UMass Safety Summit
Collision MITIGATION

Safety

Robert Buchwalter, Prevost Car

Agenda

Energizer

Knowledge is like peanut butter. It's better if you spread it around.

Sixty seconds of encouragement after a failure is worth more than an hour of praise after an accomplishment.

Safety

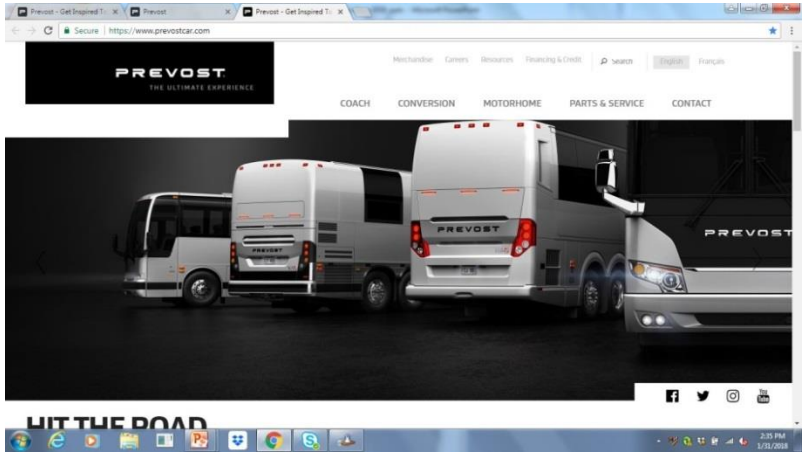
Safety First!!

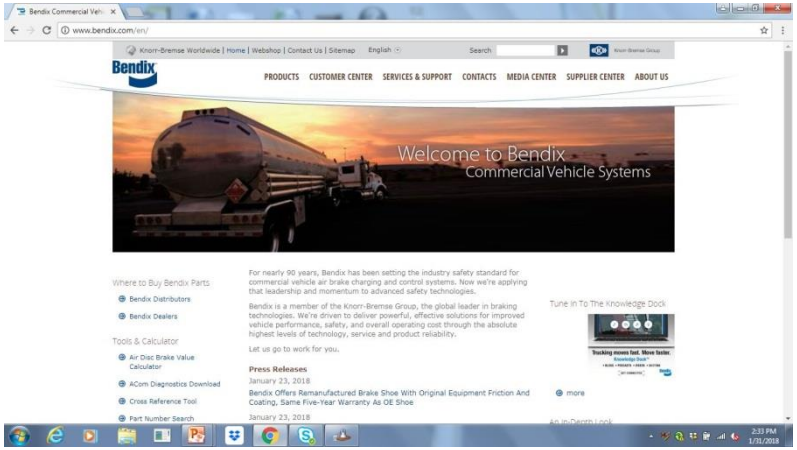
- This means:
- Communication! Don’t assume people know best practices. It is our responsibility to educate them…and document that education/training!
- Read the manuals! Safety Data Sheets, OEM info
- Obtain the proper manual and follow the safety instructions and procedures list contained therein.
- Make sure EVERYTHING is in proper working order before you trust your life to it.

Sources used in preparing this document

- www.prevostcar.com for manuals, schematics, pneumatic diagrams

- www.bendix.com for specific additional information
- SERVICE DATA SHEET 13-3333 Bendix Wingman with ACB
- SERVICE DATA SHEET 61-4960 Bendix Wingman Advanced





MPH vs Feet per Second

Feet per second

MILES PER HOUR	FEET PER SECOND
35	
40	
45	
50	
55	
60	
65	
70	

Driver’s Seat

Why is the driver seat important?
What does it have to do with Collison Mitigation?

PREVOST
COACH MANUFACTURER

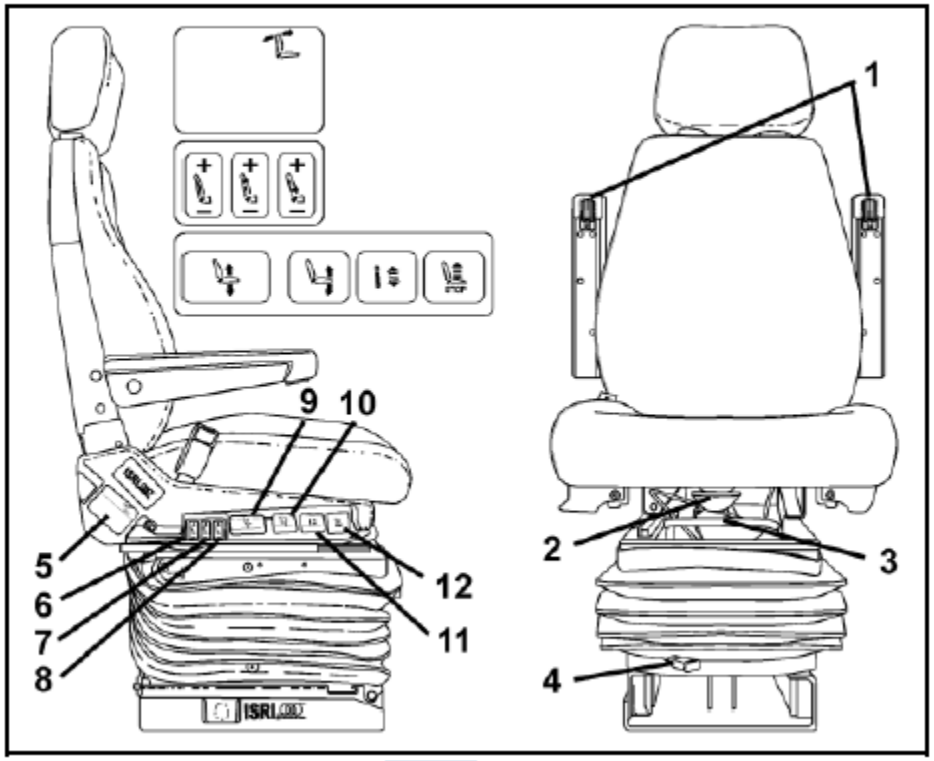
OPERATOR'S MANUAL
X3-45 COACH

PA1581

Operator Interface and the driver seat

- From our Operator's Manual

PNEUMATIC ISRI SEAT



PNEUMATIC DRIVER'S SEAT 18385

Feet per second

MILES PER HOUR	FEET PER SECOND
35	
40	
45	
50	
55	
60	
65	
70	

Technology Evolution: Brakes!

Earliest Known Braking System

How has wheel end brake pressure application evolved?

