

BENDIX CRUISE

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BENDIX CRUISE CONTROL TRAINING PROGRAM

I. INTRODUCTION

To the driver, the operation of the Bendix Cruise Control for heavy vehicles is similar to that of a passenger car with the additional features of Throttle Mode and Shift Through. Throttle mode allows the engine RPM to be adjusted and held while the vehicle is parked. Shift Through allows the gears to be changed while in Cruise mode, automatically re-engaging the Cruise Control after the shift is made.

HIGHLIGHTS

- * Increase/decrease set vehicle speed
- * Resume set speed after disengagement
- * Ability to use various speed signal sources
- * Programmable for various engine (governor) types
- * Programmable Top Set Limit
- * Vary and hold engine RPM while stationary, (Throttle Mode)
- * Allows gear changes while in Cruise mode

II. BASIC SYSTEM OPERATION

MODES OF OPERATION

CRUISE CONTROL MODE:

While vehicle is moving, the system maintains a set speed by reading the current wheel speed and adjusting the throttle accordingly. The set speed can be increased by depressing and holding the Resume switch, or decreased by depressing and holding the Set switch. The approximate vehicle speed should be between 20 MPH and the Top Set Limit (TSL) for the Cruise Control to engage. The system will not respond to a "set" if speed is less than 20 MPH. If the speed is over the Top Set Limit when a "set" occurs, the vehicle will coast down to the Top Set Limit speed and the system will maintain it. If the vehicle speed drops more than 20 MPH below the set speed, the system will disengage. This drop out will occur if there is inadequate horsepower to maintain the set speed on steep upgrades. Activating Resume will resume the original speed.

It is possible to change gears without resetting the Cruise Control, (Shift Through). The Clutch will temporarily disengage the system while the clutch pedal is depressed. Once it is released, the system will automatically resume and maintain the set vehicle speed in the new gear.

The Brake acts on the system in two ways. A light brake application will activate the Stop Lamp Switch. This electrical signal disengages the Cruise Control; Set or Resume is required to re-engage. If for some reason the brake electrical signal is not available to the CA-1 there is a pneumatic back up.

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Sufficient pressure on the brake pedal will cause the TR-3 Inversion Valve to open, releasing the air pressure from the CC-5 Actuator. This pneumatic backup only exhausts the Actuator pressure while the brake is being applied.

THROTTLE CONTROL MODE: (Programmable Option)

The stationary Throttle mode is intended for adjusting the engine RPM while the vehicle is parked. The engine RPM can be increased by repeatedly pressing the Resume switch. Likewise, repeated pressings of the Set switch reduces the engine RPM. Holding the switches in is ineffective. It is the number of momentary actuations which controls the throttle. The controller will increase or decrease the throttle position until the potentiometer in the CC-5 reads a particular value. This value is determined by the number of Set or Resume actuations made. This potentiometer value corresponds to a throttle position, not necessarily to RPM. Therefore, once the position is set, the RPM may vary over time due to the governor or engine temperature. This throttle position is maintained by the controller so that air leakage will not decrease it. There are a fixed number of discrete throttle positions possible in Throttle mode. Therefore the system cannot always select an exact engine RPM, unless it coincides with one of the possible throttle positions.

When in Throttle mode, the CA-1 controller monitors the clutch pedal and vehicle speed. If the clutch pedal is depressed or the vehicle moves Throttle mode will be permanently disengage. The brake electrical signal does not affect Throttle mode. The pneumatic brake sensing (TR-3), however, will disengage the system while the brake is being applied. Once the brake is released, the throttle will return to the previous position.

