

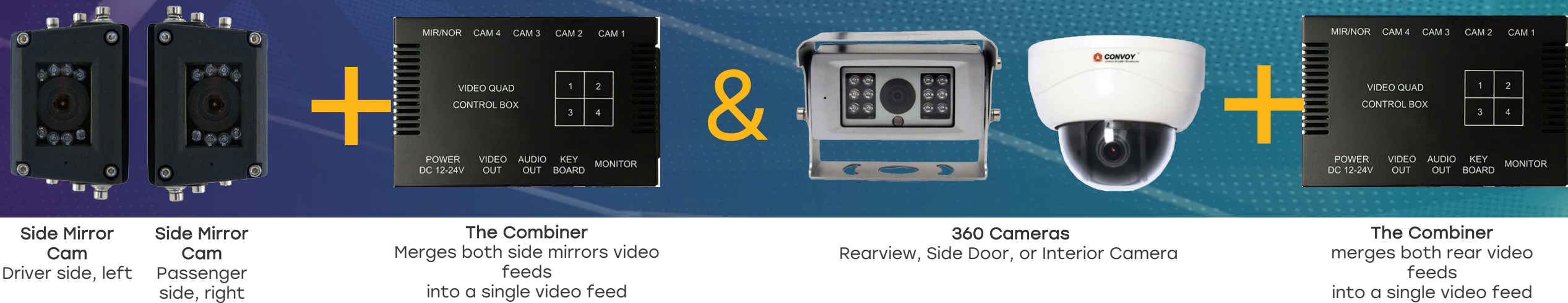
SmartDrive™ SR4 360 VSA

360 Six Camera Installation

(2) SmartDrive Cameras: Forward-facing & Cab-facing cameras

(2) Convoy Side Mirror Cameras and (2) other Convoy cameras such as Rearview, side door, or interior camera

Installation Quality Standards



360 VSA: Six Camera Installation

Examples of six camera installations

There are many reasons that a six-camera installation is needed.

Box Truck



2 SmartDrive cameras

- Forward-facing (road)
- Cab-facing (driver)

2 Side mirror cameras (left/right)

1 Rearview backup camera

1 Load/lift camera

Bus



2 SmartDrive cameras

- Forward-facing (road)
- Cab-facing (driver)

2 Side mirror cameras (left/right)

1 Rearview backup camera

1 Wheelchair lift or side exit door

Flatbed



2 SmartDrive cameras

- Forward-facing (road)
- Cab-facing (driver)

2 Side mirror cameras (left/right)

1 Rearview backup camera

1 Load camera to monitor the load during the trip and when loading and unloading the flatbed.

360 VSA: Six Camera Installation

Standards Overview

<u>1</u>	Securely mount the 360 mirror-mount camera to the vehicle using the appropriate bracket
<u>2</u>	Align 360 camera view - Properly align the camera(s) to ensure proper Field of View (FOV)
<u>3</u>	Secure & protect exterior cable run - Use cable clamps and zip ties to secure cabling & protect from pinching and damage
<u>4</u>	Secure & protect interior cable run - When routing camera cable into the vehicle (pass through) use a grommet and/or cable split loom to protect cable from pinching and damage
<u>5</u>	Merge Side Mirror videos feeds using a Convoy Combiner Box
<u>6</u>	Controller cable connection - Route and connect the camera cable(s) to the appropriate Controller ANALOG camera port
<u>7</u>	Final QA checkout
<u>8</u>	Fifth Camera Spec Guides

Securely Mount Side Mirror Cameras



360 VSA: Six Camera Installation

Securely Mount the mirror-mount camera to the vehicle

Mounting STD Mirror-Mount Camera & Bracket

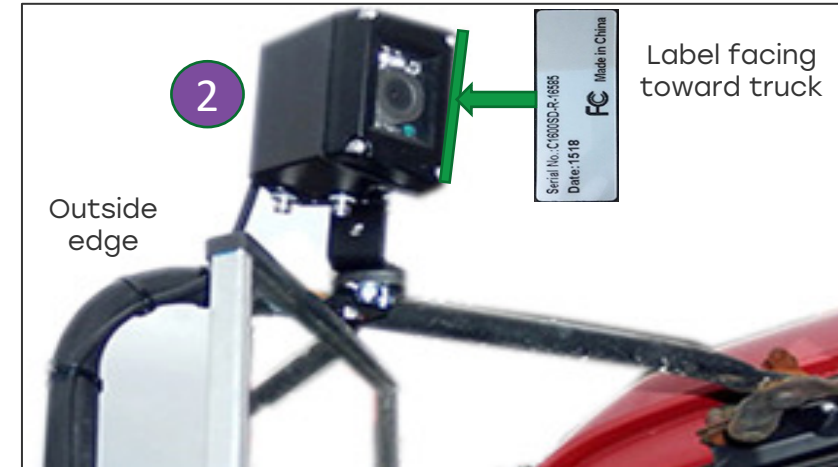
1. Use the mirror bracket designated for the vehicle make-model
2. Mount the camera vertically to the top side of the truck's mirror bracket so the lens can see the entire side of the vehicle

Verify:

- a) The camera label is facing toward the truck's door
- b) The camera is not mounted beyond the outside edge of the side mirror bracket.
- b) The bracket and camera are securely attached to the vehicle mirror mount.