- Service Brake Application-treadle valve/brake pedal
- Anti-lock brakes (ABS) introduced in early 1990s.
- Electronic stability systems were introduced in the early 2000s

BENDIX ABS, WINGMAN with ACB
BENDIX WINGMAN ADVANCED

Evolution of the System

Bendix® **Service Data** SD-13-3333

Bendix® Wingman® ACB (Active Cruise with Braking)

⚠ WARNING

Improper use of the Wingman ACB system can result in a collision causing property damage, serious injuries, or death.

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix Wingman ACB system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

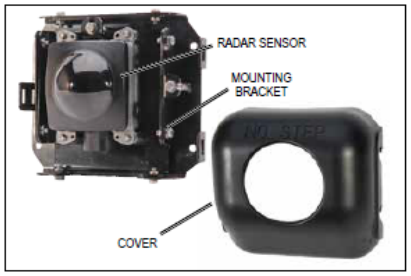


FIGURE 1 - WINGMAN® RADAR SENSOR AND COVER

DESCRIPTION

The Wingman ACB system is an integrated combination of two features:

- Active cruise with braking, and
- Alerts (three types of alerts).

PART ONE: ACTIVE CRUISE WITH BRAKING

The active cruise with braking feature is an additional upgrade of ordinary cruise control. When using cruise control, the Wingman ACB system will maintain the set speed, and also will intervene, as needed, to help maintain a set following distance behind a detected forward vehicle.

Using a radar (with a range of approximately 500 feet) mounted to the front of the vehicle, the Wingman ACB system reacts to detected forward vehicles in the same lane, traveling in the same direction. *See Figure 1.*

The active cruise with braking feature is designed to help the driver maintain a set following distance between his vehicle and a detected forward vehicle when cruise control is set. *See the gray "Radar Beam" area in Figure 2.*

Bendix® **Service Data** SD-61-4960

Bendix® Wingman® Advanced™ System (FLR20™ Sensor)

FIGURE 1 - BENDIX® WINGMAN® FLR20™ RADAR SENSOR AND COVER

If the vehicle also has a Bendix™ AutoVue® FLC20™ Camera, use the Bendix® Wingman® Fusion™ System SD Sheet SD-61-4963

If your Bendix Wingman Advanced System has a black "eyeball" (FLR10™) radar sensor, use SD Sheet SD-61-4960

⚠ WARNING

Improper use of the Wingman Advanced system can result in a collision causing property damage, serious injuries or death.

The driver is always responsible for the control and safe operation of the vehicle at all times. The Wingman Advanced System does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

PART ONE: ADAPTIVE CRUISE CONTROL WITH BRAKING

The adaptive cruise control with braking feature is an additional upgrade of ordinary cruise control. When using cruise control, the Wingman Advanced System will maintain the set speed, and also will intervene, as needed, to help maintain a set following distance behind a detected

Collision MITIGATION

Bendix Wingman

Where to find additional information about the Bendix® systems on your vehicle

1. Consult the vehicle manufacturer's documentation.
2. Visit www.bendix.com for free downloads of the Service Data sheets listed below, or order paper copies of these publications from the Literature Center at www.bendix.com.

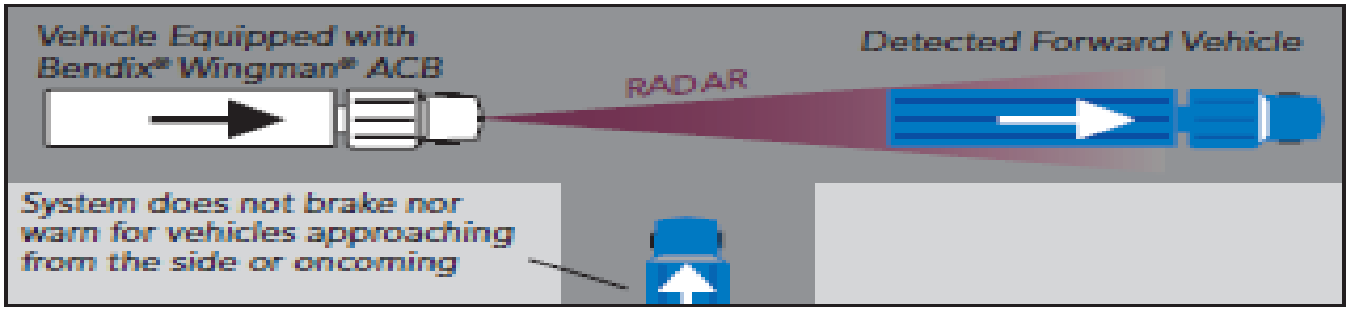
   • SD-13-3333 Bendix® Wingman® ACB Service Data Sheet

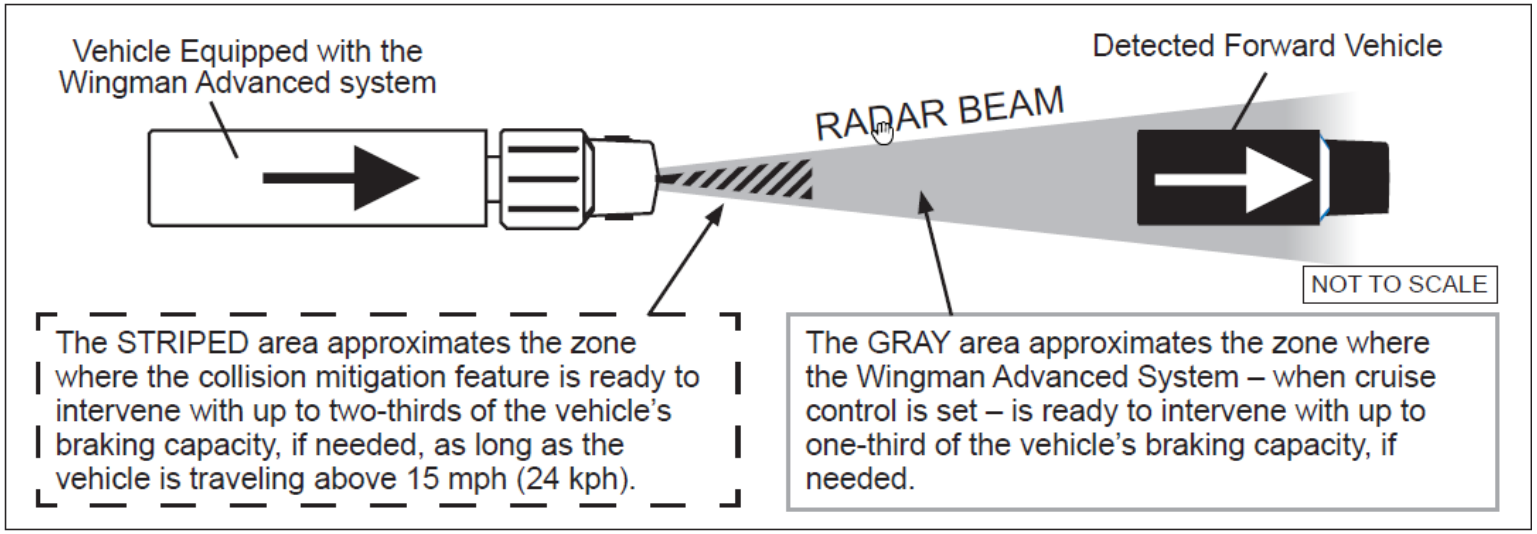
   • SD-13-4869 Bendix® EC-60™ ABS/ATC/ESP Controllers (Advanced) Service Data Sheet