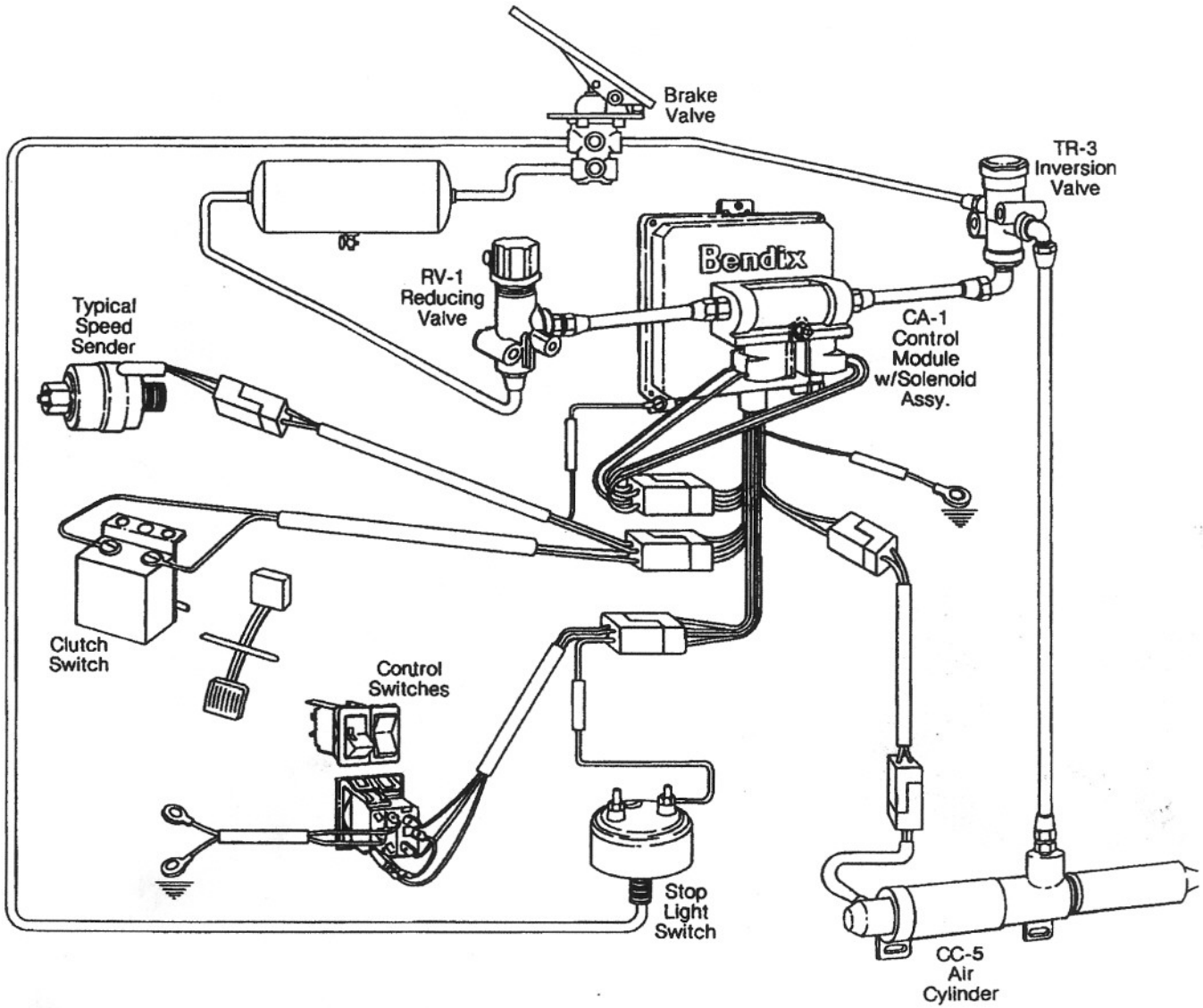
Stationary Throttle mode should not be used with automatic transmissions. This is to avoid the chance of the vehicle lurching if it is put into gear while throttle mode is being used. Since there is no clutch switch input, the Throttle mode would not release until the speed signal is sensed.