Camera Type	Description	Mounting Location
<u>Passenger-side</u> Mirror-Mount	Passenger side (RIGHT) C1600SD- R	TOP Right-side mirror
<u>Driver-side</u> Mirror-Mount	Driver-side (LEFT) C1600SD- L	TOP Left-side mirror

Standard SIDE MIRROR-MOUNT CAMERA ORIENTATION



C1600SD-L
Driver side, left



C1600SD-R
Passenger side, right

Rotated Mirror Installation on Heavy-duty vehicles

Securely Mount the mirror-mount camera to the vehicle

Mounting Rotated Mirror-Mount Camera & Bracket

Only effects heavy-duty Vehicles: Kenworth T660, T680, & T880

Rotated Camera Orientation

The camera's imager is rotated to allow mounting to the bottom of a mirror and still capture the side of the vehicle.

1. Mount the camera horizontally to the bottom of the truck's mirror using the pre-equipped adjustment plate. This mount DOES NOT require a bracket.
2. The camera label should face up toward the mirror, and the camera lens needs to capture the entire side of the vehicle.

Camera Type	Description	Mounting Location
Mirror-Mount <u>Passenger-side</u>	ROTATED Passenger side (RIGHT) C1600SD- RR	BOTTOM Right-side Mirror
Mirror-Mount <u>Driver-side</u>	ROTATED Driver-side (LEFT) C1600SD- LR	BOTTOM Left-side mirror

ROTATED SIDE MIRROR-MOUNT CAMERA ORIENTATION



C1600SD-LR
Driver
side left



C1600SD-RR
Passenger
side, right

- a) The camera must not be mounted beyond the outside edge of the side mirror bracket
- b) The bracket and camera are securely attached to the vehicle's mirror mount.

360 VSA: Six Camera Installation

360 Side Mirror Camera: Approved Mounting Locations

TOP OF MIRROR

1. Top of the mirror's frame (standard camera)



IMPORTANT: The side mirror camera must not be mounted beyond the outside edge of the side mirror



Rotated Mirror Installation

360 Side Mirror Camera: Approved Mounting Locations

BOTTOM OF THE MIRROR

1. Bottom of the mirror (rotated camera)

Only affects heavy-duty Vehicles
Kenworth T660, T680, & T880



Bottom of the mirror - Rotated Camera

IMPORTANT:
The side mirror camera must not be mounted
beyond the outside edge of the side mirror

2. Bottom of the mirror bracket using a custom bracket (standard camera)



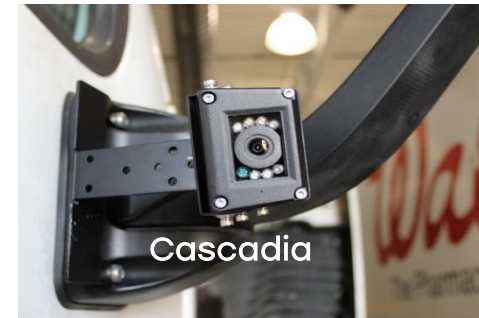
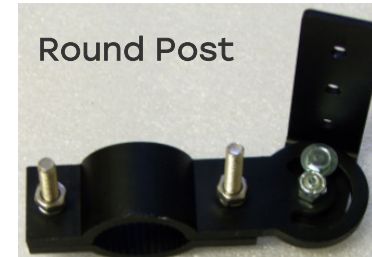
Bottom bracket
Standard Camera



360 VSA: Six Camera Installation

Available Convoy Camera Brackets

APPLICATION	BRACKET USED with C1600SD camera
Large Round Post style bracket (Post size 1.125" and larger)	1600BKA3
Small Round Post style bracket (Post size <.75" - 1.125")	1600BKA2/B1
Freightliner <i>Classic Cascadia</i> Right side (seen on 2007-2019 Classic Cascadia)	1600BK-A1R
Freightliner <i>Classic Cascadia</i> Left side (seen on 2007 - 2019 Classic Cascadia)	1600BK-A1L
Freightliner <i>New Cascadia</i> Right side (seen on select 2018 and up New Cascadia)	1600BK-A2R
Freightliner <i>New Cascadia</i> Left side (seen on select 2018 and up New Cascadia)	1600BK-A2L
Peterbilt modular mirror (579 and others like it)	1600BK-PB
Volvo 3 bolt bracket Right side	1600VOLBKT-R
Volvo 3 bolt bracket Left side	1600VOLBKT-L



Align 360 Camera View



360 VSA: Six Camera Installation

Align 360 camera view - Properly align the camera(s) to ensure proper Field of View (FOV)