3. Contact the Bendix Tech Team at techteam@bendix.com or call 1-800-AIR-BRAKE (1-800-247-2725). Representatives are available Mon.-Fri. 8:00 a.m. to 6:00 p.m. EST.

The visual: Bendix Wingman with ACB (top); Bendix Wingman Advanced (bottom)

The Bendix® Wingman® ACB system reacts ONLY to vehicles moving in the same direction as your vehicle. The Wingman ACB system DOES NOT respond to side-to-side moving traffic, or oncoming traffic. The system WILL NOT slow your vehicle or provide an alert as you approach vehicles in these circumstances.



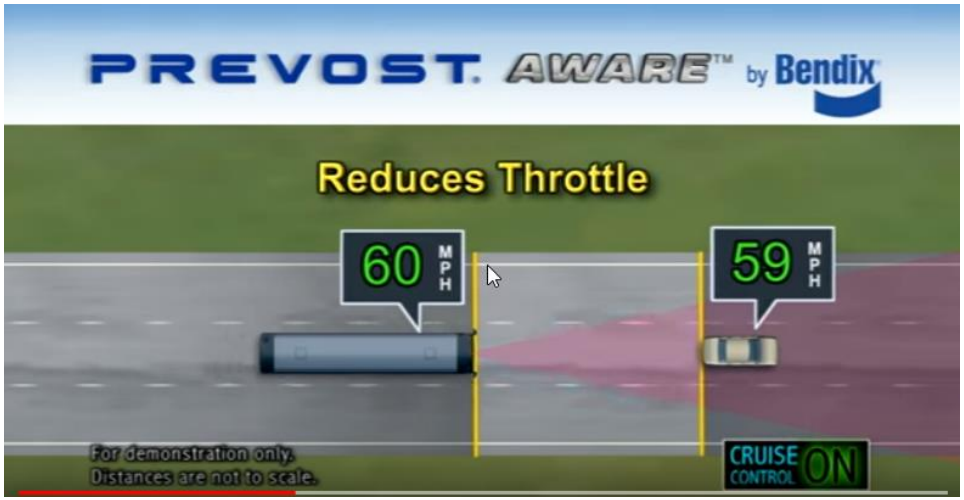


Don’t expect ACB to cover every possible circumstance

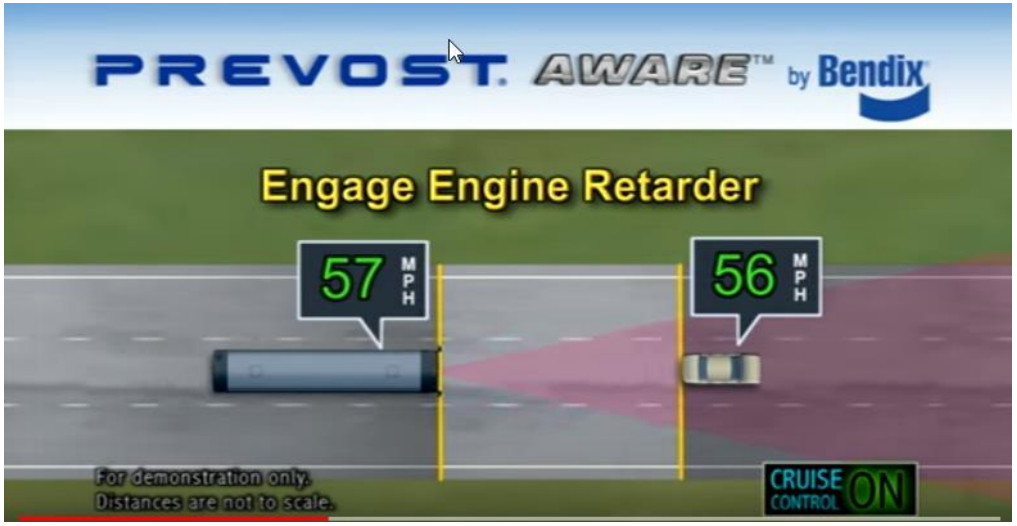
Part One: All driving scenarios (Cruise is either “on” or “off”)		
Situation	**Typical System Indication/Alerts**	**Typical System Actions**
A broken-down vehicle is stationary in the lane in which the truck is traveling.	A Stationary Object Alert (SOA) may be issued up to (three) 3 seconds prior to impact.	None.
A pedestrian, deer or dog runs in front of the truck.	None.	None.
Another vehicle crosses the road perpendicular to your path of travel – such as at an intersection.	None.	None.

System operation

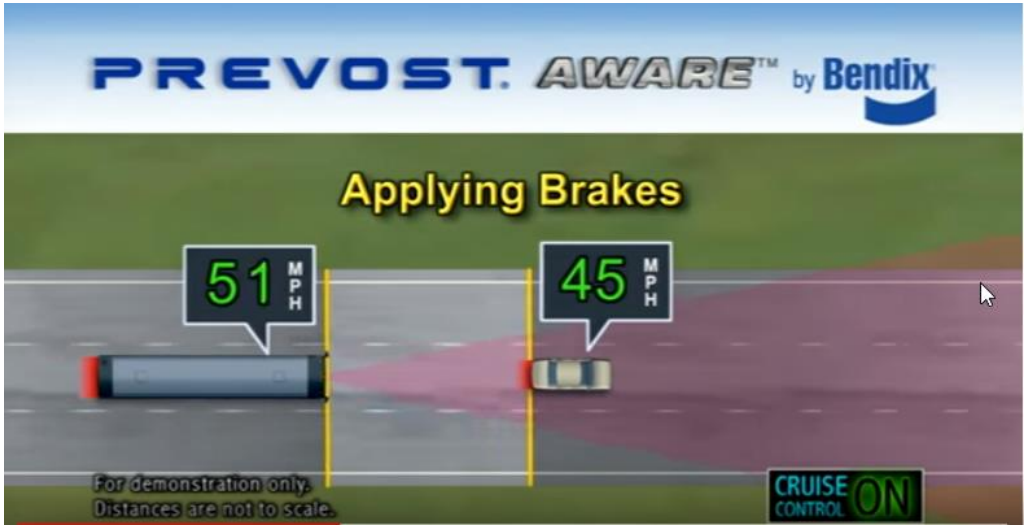
System operation



System operation



System operation



System operation

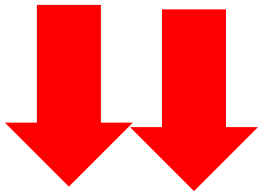
Collision mitigation is ***not*** collision prevention