III. BASIC COMPONENTS/FUNCTIONS/LOCATIONS

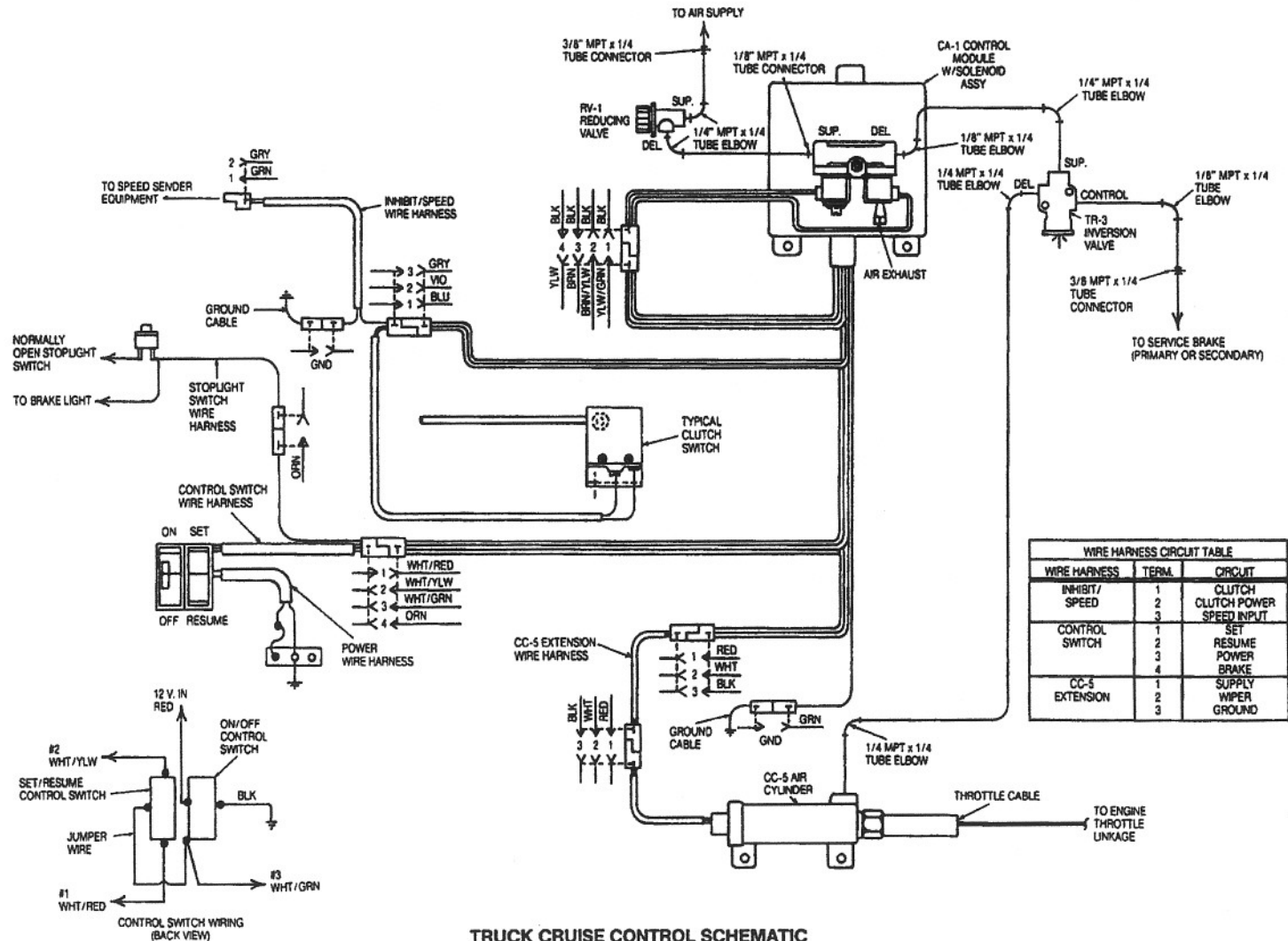
The basic Cruise Control system is shown on the next page. It is really a very simple system. The number of components are few, and their functions are easy to understand. A brief description of each component in the system follows. Locations of the components on the vehicle can vary widely between installations. Some typical and recommended locations are given.

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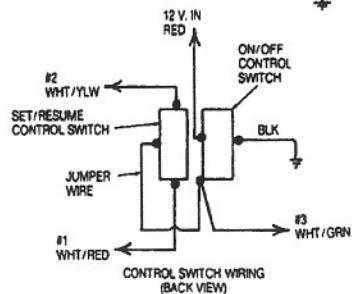
Typical Truck Cruise Control System



Typical Cruise Schematic



TRUCK CRUISE CONTROL SCHEMATIC



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CA-1 Control Module

This is the Microprocessor based module which is the heart of the system. This module responds to inputs from the speed signal, the switches (power, clutch, brake, control), and CC-5 Actuator. The CC-5 in turn moves the throttle linkage.

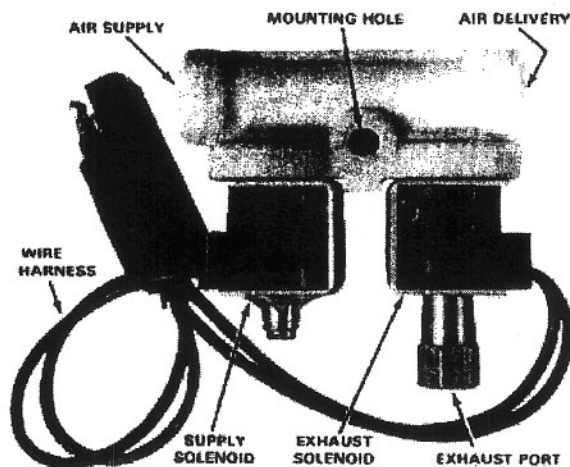
The CA-1 is programmable. DIP switches inside the module are used to select engine type (governor), Throttle mode, speed signal rate (Hertz rate), and Top Set Limit. All modules are waterproof and contain DIP switches for programming. Although the field programmable unit is most popular, there are some pre-programmed units available which have the enclosures riveted together and are not intended to be reprogrammed. Programming and part numbers of the various CA-1s are given near the end of this book.