Correct Camera Mounting

Good camera angle

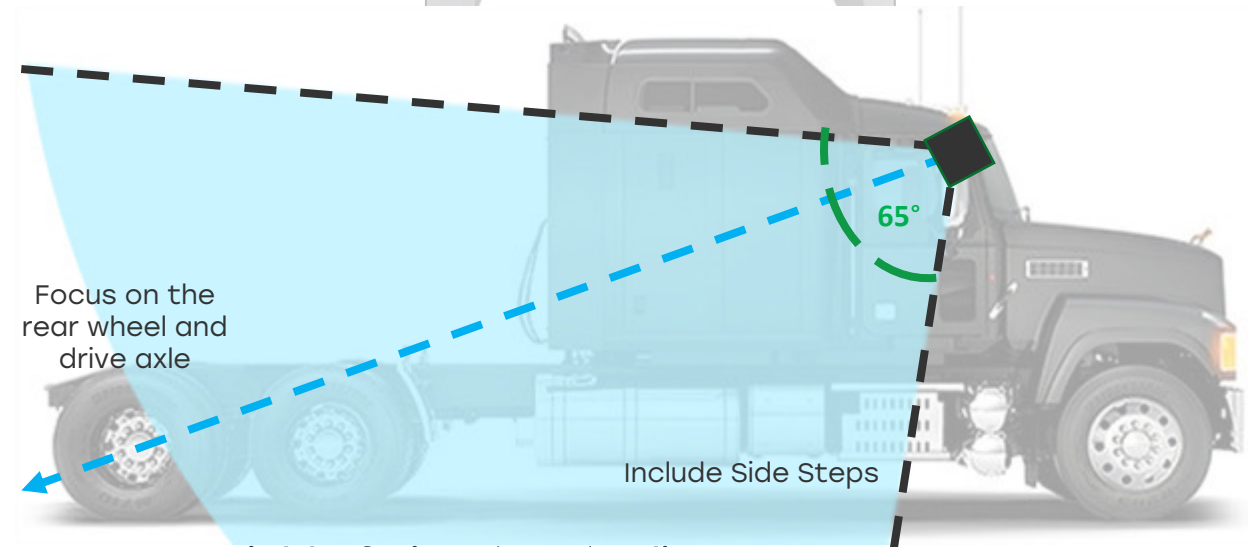
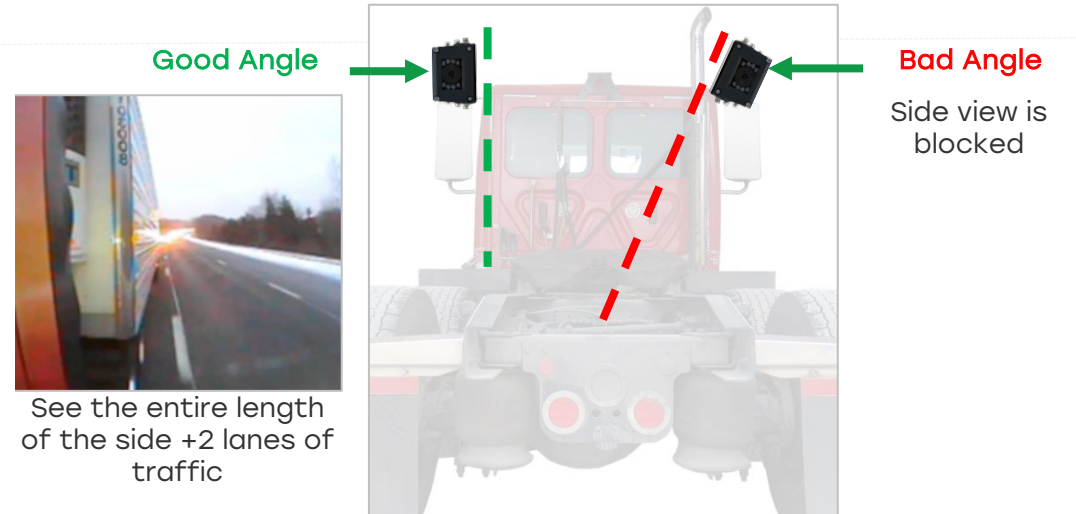
- Make sure you are using the camera for the correct side
 - 1600SD-L is driver side
 - 1600SD-R is passenger side
- Camera label must be facing the truck side



- Aim camera lens towards the rear axle and capture the front steps
- Must see the entire side of the vehicle and 2 lanes of traffic

Bad camera angle

- Can't see along the entire side of the vehicle
- Can't see 2 lanes of traffic



Camera's Field of View (FOV) Alignment

360 VSA: Six Camera Installation

Align 360 camera view – Avoid FOV Obstructions

Watch for obstructions in the Field of View (FOV)

When mounting the side mirror camera, it is important to mount the camera toward the outer edge of the mirror.

The following obstruction must not block the side view of the vehicle

- ✓ Exhaust stack
- ✓ CB antenna & additional mirrors
- ✓ Large bulkheads
- ✓ Trailers and other equipment that is wider than the tractor

Quality Check (QC) Verify no Obstructions and Pinched Wires

Before creating a manual event for the QC check, make sure the camera is not obstructed, or wires are pinched:

- ✓ All side mirror cables are secured
- ✓ Camera lens is aimed towards the rear axle and captures the front steps
- ✓ Camera wires are not pinched or damaged
- ✓ Open the door and make sure the camera is not blocked
- ✓ Make sure there are no other obstructions