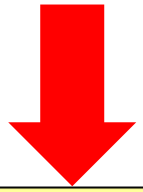
- It is the driver responsibility to drive and avoid collisions to the highest extent
- With FLR 20 Wingman Advanced Systems, collision mitigation is functional ***whether the cruise is off or on*** and if the vehicle is travelling above 15 mph.
- Collision mitigation can assist in reducing the severity of an impact
- Collision mitigation will not prevent collisions
- Collision mitigation will not function in the event of a Stationary Object---CM only occurs when the ACB has detected a Forward Detected Vehicle (FDV)

Which system do you have?

ABS?
Wingman with ACB?
Wingman Advanced?
Close up look at features.

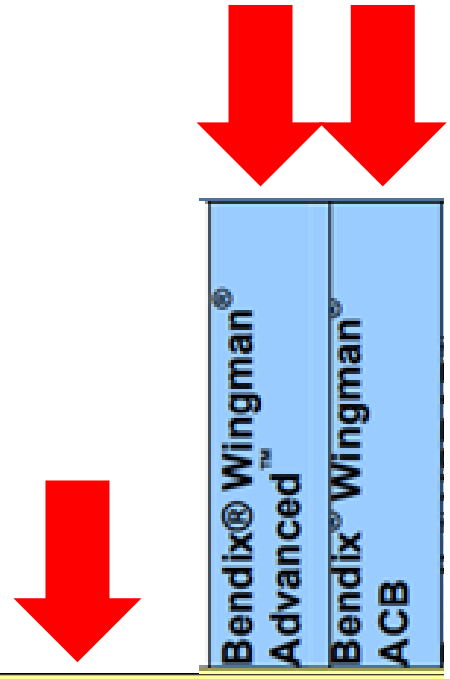
Close up on features-Alerts





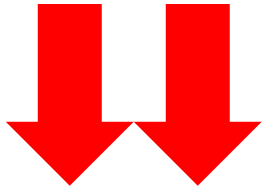
Feature	Bendix® Wingman® Advanced™	Bendix® Wingman® ACB
Alerts *(are always available whether cruise control is engaged or not)*		
• *Following Distance Alerts* – Audible and visual alerts which lets driver know when getting too close to forward vehicle	√	√
• *Impact Alert* – Audible and visual alert warning the driver that a collision with the forward vehicle is likely and that they should address the situation immediately	√	√
• *Stationary Object Alerts* – Audible and visual alert that provides driver up to 3.0 second alert when a ***metallic*** object(s) may be blocking lane of travel	√	√

Close up on features



Adaptive Cruise Control with braking *(functions when cruise control is on and speed is set)*	Bendix® Wingman® Advanced™	Bendix® Wingman® ACB
• Reduces throttle to help the driver maintain a set following distance behind a forward vehicle	√	√
• Engages engine retarder to help the driver maintain a set following distance behind a forward vehicle	√	√
• Applies foundation brakes to help the driver maintain a set following distance behind a forward vehicle	√	√

Close up on features



Electronic Stability system	Bendix® Wingman® Advanced™	Bendix® Wingman® ACB
• Bendix ESP full stability system to help drivers mitigate rollovers and loss-of-control situations on wet and dry roadways	√	√

Close up on Collision Mitigation

Collision Mitigation *(functions whether or not cruise control is on and speed is set)*	Bendix® Wingman® Advanced™	Bendix® Wingman® ACB
• Provides audible and visual alerts to the driver and applies the brakes when the system determines a collision with forward vehicle is imminent	√	

The *collision mitigation technology* adds additional braking power that may help drivers mitigate a potential rear-end collision by warning the driver first, then applying brakes if necessary when a forward collision is likely to happen. ***The collision mitigation feature of Bendix Wingman Advanced is always available – whether or not vehicle cruise control is on and set.***

Know your fleet and share the information

Whizz Bang stuff-but we have mixed fleets!

- As part of your driver training program, do you provide your drivers with an OEM Operator Manual?
- If YES, great? Is there a regular review of it…on a semi-annual/annual basis?
- If NO, this ought to be part of the driver training curriculum.
- Checklist?

What's the take home? Different systems/different functions! We must:

- **ENSURE** our drivers are TRAINED and UNDERSTAND which system is on the coach they are assigned
- **ENSURE** our drivers UNDERSTAND the highest function is found on the Bendix Wingman Advanced System with Collision Mitigation Technology
- **ENSURE** our drivers UNDERSTAND what is meant by COLLISION **MITIGATION**
- **ENSURE** our drivers UNDERSTAND just because there is a radar antennae on the front of the vehicle does NOT mean it has collision mitigation technology. It might be Bendix Wingman with Adaptive Cruise with Braking.

Problems can arise (or can be inflicted).

ACB Radar Module A114A ***disconnected***

This creates two problems:

The drive train control network (DL1) is exposed to the elements

The radar is inoperative

PREVOST

How do we know if we have a fault?

- Pop up message on Information Display -and/or-
- Drill down the Information Display to get to faults (Brake ECU)

