper unit ID's based on the generation of CU)
- set to the same radio channel

Refer to the specific unit's user field guide for instruction on setting the above.

1. Ensure all secondary units are powered, assigned the proper unit ID, and set to the correct radio channel.

2. Proceed to the Gen 3 AFAD unit and from the home screen select OPTIONS.
3. Set the UNIT ID to PRIMARY.
4. Set the RADIO CHANNEL to the same as all other secondary units in the network.
5. Set COMPATABILITY to GEN 1 AFAD. (OPTIONS > COMPATABILITY MODE)
6. Refer to SECTION 7 SETTING UP A WORK ZONE for detailed information on selecting the proper CONTROL MODE, LAYOUT, TIMING and OPTIONS settings (all timing and settings for all secondary units across the network are input/set at the Gen 3 primary unit).

9.2 OPERATING WITH GEN 1

The Gen 3 AFAD RCF 2.4 will operate with Gen 1 AFAD units using program version 62-7.

Due to the software structure of the Gen 1 system, unit ID's are not alike (or interchangeable) between the Gen 3 and Gen 1. For example, Gen 1 uses the unit ID of SECONDARY PHASE 1B and Gen 3 uses the equivalent unit ID of SECONDARY 1. This unit ID structure has a bearing on which Gen 1 unit ID's are assigned, based on the layout selected at the Gen 3 primary unit. Refer to the chart below to determine which Gen 1 secondary unit ID's are required, per the selected layout.

Note: The numbered boxes indicate the assigned phase (i.e. 1 = phase 1, 2 = phase 2)

GEN 3 SETUP		GEN 1 Secondary Unit ID's				
SITE LAYOUT	**Pri**	**S1B**	**S2A**	**S2B**	**S3A**	**S3B**
ONE-WAY ZONE - TWO UNITS	1	2				
TWO-WAY ZONE (MANUAL MODE)	**1**	**1**				
TWO-WAY 1 SIDE ROAD	**1**	**1**	2			
TWO-WAY 1 CROSS ROAD	**1**	**1**	**2**	**2**		
TWO-WAY 2 SIDE ROADS	**1**	**1**	2		3	
TWO-WAY 2 CROSS ROADS	**1**	**1**	**2**	**2**	**3**	**3**
TWO-WAY 3 SIDE	**1**					
TWO-WAY 4 SIDE	**1**					

Note: The Gen 3 primary CU alters its radio protocol when operating in Gen 1 compatibility mode. This may require the user to force a re-write of the radio channel on the Gen 3 radio modem. This can be accomplished by ensuring the correct radio channel is set on the Gen 3 CU, then completing a power off/ on cycle. This will establish communication between the Gen 3 CU and all associated Gen 1 CU's.

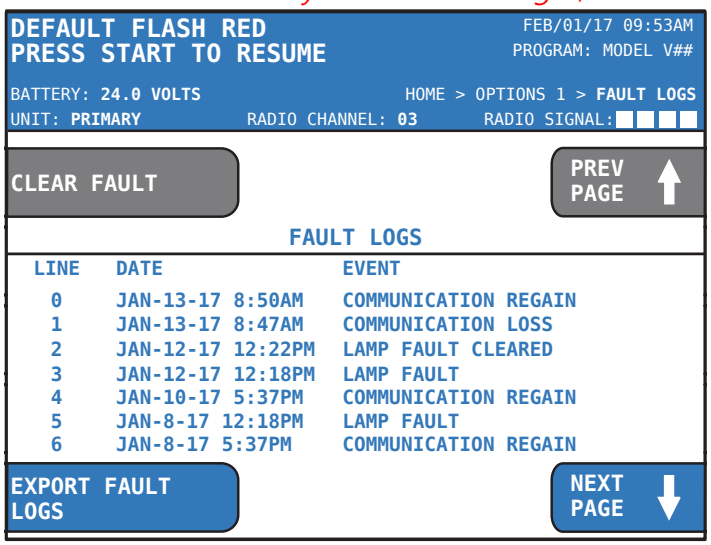
10 DATA MANAGEMENT

10.1 FAULT/DATA LOGS

The FAULT LOGS records both systems faults, as well as operational data. 10,000 events are held in memory for viewing on-screen or by means of export to a spread sheet file format.