Avoid Exhaust Stacks

Trailer wider than tractor

No steps are shown



Exhaust stack not blocking side of vehicle

Clear view of the side of the vehicle



360 VSA: Six Camera Installation

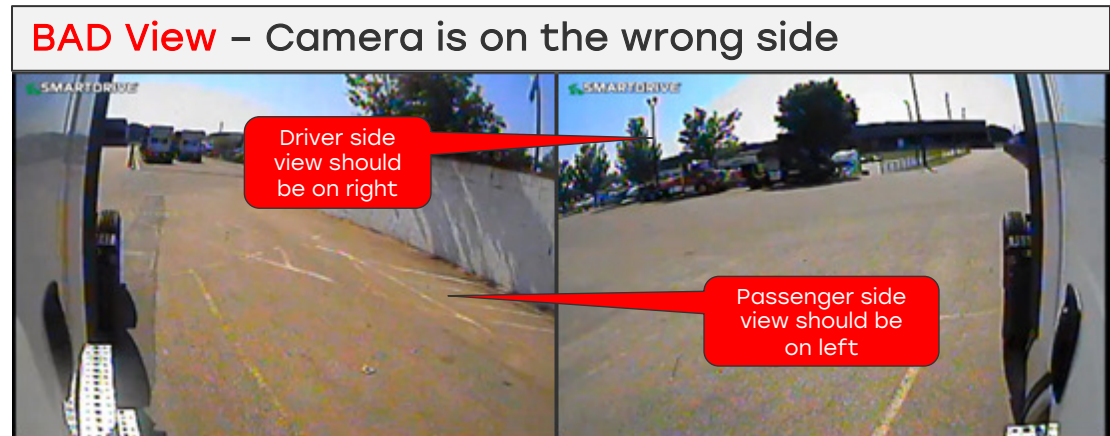
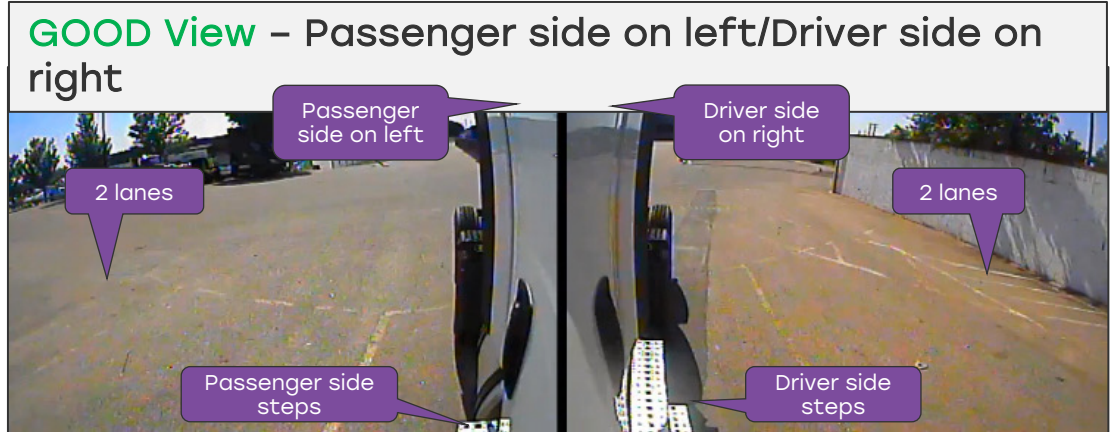
Align 360 camera view – Properly align the camera(s) to ensure proper Field of View (FOV)

Steps to align the camera view

- Focus the camera facing the back of the vehicle
- Mounting location is the same on each side of the vehicle
- Adjusted down at the same height and angle
- Must see the entire side of the vehicle
- Must see some of the bottom steps on each side

Quality Check (QC) Criteria

- Must see the entire side of the vehicle
- See two lanes on each side of the vehicle
- The view is approximately the same on each side
- Passenger side view on the left – Driver side view on right
 - Sides of the vehicle should meet in the middle of the two images (see good view)
- See some of the bottom steps on each side



Secure & Protect Exterior Cable Run



360 VSA: Six Camera Installation

360 Side Mirror-Mount: Camera on top

Side Mirror Cable Run

1. Depending on vehicle type, route wire through door, fender, or engine bay. (Each vehicle will be different; the installer needs to work with the customer on wire entry options)
2. Weatherproof the adjoining connectors between the camera and the SmartDrive cable with die electric grease and using heat shrink tubing or the black sleeve protector on SmartDrive's extension cable (if supplied)

Protecting the cable in a pass-through

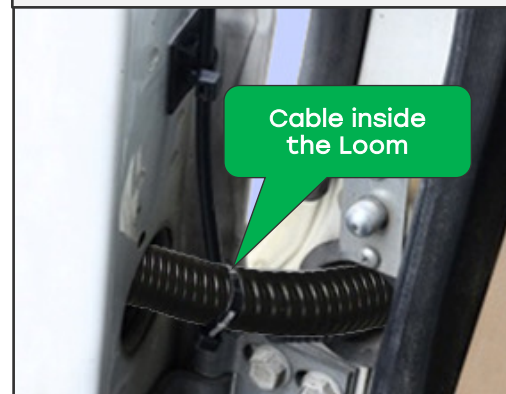
It is highly recommended to use an existing pass-through to run the cable into the cab

In a door jamb, use a split loom to protect the cable from pinching and damage when the door is used

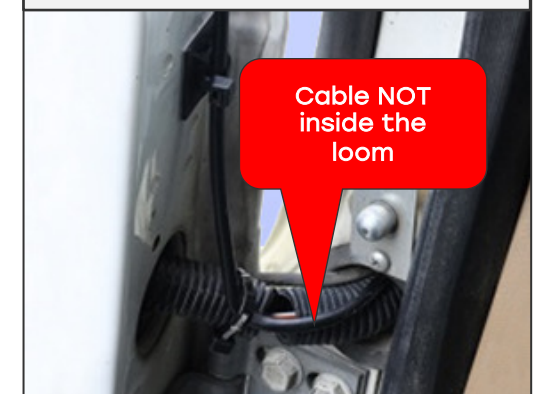
Cable run from camera



GOOD - LOOM USED



BAD - NOT INSIDE LOOM



Secure & Protect Interior Cable Run



360 VSA: Six Camera Installation

Best Practices for Securing Cables

The cable must not impede the operation of the vehicle or the driver's safety.