We can also drill down into the Diagnostic Fault Codes menu

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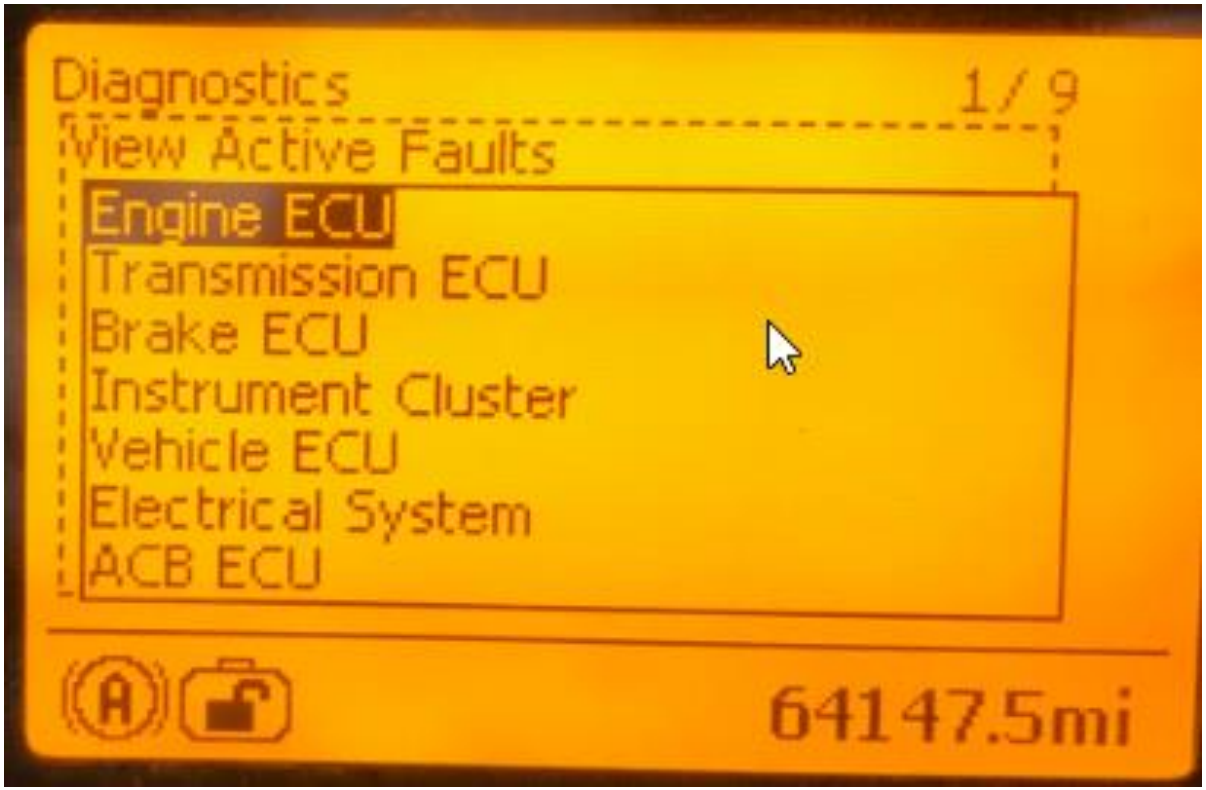