Fault logs can be viewed at any unit within the network (PRIMARY or SECONDARY). Any fault event can be cleared from the PRIMARY unit (given the issue that caused the fault has been resolved), but only local fault events can be cleared at the SECONDARY unit at which the fault event took place. For example, a red lamp fault event at SECONDARY 2 unit cannot be cleared from the fault log screen at SECONDARY 1 unit. After correcting the issue, the user must clear the fault at the SECONDARY 2 unit or the PRIMARY unit.

Note: to see full list of system fault messages, see SECTION 15 TROUBLESHOOTING.



The Data Log records:

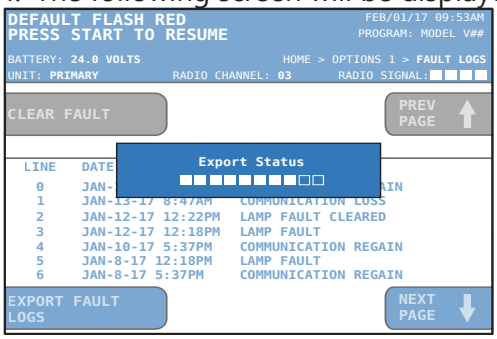
- Daily battery voltage at 12AM and 12PM
- System power on/off
- Program start (with timing inputs when DISTANCE calculator used)
- All timing changes made during operation
- Battery threshold transitions
- Pre-emption events (emergency vehicle and hold for railroad)
- System forced actuation events
- Software parameter import/exports
- Export of Data Logs

Viewing Fault and Data Logs:

1. From the HOME screen, select OPTIONS.
2. Scroll to OPTIONS PAGE 2 and select FAULT LOGS
3. Use the NEXT PAGE or PREV PAGE soft buttons to scroll through the logs.

Exporting Logs:

1. From the FAULT LOGS screen select EXPORT FAULT LOGS.
2. A prompt will appear to insert the USB flash drive.
3. Press EXPORT FAULT LOGS.
4. The following screen will be displayed.



5. Remove USB flash drive after the Export Status pop-up window disappears.

Note: If a previous data log is present on the USB flash drive, it will be overwritten by the next log export. Save or copy the existing log file to a computer prior to accepting another log file export to prevent data loss.

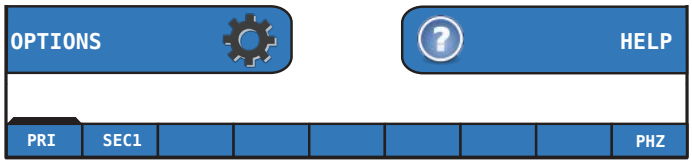
Note: The exported file type is a .csv (named "NATLogs") and can be viewed in any spreadsheet software. Once saved to the USB flash drive or computer the file name can be changed.

Viewing Exported Fault and Data Logs in a Spreadsheet:

1. Insert the USB flash drive in computer.
2. Open file "NATLogs.csv"

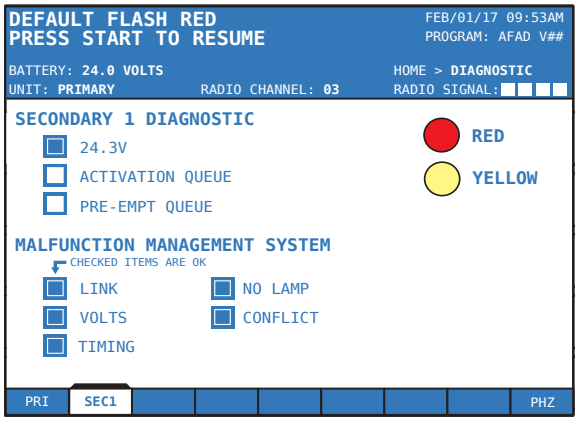
- Logs sort from oldest to newest
- Column identification:
  - A: date and time stamp (may require altering the data format to short or long date to properly view log dates)
  - B: numerical ID for fault or data code
  - C: fault/data message
  - D: additional data captured by system as it relates to the type of data log
- Columns A and C contain pertinent infomation by the end user

10.2 SYSTEM STATUS AND DIAGNOSTICS



Using the ← and → directional buttons from the HOME screen will allow you to view the PHASE STATUS and DIAGNOSTIC screens for each unit in the network. Press ENTER to view the selected tab.