Cable Protection

It is important to maintain the integrity of the cable itself from pinching, binding, or tension of any kind

Secure the cable

- **Zip ties:** Secure the cable with zip ties as needed
- **Cable ties/P-rings:** Use in areas where a zip tie cannot be used

Avoid moving parts

- Keep cables away from moving parts such as windows and windshield wipers

Cable movement

- When a cable runs from a location that is movable such as a door or side mirror, then folds up against the vehicle, leaving enough slack in the cable to prevent binding or pulling on the cable. Be sure the cable to secure and will hold its place during movement.

Weather Proofing

- When a cable connector is exposed to the elements, it needs to be weatherproofed.
- Apply a small amount of die-electric grease to the connection
- Use a rubber sleeve (if provided) or heat shrink wrapping.



360 VSA: Six Camera Installation

Secure & protect interior cable run

Protecting the cable in a pass-through

It is highly recommended to use an existing pass-through to run the cable into the cab

In a door jamb, use a split loom to protect the cable from pinching and damage when the door is used

When an existing pass-through is not available
Use a rubber grommet when a hole is drilled. Seal the pass-through to prevent water from entering the vehicle



GOOD - LOOM USED



BAD - LOOM NOT USED



GOOD - GROMMET USED



BAD - GROMMET NOT USED



360 VSA: Six Camera Installation

Protect the cable when using a pass-through

HOME

Corrugated split loom

Loom is used to protect cables from abrasion and corrosion. Use loom when the cable is in harsh environments, such as the engine compartment.

Rubber grommet (drill hole)

When a hole is drilled through metal or other surfaces, use a rubber grommet to protect the cable from abrasion. Each Convoy camera includes a grommet on the cable.

Pass through

Try to use existing pass-through as an alternative to drilling holes. They are found in the firewall, the door jamb, and sometimes in the floor.

Water seal

When using a pass-through, seal the hole to prevent water from entering the vehicle. When possible, it is good practice to let the cable loop below the pass-through so that water drips off the loop vs. attempting to enter the cab.



Merge Camera Video Feeds using a Convoy Combiner Box



360 VSA: Six Camera Installation

360 Rear Cameras – Combine Rear video feeds using a Convoy Combiner Box

Details

Combine the rear camera video feeds into a single feed using a Convoy Combiner Box

1. Connect both rear view cameras to the Combiner Box
 - Closer camera to Cam1 port
 - Further camera to Cam2 port
2. Using the RCA Video (OUT) port, use the RCA output to the E1 Cable
 - A. An extension cable is available if needed
3. Connect the E1 cable to the controller to the Analog 1 port