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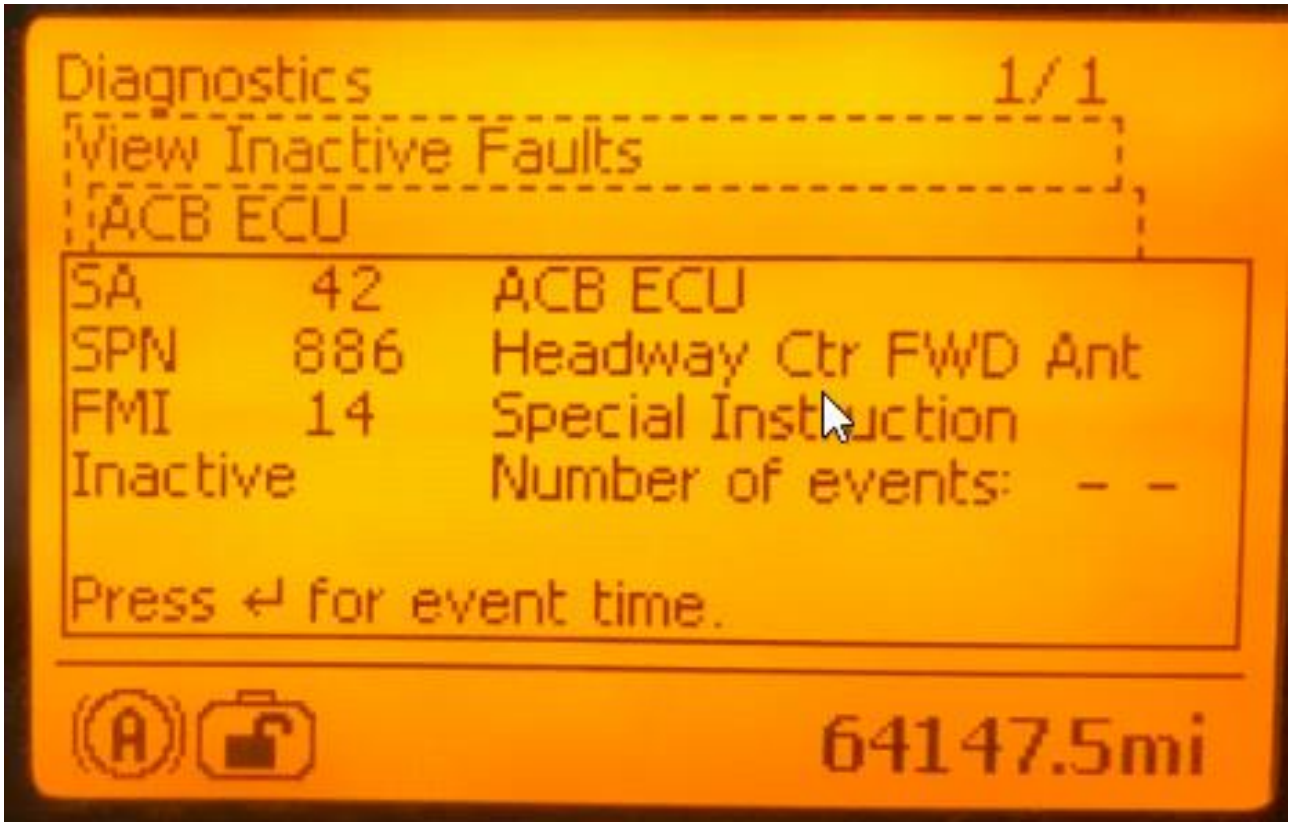
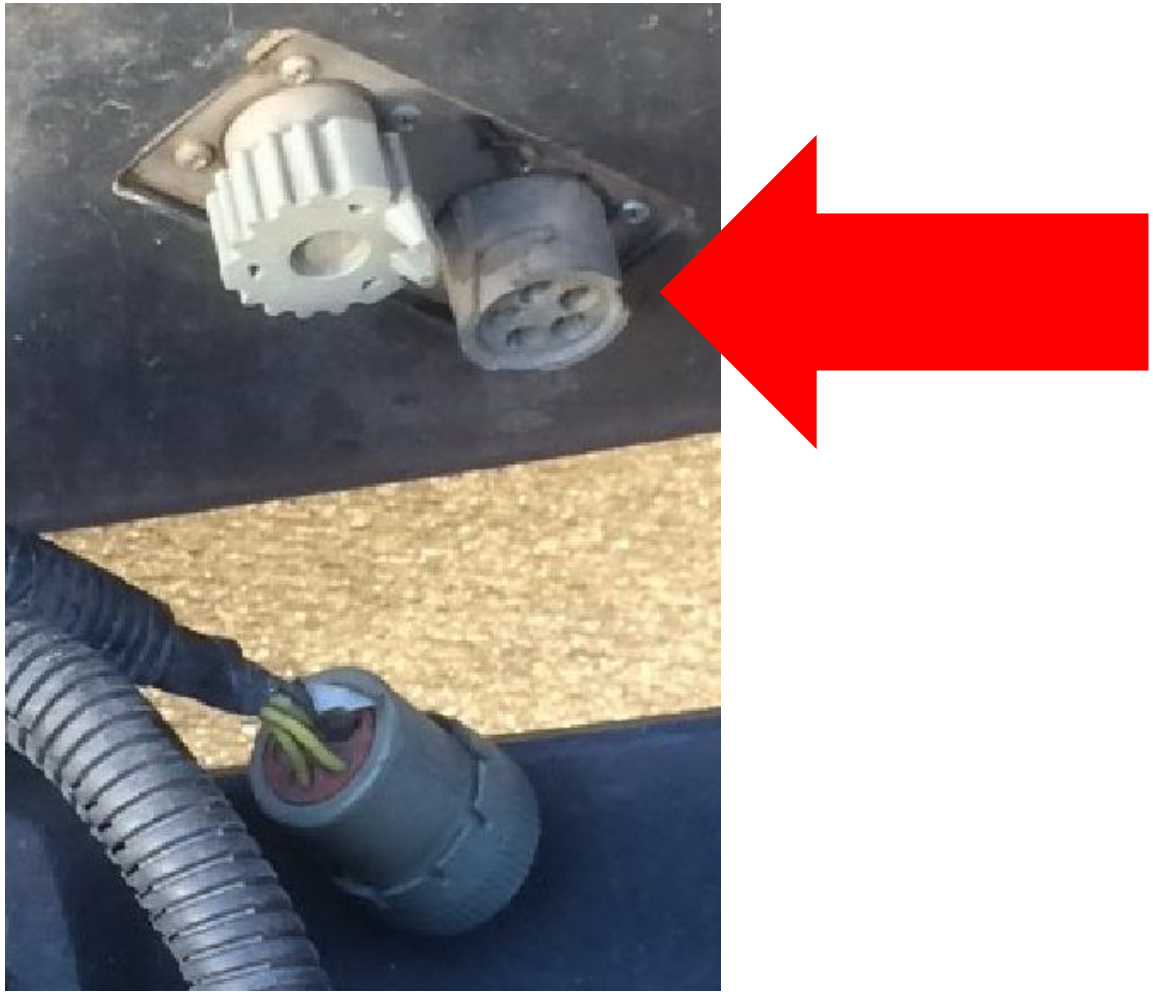
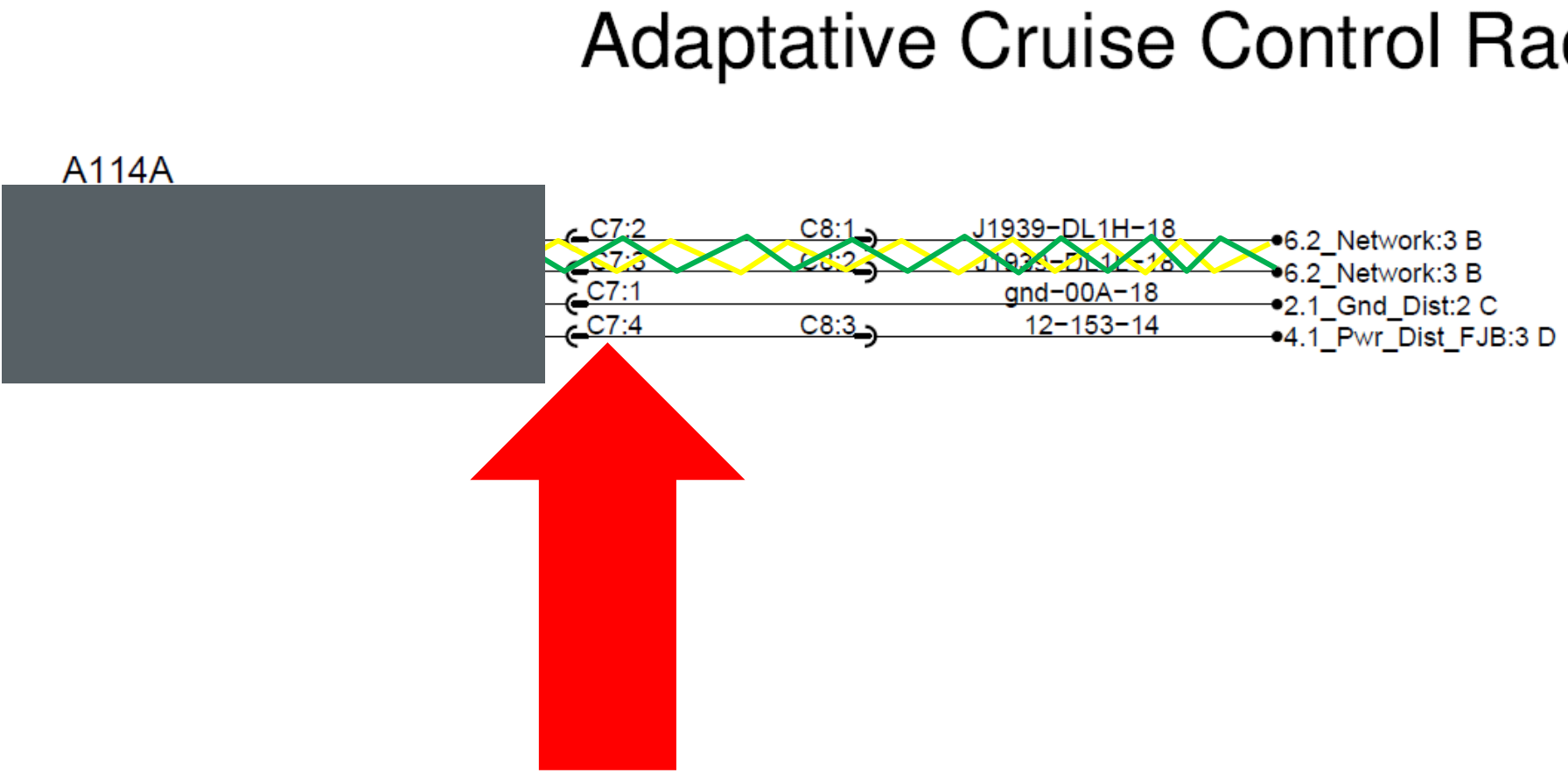