Diagnostic Screen:



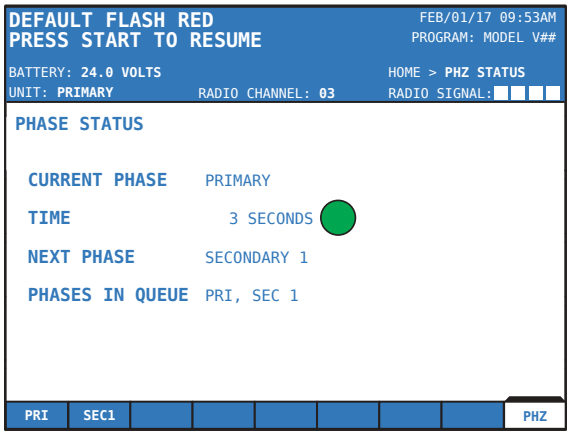
Status of Lamps – graphic displays the active lamp.

Basic Unit Diagnostic:

- Battery voltage
- Activation Queue: checked if vehicle detection event is present
- Pre-empt Queue: checked if preemption event is present

MALFUNCTION MANAGEMENT SYSTEM – the MMS runs through its systems checks and the checked items confirm there are no issues.

Phase Status (PHZ):



CURRENT PHASE – displays which unit(s) is being served by the current phase.

TIME – indicates how many seconds are remaining for the corresponding signal indication.

NEXT PHASE – indicates which unit will be served by the following phase.

PHASES IN QUEUE – displays which units will be served following the unit listed in "NEXT PHASE".

10.3 SOFTWARE IMPORT/EXPORT

Software updates and preprogrammed traffic plans can be imported via USB flash drive. Exporting can be used to save plans or for tansfer of plans to other controllers. This will save all program settings to the USB flash drive.

1. From the OPTIONS menu, select SOFTWARE IMPORT/EXPORT. Following the prompt on screen, insert the USB flash drive.
2. Select START IMPORT or START EXPORT when ready.
3. Prompt to enter the system passcode will apprear. Enter the passcode (see SECTION 5.3 SYSTEM PASSCODE).
4. Pop-up status window will appear and notify when the export/import in complete.
5. Remove the USB flash drive.

11 Optional Equipment

11.1 Remote Monitoring Services (RMS)

Two forms of RMS are offered:

- Cellular
- Satellite

Both forms of RMS require external hardware to be interfaced with the Gen 3 controller. They also both provide the end user with the same system fault information:

- Communication Failure
- Conflict between signals
- Lamp Fault
- Other (i.e. low battery status, damage to controller)

The GPS system allows for asset location tracking and geofencing via a secured website. The battery bank voltage can also be remotely monitored. (A geofence is a virtual barrier which is set in the GPS software).

	Cellular	**Satellite**
Communication Method & Coverage	- communicates from the automated flagger assistance device (AFAD) to the end user through the cellular network - limited to areas of cellular coverage	- communicates from the AFAD to the end user through connection to orbiting satellites - communication anywhere in the world where the AFAD is deployed
Fault Message Delivery	- text messages (4 max) - email (4 max)	- text messages* (unlimited) - email (unlimited) *end user must have 'email to text' capability through their cellular carrier
Web Based User Interface	- user can login to view: • current operating status (on/off and battery voltage at that AFAD) • physical location of the AFAD • activity log of on/off and fault events	
Theft Prevention (Geo-Fencing)	- user can set up desired radius; if the AFAD is moved outside the designated area, the user is notified by text or email	

11.2 Intrusion Alarm

The intrusion alarm system requires the following hardware additions on the base RCF 2.4:

- siren amplifier
- siren speaker
- intrusion infrared sensor

Application

The intrusion alarm (when enabled) will sound the siren if a vehicle passes through a red indication. This notifies the workers on site of a vehicular intrusion, granting them time to exit the roadway.