NOTE – LEAVE 2 PINS ON THE E1 CABLE FOR COMBINER DISCONNECTED

CAMERAS WILL GET POWER FROM THE COMBINER



Combined side mirror cameras

Combined rear-view cameras

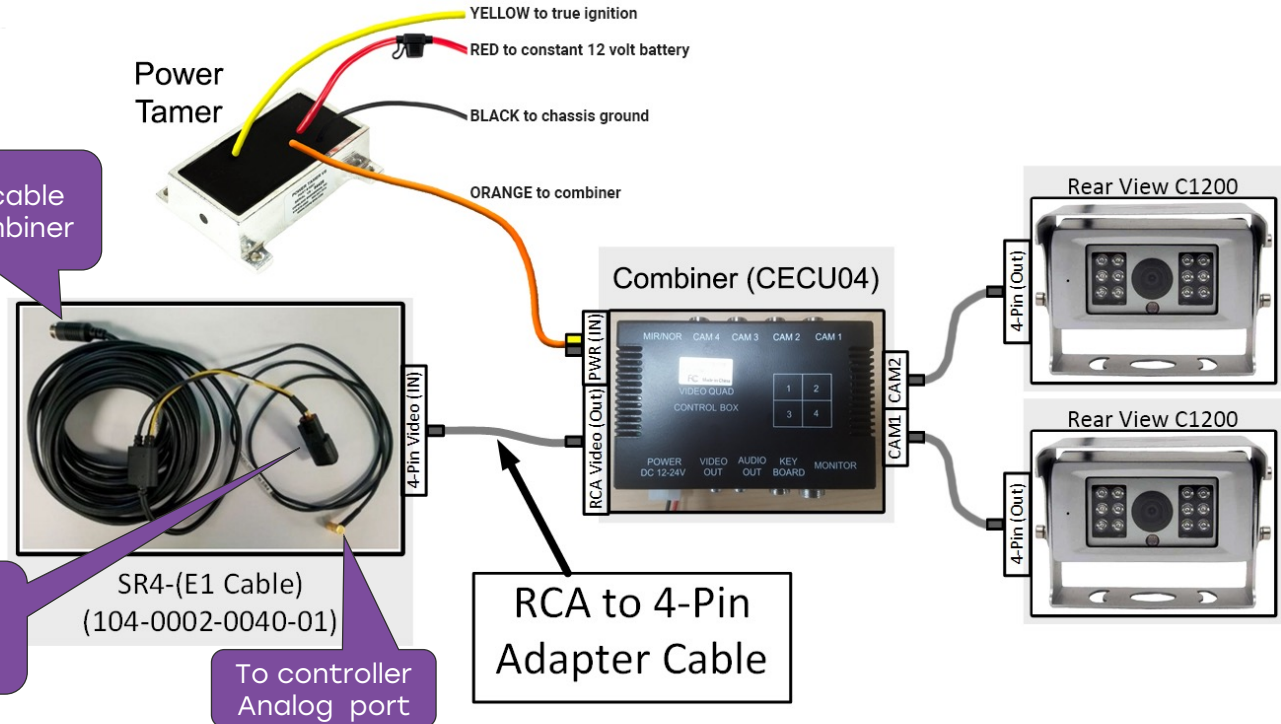
To RCA cable from combiner

Do not connect 2 pin cable on E1 cable when using combiner

SR4-(E1 Cable)
(104-0002-0040-01)

To controller Analog port

RCA to 4-Pin Adapter Cable



360 VSA: Six Camera Installation

360 Side mirrors – Combine left & right video feeds using a Convoy Combiner Box + Power Tamer

Details

Combine the left & right-side mirror camera video feeds into a single feed using a Convoy Combiner Box

1. Connect both side mirror cameras to the Combiner Box

- Right camera to Cam1 port
- Left Camera to Cam2 port

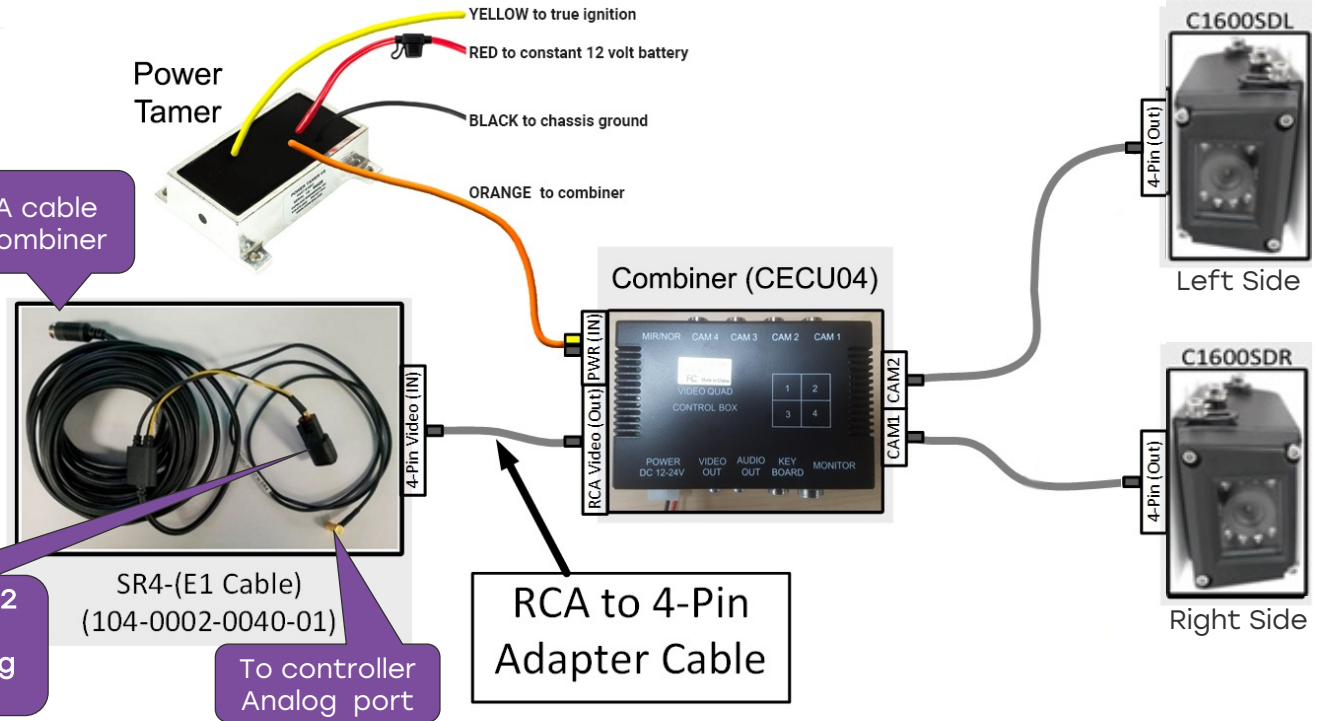
2. Using the RCA Video (OUT) port, use the RCA output to the E1 Cable