The part number of the CA-1 is stamped into the narrow end of the enclosure. It indicates the type and programming of the CA-1. The part number which is printed in ink on the bottom cover of earlier units does not give any indication of the programming.

CA-1s are available with molded rubber connectors in 12 volt and 24 volt versions. They are also available with Packard 56 series connectors for 12 volt systems. A red grommet where the wire harness enters the enclosure indicates a 24 volt unit; black grommets are used for 12 volt units.

Versions with the Packard 56 series connectors should be located in a moisture protected environment. Versions with molded rubber connectors can be located in numerous places on the vehicle. Although the circuit board is waterproof, the enclosure is not. If there is a chance that moisture may enter the enclosure, it should be mounted with the grommet end down so that any liquid can drain out. It should also be mounted so that it is not exposed to direct road spray; avoid wheel wells and underneath sleepers. The engine compartment is acceptable, but never mount the CA-1 on the engine.

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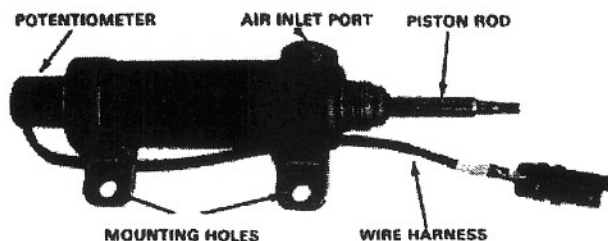
* Solenoids

The solenoid package consists of two solenoids which are used to control the air pressure in the CC-5 Air Cylinder. When the system power switch is on, the CA-1 provides constant power (12 volts) to one side of each solenoid. The CA-1 momentarily grounds the other side of the supply solenoid to allow air to enter the CC-5, (increase throttle). The Exhaust solenoid is grounded through the CA-1 to maintain air pressure within the system. To exhaust air, (decrease throttle), the CA-1 momentarily removes the connection to ground. These solenoids are pulsed as needed to adjust the throttle position.

Solenoid assemblies are available in 12 or 24 volt molded connector types, or 12 volt with Packard 56 series connectors. The 24 volt type is identified by black and red coil leads. The 12 volt type has all black leads. The connector and voltage type of the solenoid assembly must match the particular CA-1 that it is intended to be used with.

Although it is not necessary, solenoid assemblies are generally mounted on a stud which protrudes from the CA-1 cover, (when provided). Solenoids should be mounted where they will not be heard by the driver, since the exhaust pulses can be annoying. The solenoid can also be exhausted through an air line to reduce the noise. Solenoids should be mounted so that direct road spray is avoided and the exhaust port aims downward. If the Packard 56 connector type is used, the solenoids must be in a moisture proof location. Solenoids are never to be mounted on the engine.

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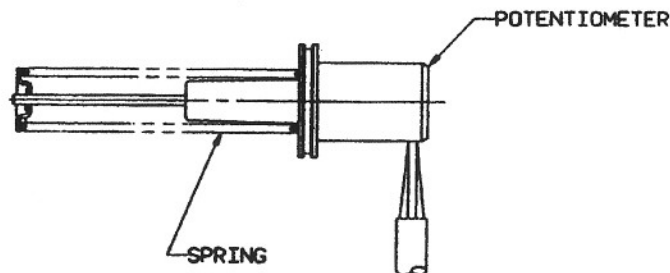
* CC-5 Actuator

This is a pneumatic cylinder which controls the throttle position. When the air pressure within this cylinder increases, the shaft is pulled inward. The solenoid assembly controls the air pressure to this cylinder. The CC-5 contains a potentiometer, which feeds necessary position information back to the CA-1, (potentiometer described below).

CC-5s vary by internal spring strength, (2 types, stronger for a truck, weaker for a bus), and by the type of connector, (2 types), on the potentiometer. The particular connector style must match the CA-1. Whenever there is excessive resistance to throttle movement due to the throttle return spring or linkage, the bus CC-5 should be used.

The full stroke of the CC-5 is approximately 1.5" and approximately 45 PSI is required to pull it to full stroke. The exact pressure varies with the type of CC-5 and the throttle return spring.