The intrusion alarm sensor becomes inactive when a “flash amber” phase is served. Once the unit transitions to an ALL STOP, the intrusion sensor becomes active.

Should a vehicle intrude on a red signal while the gate arm is lowering, the gate arm will retract. This retract feature can be enabled or disabled in the software.

12 Communications

12.1 Radio System

Best Practices:

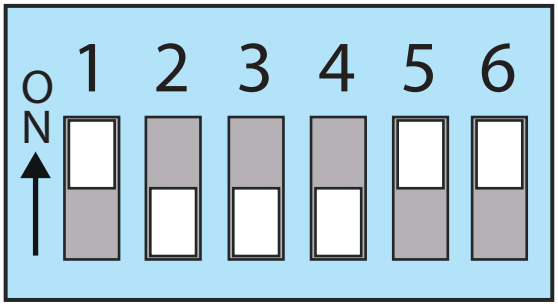
- Operate with strong radio signal strength. At least 50% strength consistently (see Systems Tray).
- Operate within 1/2 mile (0.8 km) apart including line of site (if using the standard omni-directional antenna).

Common Interference:

- Anything that interrupts line of sight between the units. i.e. tractor trailers, bridges, heavy equipment, elevation changes.
- Anywhere there is large amounts of rock exposed causes interference.
- Anything in the area containing a lot of structural steel.
- Close proximity to radio stations, airports, and powerlines.

Dip Switch Settings:

1 Watt Radio Module



12.2 Hardwire

Where it is required:

- Weak RSSI signal strength. Less than 50% consistently (see Systems Tray).
- No line of sight. i.e. inside a parking garage, tunnels, across large steel bridges, under an overpass.

Cable Requirements:

- Minimum Cable Specification: Single twisted pair with a ground and braided wire; shielded. 22 AWG conductor size. Max length of 4000 ft. (1219 m) and/or 4 splices.
- Recommended Cable: Belden Cable 3106A Multi-conductor.
- Cable may need to cross roadway overhead, by saw cuts in the road, or through a culvert.
- An alternative to these would be a cable protector channel.

13 Power System Information

13.1 Solar

The RCF 2.4 has one (1) 100 Watt solar panel. The solar panel is regulated with a 10 amp regulator. The solar panel provides only supplemental charge to the battery bank and does not allow for infinite operation. Charging an operating battery bank (4 batteries) by means of 120VAC source may be required every 7 days (temperature will have an influence on this. Refer to Section 13.2 Batteries).

Importance of Sun Exposure

Shade and even dust has a significant impact on solar collection. Roughly 5% coverage almost completely negates the solar panel's current output. Steps should be taken to minimize shading of the panel, if possible.

Cleaning

The accumulation of dirt, debris, and snow will significantly hinder the solar arrays capability to provide charge to the batteries. It is recommended that the solar array be inspected on a daily basis to ensure it is free of dirt and debris. Should the array require cleaning, use water and a mild soap and wipe clean. Do not use harsh chemicals on the solar array. Do not use shovels, rakes, or any other metal tool to clean debris from the solar array as damage to the glass may occur. Use a car snow brush or broom to remove snow or other large debris from the solar array.

13.2 Batteries

The RCF 2.4 battery bank is comprised of wet cell (lead acid), 6 volt batteries, wired for a 24 volt power supply. This model comes equipped with a 4 battery configuration. As an option, sealed lead acid (AGM) batteries are available.

Autonomy

The autonomy of the battery bank is defined as how many hours the units will operate the signal lamps and controller hardware for without receiving any recharge aid from the solar array (in the absence of sunlight). The autonomy for the battery configuration is:

Flooded Lead Acid (FLA):

4 batteries: 168 hours

Sealed Lead Acid (AGM):

4 batteries: 162 hours

Note: The above autonomy ratings are based on fully charged, maintained batteries (as per the manufacturer's guidelines), operating at a temperature of 21° Celsius or 72° Fahrenheit.