- A. An extension cable is available if needed

3. Connect the E1 cable to the controller to the Analog 2 port

NOTE – LEAVE 2 PINS ON THE E1 CABLE FOR COMBINER DISCONNECTED

CAMERAS WILL GET POWER FROM THE COMBINER



Combined side mirror cameras

360 VSA: Six Camera Installation

Power tamer connections

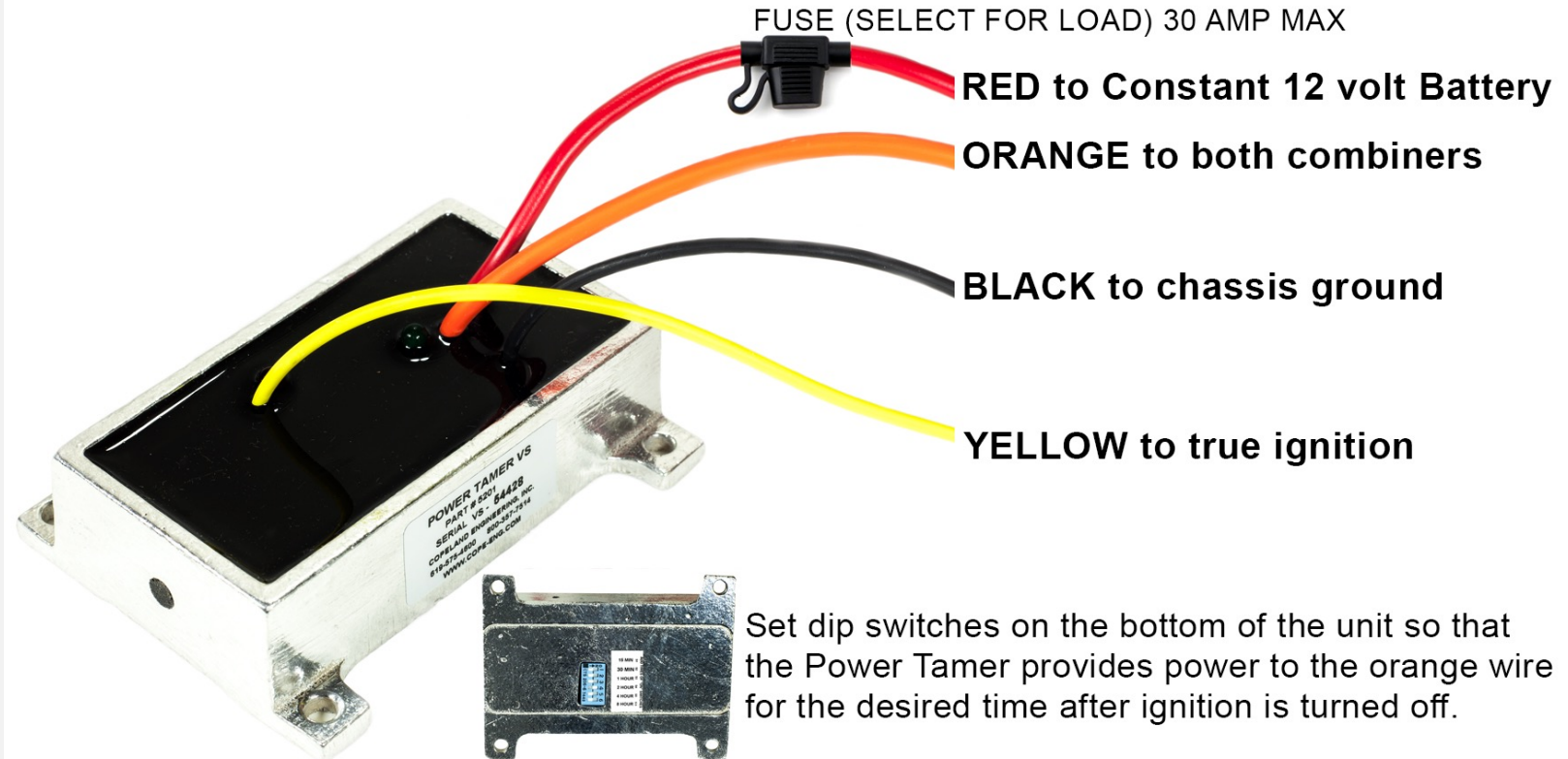
Power Tamer Wiring Instructions

1. Red to Constant 12 Volts
2. Black to Chassis Ground
3. Yellow to True Ignition
4. Orange to both combiners red power lead

Dip Switches

1. S3 set to "ON" for 1 hour timer
2. All other dip switches set to "OFF"

POWER TAMER WIRING DIAGRAM



360 VSA: Six Camera Installation

Optional Combiner to Ignition Wire

Details

Combiners can be wired to ignition if customer does not need the need for 1 hour delay after ignition off

1. Connect each camera to the Combiner Box
 - Right camera to Cam1 port
 - Left Camera to Cam2 port
2. Connect the backup and cargo camera to a Combiner Box
3. Using the RCA Video (OUT) port, use the RCA output to the E1 Cable
 - A. An extension cable is available if needed
3. Connect the E1 cable to the controller to the Analog 2 port