It is not unreasonable to assume:

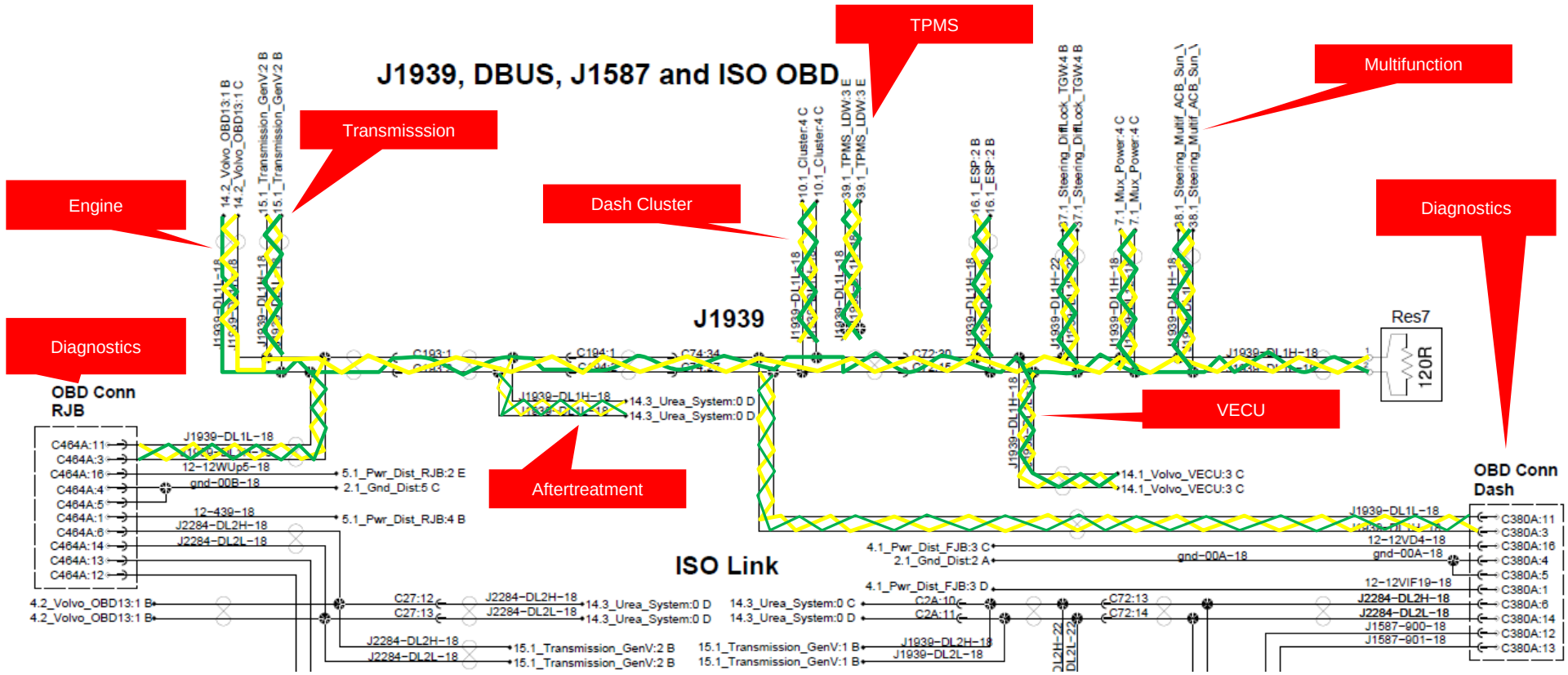
- A DL1 network problem could arise due change in ohms due to ice/snow/slush forming on the connector



Among the other issues that could arise:



What is DL1? What could be affected? Drive Train Control



We can also look at ACB reports

ACom® Diagnostics v6.14.2.0
EC-60 Diagnostics v2.8.0.0

EC60 EVENT REPORT

901 Cleveland Street
Elyria, OH 44035
800 AIR BRAKE
www.bendix.com

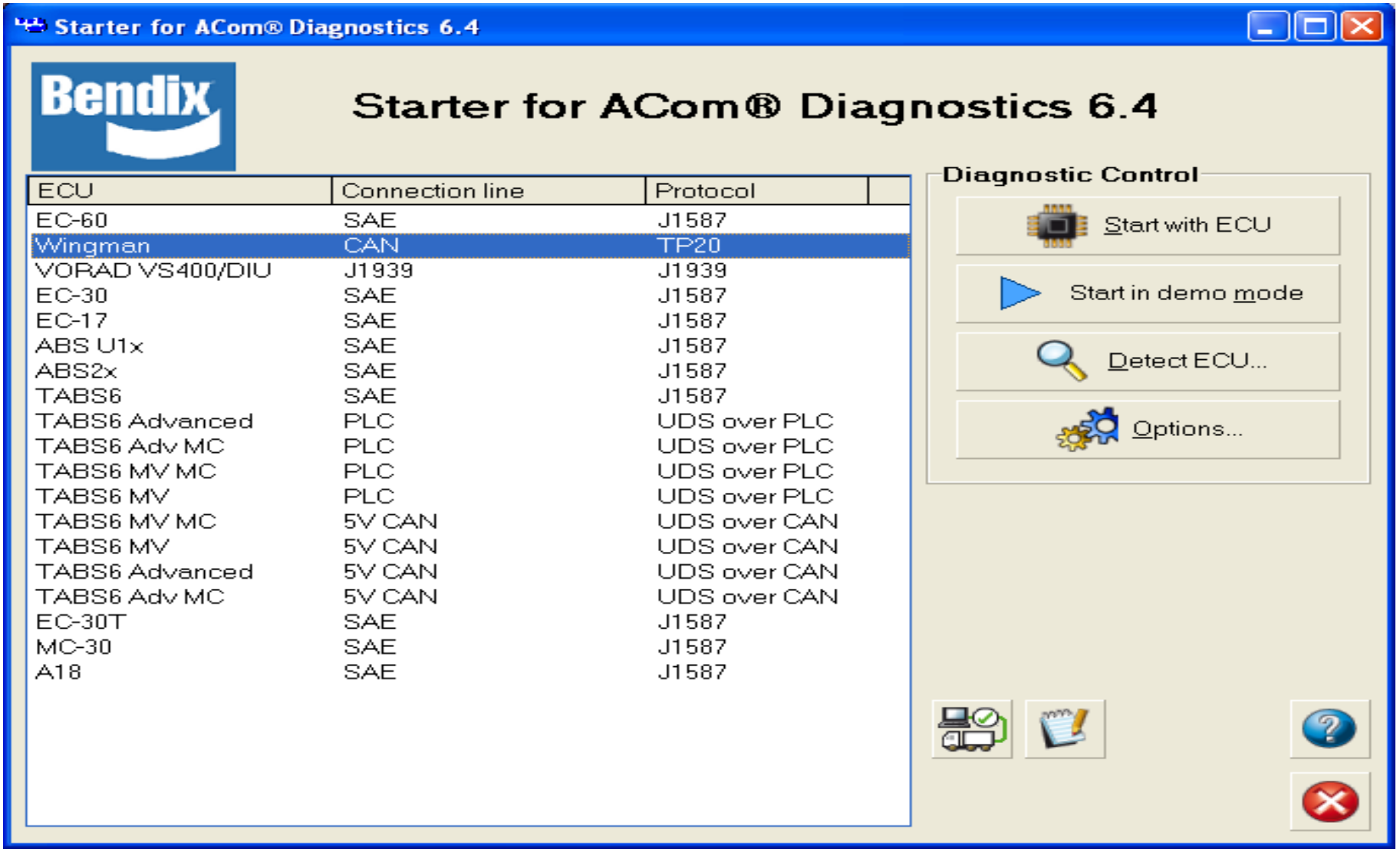
Bendix

Make	Prev Customer	Model	X345
Year,ECU Manufacture Date	-, 12-03-23	VIN	D5352 (User)
Vehicle Configuration	-	ECU stored VIN	DC7353
Company	-	Vehicle Application	-
Technician	Buchwalter	Location	GDLTSVL
ECU Part Number	K038368	Product Family	EC60-adv
ABS Software Version	BB41062	Serial Number	5Q13120705
ESP Software Version	BB41065	ATC Configuration	Brake and Engine
Mud and Snow Switch	Mud and Snow	System Configuration	6S/5M
Retarder Configuration	Retarder Datalink	Steer Axle Configuration	Modified
Yaw Control	Enabled	Steer Axle Tire Size	487
RSP	Enabled	Rear Axle Configuration	Individual
Steer Angle Sensor	Standard	Rear Axle Tire Size	487
Yaw Control Sensor	Standard	Additional Axle Configuration	Axle Select Smart
Lateral Acceleration Sensor	Standard	Additional Axle Tire Size	492
Engine Hours	N/A	Wingman Configuration	ACB
HSA Configuration	Not Enabled	eTrac Configuration	Disabled
Difflock Status	Unavailable	BaudRate	9.6KB
PLC Support	Yes		

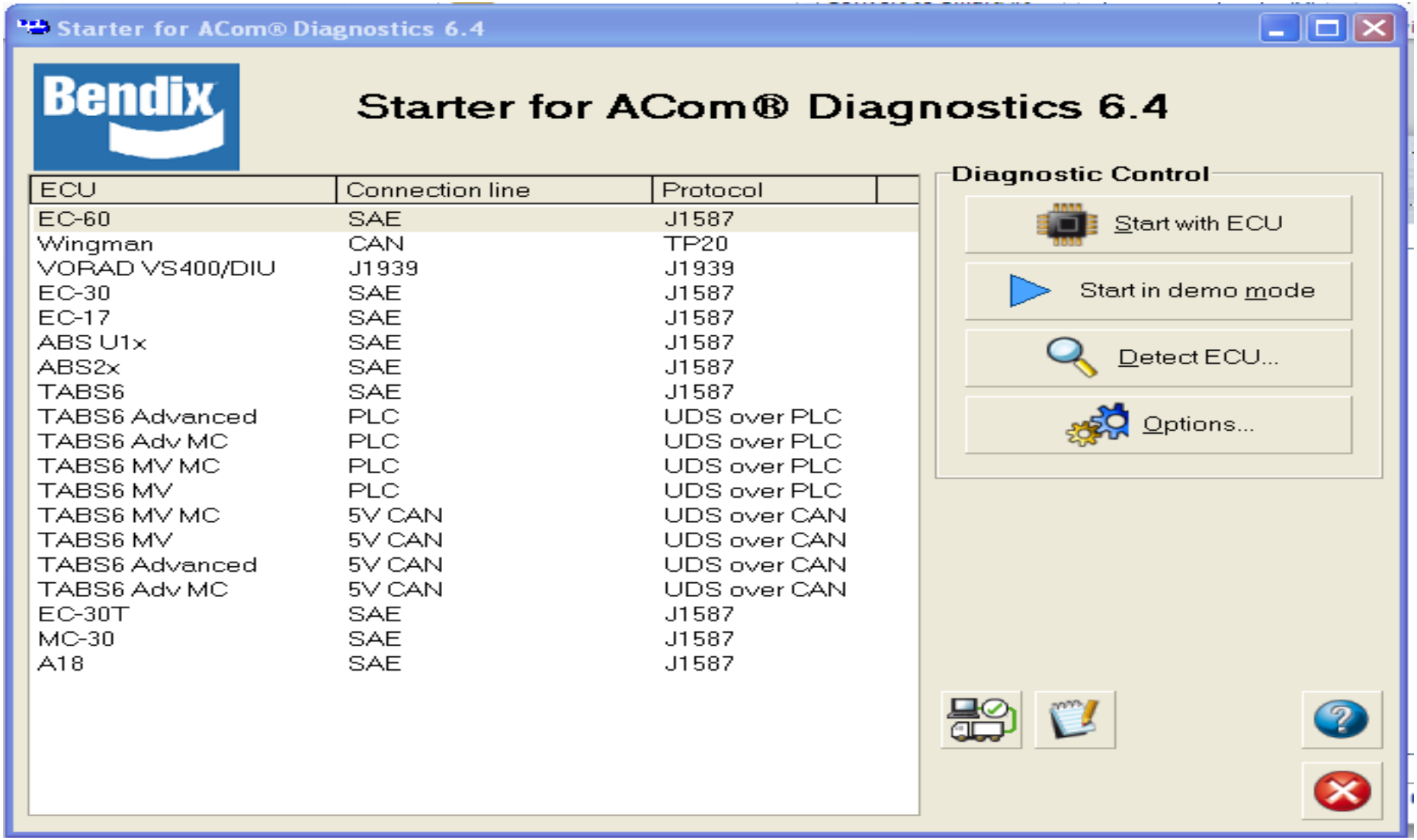
ACTIVE DTCs

PREVOST

Software for Bendix ACB



Diagnostic Software



THE ULTIMATE EXPERIENCE

PREVOST