Factors that affect battery autonomy are:

Temperature

Extreme temperatures (both high and low) can dramatically affect battery autonomy and charging.

High

Heat increases water usage and can result in overcharging and depletion of water, leading to damage. Batteries naturally discharge at temperatures above 49° Celsius (120° Fahrenheit). Batteries require less time to charge in high temperatures, which can result in rapid over-charging and damage to the batteries.

Low

Discharging batteries at low temperatures makes the batteries susceptible to freezing due to the

depletion of acid within the battery as it discharges. Batteries require a longer period of time to charge in cold temperatures.

Batteries should be operated (discharged) in the temperature range of -29° to +49° Celsius (-20° to +120° Fahrenheit). Batteries discharged below 0° Celsius (32° Fahrenheit) should be charged immediately to avoid freezing.

Over Discharge

Lead acid batteries are 'non-memory' and over-discharge will cause damage and premature battery failure. To avoid over-discharge, the RCF 2.4 notifies the user of low battery voltage (23.6 Volts or less) by emitting a continual beep and displaying the message 'CHARGE FOR 24 to 48 HOURS' on the screen.

Inactivity

Lead acid batteries that are not in use will slowly discharge over time, possibly leading to over-discharge and damage to the batteries. If the batteries will be inactive for a long period of time (EXAMPLE: sitting over the winter months), then the charger should be plugged in periodically or ensure the solar panels have good exposure to the sun and are free of debris.

Low Battery Notification and Charging

The signal controller will notify the user that charging is required when the battery bank voltage reaches 23.6 Volts. The notification consists of continuous beeping emitted from the controller hardware and a message on the controller of 'CHARGE FOR 24 to 48 HOURS'. Connection to a 120 VAC source for a minimum of 24 hours is required to bring the battery bank back to a full charge. If using a generator, refer to Section 13.4 Generator Use for instruction.

Note: intermittent charging for short periods of time will not provide adequate charge to the battery bank. A continuous charge for a minimum of 24 hours is required.

Battery Threshold states:

Low - 23.6 Normal operation continues, but system warns user to charge the batteries for 24 to 48 hours.

Dead - 23.0 Operation is terminated and system enters default mode behaviour. Charging message displayed on the controller.

Blackout - 21.0 Lamp indications are terminated and go dark. Radio communications continue within the network and controller interface remains operable.

13.3 Charger

The battery charger is used to recharge the batteries by means of connection to a 120 VAC power source (wall outlet or generator). The RCF 2.4 has a 15 Amp charger with a maximum power output of 675 Watts (at 24 VDC).

The charger plug (for connection to the 120 VAC source) is located at the base of the control cabinet door and can be accessed without the need to open the control cabinet (refer to Section 13.4 Generator Use if using a generator).

Note: Always ensure that the power cable used to connect to the battery charger is the correct gauge, in good working condition and properly grounded.

13.4 Generator Use

A minimum 1200 Watt generator is required to meet the power requirements of the battery charger.

Connection and Operation

Caution: never start up the generator while connected to the battery charger. This may lead to damage and/or failure of the battery charger.

Generators can output high voltage spikes upon initial startup. To protect the battery charger from such voltage spikes, allow the generator to run for a few minutes after initial startup, then make the connection to the battery charger.

14 General Maintenance

Please refer to website for latest maintenance forms.