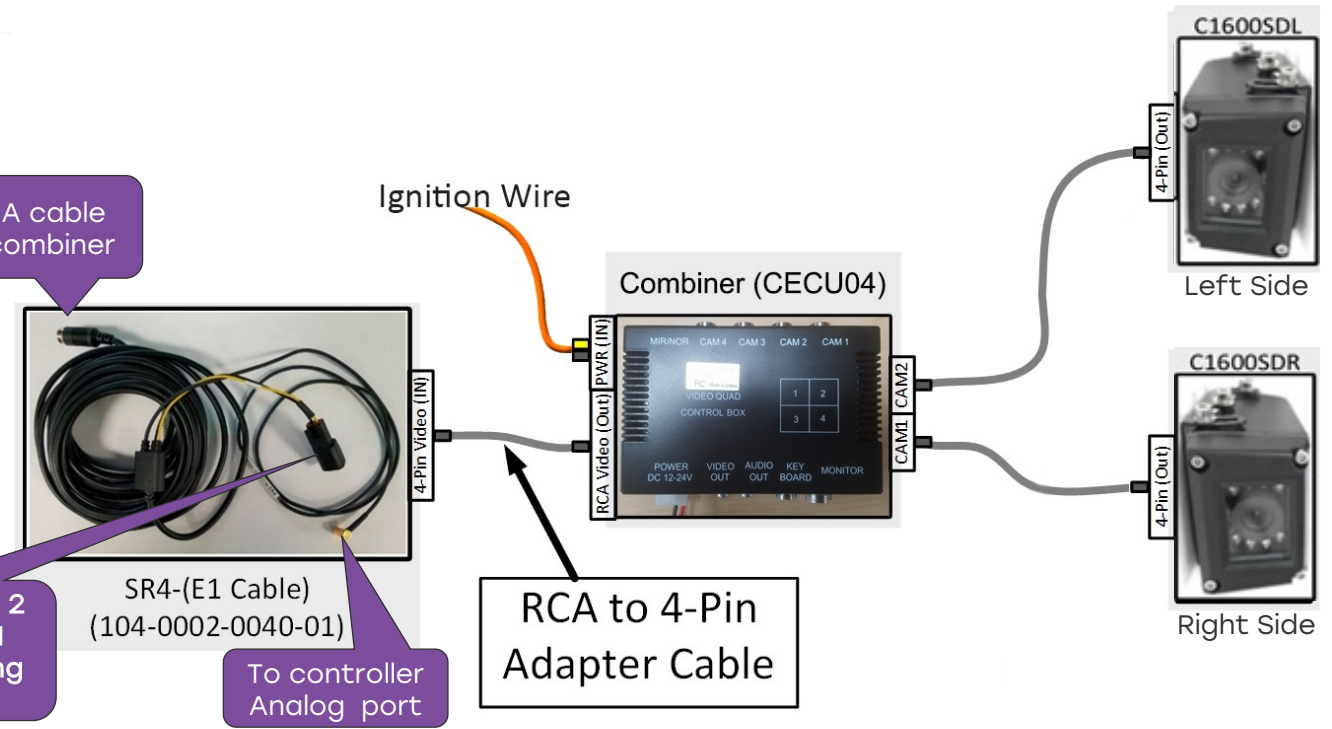
NOTE – LEAVE 2 PINS ON THE E1 CABLE FOR COMBINER DISCONNECTED

CAMERAS WILL GET POWER FROM THE COM

To RCA cable from combiner

Do not connect 2 pin cable on E1 cable when using combiner

To controller Analog port



Combined side mirror cameras

Rear Camera Spec Guides



360 VSA: Six Camera Installation

The rear cameras can be any of the following:

- Rearview camera
- Side view camera
- Internal dome camera

Each 360 camera has its own Spec Guide, which describes in detail how to install them. Use these guides in conjunction with the six Camera Spec Guide to complete your six-camera installation.



Final QA Checkout



360 VSA: Six Camera Installation

Creating a diagnostic mode manual event

HOME

- Start the vehicle and let it run
- Press the green button on the keypad five times in 10 seconds to initiate diagnostic mode

If the test finds any problems, it will display the fault code on the keypad.

Use the SR4 Fault Codes section of the Vehicle Specification Assessment (VSA) to troubleshoot the issue.

Rerun the Diagnostic mode until the keypad displays all Zeros (000000). When you need assistance in resolving an error code, call Tech support for assistance.

866.933.9930, Option 4

When the keypad displays all Zeros (000000)

Call Tech Support for QA verification.

866.933.9930, Option 1



Additional Information for Installers



360 VSA: Six Camera Installation

SR4 E1 Cable

SR4 E1 20 ft. cable

Part # 104-0002-0040-01

Tip: Best practice is routing the cables from the cabin > rubber boot > door panel > exit hole > camera. Pulling the 4-pin DIN connector from the cab to the camera is easier than pulling the split end to the cab.

Prior to routing the cables, check the 4-pin DIN connector to ensure it matches the camera.

To help pass the DIN connector through the rubber boot, it's best to keep it as straight as possible, using a small amount of grease to help slide it through.



SR4 E1 Wiring Diagram

The E1 cable is 20 feet long. The 4-pin DIN connector connects to the 360 Analog camera. The cable splits the video and power feeds.



360 VSA: Six Camera Installation

Extension Cable

Extension Cable

Part # MCBL510 (10 meter)

Part # MCBL530 (30 meter)

Part # MCBL550 (50 meter)



Extension Cable Wiring Diagram

Primary use

TBD

Female Connector

2 -Weather Proof Seals (one for each side)

Male Connector