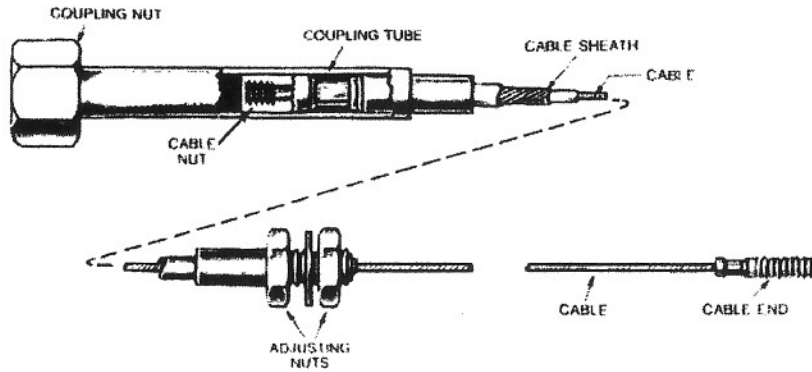
The CC-5 can be installed anywhere on the vehicle except on the engine. If the molded connector type is not used, the CC-5 should be installed in a moisture proof environment.



* Potentiometer

The potentiometer is contained in the CC-5 assembly. It is used to feed throttle positional information back to the CA-1. Without this information the system will not function in either Cruise or Throttle mode. The CA-1 supplies a fixed 2.8 volts across the resistive element of the potentiometer. The potentiometer wiper voltage is greatest when the CC-5 is compressed, (pressurized).

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* Throttle Cable

The Throttle Cable connects the CC-5 to the throttle linkage. The various types of throttle brackets, which are contained in the Engine Kits, are also required to make this connection. The actuator cable must pull on the linkage in a straight line, (+/- 4 degrees), to avoid cable damage and binding of the linkage, and it also must not have any slack to take up before pulling on the throttle linkage. The sheathed part of the cable cannot be bent in a radius of less than 6" or binding will result. Due to the limited range of the CC-5, the lever arm of the throttle linkage must allow idle to full throttle with a 1.5 inch stroke.

There are two types of Throttle lever cables available, depending on the end, (bead or swivel). Both types are sheathed. The unsheathed type, which was offered in the past, should no longer be used.

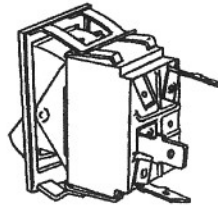
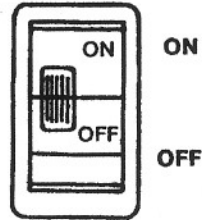


THROTTLE
CABLE WITH
BALL SWIVEL



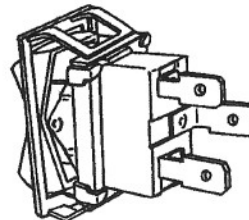
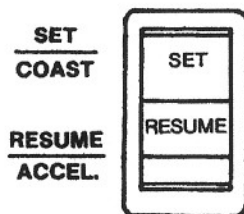
THROTTLE
CABLE WITH
BUTTON

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- * **Power Switch** – this lighted rocker switch turns power to the system on/off. All previously stored set speeds are cleared when power is removed. The supply to this switch should be fused to at least 2 amps but less than 8 amps.

This switch is located next to the Set/Resume switch. Both switches are to be mounted where they are easily accessible to the driver.



- * **Set/Resume Switch (Control Switch)**

This is a momentary two-way rocker switch. When it is actuated, power is connected to either the Set or Resume input of the CA-1. This switch serves various functions in the Cruise Control system, as described below.

While Driving (CRUISE MODE):

SET – While depressed, vehicle coasts. When it is released, the present vehicle speed is put into system memory and this speed is maintained. This switch is used to initially set the Cruise Control. It can also be used to reduce the previously set speed by depressing and holding the switch until the vehicle coasts down to the desired speed, then released.

RESUME – Momentarily depressing this switch sets the Cruise Control to the last speed which was loaded into the system memory. Holding this switch in causes the vehicle to accelerate, when it is released this new speed is put into system memory and is maintained.

While Stationary (THROTTLE MODE):

SET – Each time the Set switch is momentarily depressed, the throttle decrements slightly. This throttle position, (not necessarily RPM), is then maintained.

RESUME – The Resume switch increments the throttle position slightly each time it is momentarily depressed. This position is then maintained.

This switch is to be located next to the Power switch and in reach of the driver. Power is supplied to it via a short jumper wire from the Power switch.