www.northamericatraffic.com

15 Troubleshooting

Message	Description	Cause	Solution
CHECK SETTINGS THEN PRESS START	Primary unit is ready to operate	Machine(s) running properly	Press “Start” button on Primary when ready to start program
CYCLE PAUSED	While running automatic cycle	User has paused the cycle (all red) with the hand held remote	Press the green button on HHR when ready to start program
TURN ON SECONDARY UNIT “X”	The Primary unit is waiting for communications from the Secondary “x” after the power is turned on	Secondary “x” is not turned on Secondary “x” is on, radio channel is different then primary unit Secondary “x” is on, radio cable is not attached to transmittor Secondary “x” is on, radio dip switches have been changed Secondary “x” is on, antenna has been damaged Secondary “x” is on, radio cable has been damaged	Turn on Secondary “x” Change radio channel on Secondary “x” to match Primary Attach radio cable to radio to radio transmittor Set the dip switches as per diagram (see Section 12.1) Replace antenna Replace radio cable
TURN ON PRIMARY UNIT	Secondary waiting for communications to start after power is turned on	Primary is not turned on Primary is on, radio channel is different than Secondary “x” Primary is on, radio cable is not attached to transmittor Primary is on, radio dip switches have been changed Primary is on, antenna has been damaged Primary is on, radio cable has been damaged	Turn on Primary Change radio channel on Secondary“x” to the same as Primary Attach radio cable to radio transmittor Set the dip switches as per diagram Replace antenna Replace radio cable
COMMUNICATION OK PRESS START TO RESUME	Primary unit sees good communication from all enabled Secondary units	Machine(s) running properly	Press “Start” button on Primary when ready to start program
COMMUNICATION FAILED SEE PRIMARY UNIT	Secondary unit sees a radio communication failure	Go to Primary and refer to “REPAIR COMMUNICATION”	

Message	Description	Cause	Solution
REPAIR COMMUNICATION	Communication failure is seen by the primary unit	Primary and Secondary “x” are too far apart Primary and Secondary “x” do not have line of sight Primary and Secondary “x” lost communication due to temporary loss of line of sight, i.e. slow moving transport truck between signals Radio channel is changed on one signal only Radio dip switches have been changed Radio cable is not attached to the transmittor Radio cable has been damaged Radio interferance	Move machines closer or use hardwired connection Move machines to achieve line of sight or use hardwired connection Increase drop out time (see Section 6.4) Enable COMMUNICATION REGAIN (see 6.4) Change other signal(s) to same radio channel Set the dip switches as per diagram (see Section 12.1) Attach radio cable to radio transmittor Replace radio cable Change radio channel on all signals up or down one channel. Ensure all singals are changed to the same channel
PROBLEM DETECTED ON LAMP: X REPAIR MACHINE	Current overload (short circuit) or underload (open circuit) lamp outputs	Faulty wire connection Faulty wires Faulty lamp Faulty controller	Check connections and reconnect wiring Check wires, replace where necessary Replace faulty lamp Replace faulty controller
ATTENTION: SEE PRIMARY UNIT	Secondary sees a problem with the Primary unit	Problem with Primary signal	Go to Primary signal to view error
ATTENTION: SEE SECONDARY UNIT “x”	Primary sees a problem with Secondary unit “x”	Problem with Secondary “x” signal	Go to Secondary “x” signal to view error
DEFAULT FLASH RED	Default flashing, as shown on Secondary machine	Previous fault has cleared automatically Machine Failure	Press “START” button on Primary when ready to start program See Primary unit for instruction
DEFAULT FLASH RED PRESS START TO RESUME	Default flashing, as shown on Primary machine	Previous fault has cleared automatically Machine Failure	Press “START” button on Primary when ready to start program See Primary unit for instruction

Message	Description	Cause	Solution
ALL STOP	System is in “all red”, Secondary unit	All stop has been triggered by radio remote or “ALL STOP” button on the Primary or Secondary controller	Press “START” button on Primary, when ready to start program Press “RESUME PROGRAM” at the Secondary unit at which the ALL STOP was conducted
ALL STOP PRESS START TO RESUME	System is in a red state at all units	All stop has been triggered by preemption, radio remote or “ALL STOP” button on controller	Press “START” button on Primary, when ready to start program
STARTED OPERATING FINE	Normal operation, as shown on Primary machine	Signal is operating within normal parameters	
OPERATING FINE	Normal operation, as shown on Secondary machine	Signal is operating within normal parameters	
BATTERY LOW CHARGE FOR 48 HRS	Battery bank voltage is reading low	Battery charge is below 23.6V, machine will still operate	Plug internal charger into 110V power source for minimum 24hrs of continuous charging
MALFUNCTION RESPONSE BATTERY DEAD CHARGE FOR 48 HRS	Malfunction management system detected that the battery is too low to operate	Battery charge is below 23.0V, machine will not operate	Plug internal charger into 110V power source for minimum 48hrs of continuous charging
MACHINE FAULT CHECK RS-485 WIRING	Communications timeout on the RS-485 network	Wiring harness to controller faulty Malfunction management system link is broken Controller failure	Replace faulty harness Check unit diagnostic tab, check for Malfunction management system link (checked box) Replace controller
CHANGING…	Machines are changing states (between default flashing, default all stop, operating)		
MALFUNCTION RESPONSE NO LAMPS (DARK) REPAIR MACHINE	Malfunction management system detected that no lamps were displayed	All LED lamps not connected Faulty controller	Connect LED lamps Replace controller
MALFUNCTION RESPONSE CHECK LAMP WIRING REPAIR MACHINE	Malfunction management system detected a timing fault on a lamp circuit	LED lamp(s) not connected Faulty controller	Connect LED lamp(s) Replace controller

Message	Description	Cause	Solution
MALFUNCTION RESPONSE CONFLICTING LAMPS REPAIR MACHINE	Malfunction management system detected a conflicting lamp output	Short circuit in wiring LED lamps connected to wrong terminal	Check and replace faulty wiring Check wiring diagram and terminal block
DEFAULT ALL RED PRESS START TO RESUME	Default solid red, as shown on Primary machine	Previous fault has cleared automatically	Press “START” button on Primary, when ready to start program
DEFAULT ALL RED	Default solid red, as shown on Secondary machine	Previous fault has cleared automatically	Press “START” button on Primary, when ready to start program
HOLD FOR RAILROAD	While running automatic cycle, system has paused for railroad preemption (all red)	Signals are operating within normal parameters	Automatic cycle will restart once the system is told the railroad is clear
DEFAULT FLASHER PRESS START TO RESUME	When primary unit is first powered	Post-power up	Press START PROGRAM

16 Parts List

Part Name	Part Number
Gen 3 Controller	**500-0676**
12" Red Lamp (P3)	**500-0691**
12" Yellow Lamp (P3)	**500-0692**
4" Back Lamp (24V)	**500-0737**
Two Section Housing w/ Visors	**500-0064**
10" Ball Cap Visor	**500-0070**
1200lbs Hand Winch	**500-0182**
Flat Mount Pulley	**800-0480**
7dB Whip Antenna	**500-0003**
Antenna Base Plane Station	**400-0146**
Antenna Coil Cable	**400-0416**
XTend 1 Watt Radio Transceiver	**500-0092**
Lamp and Solar Coil Cable	**500-0995**
100 Watt 24V Solar Panel	**500-0782**
10A Solar Regulator	**500-0673**
6V FLA US2200 Battery	**500-0149**
15A 24V Battery Charger	**500-0731**
5A ATC Fuse	**400-0419**
15A ATC Fuse	**500-0377**
ST175/80R13 Tire w/ Wheel	**500-0119**
Fender	**100-0076**
Leaf Spring Axle	**500-0262**
2" Ball Coupler	**500-0235**
Running Light Plug 7-Way	**800-0227**
Running Light Receptacle 7-Way	**800-0226**
10ft Aluminum Gate Arm	**500-0981**
18" x 18" Orange Flag	**500-0055**
R10-6 24" x 36" Stop Here on Red Sign	**500-0608**
1/2" x 4 3/4" Hitch Pin (Towing, Gate Arm) x1	**300-0095**
1/2" x 6 1/2" Hitch Pin (Towing, Gate Arm) x5	**300-0093**
Locking Plates (Towing)	**100-0086**
Coupling Bar (Towing)	**100-0085**
T-Handle Latch	**500-0168**
J1 Harness	**400-0212**
J2 Harness	**400-0213**
24V RCF 2.4 Actuator	**500-0990**
Abus Lock	**500-0001**
LED Running Light Kit	**400-0272**
Rb-78 24" x 36" Stop Here on Red Signal Sign (Canada)	**800-0133**