



# Understanding The Mitsubishi Montero Active Trac 4WD System

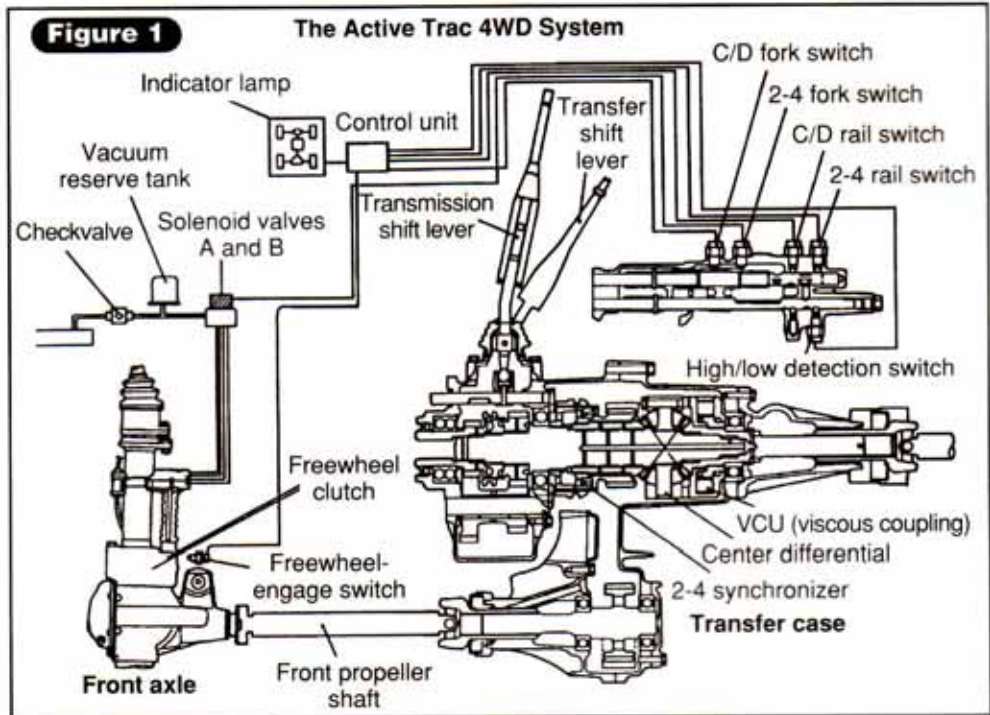
By Mike Weinberg  
Contributing Editor

In our ever-changing world of automobile technology nothing is evolving more quickly than transfer cases. Every year a number of new models are introduced with more-sophisticated and complex technology. With sport/utility vehicles selling at an amazing pace, any manufacturer that is not equipping its vehicles with the latest bells and whistles will lose market share. The customer is paying a lot of money for these high-tech 4x4s and is being pampered with ever-increasing luxury. No car-maker wants a customer to have to step out into the snow and sleet to lock front hubs. Viscous couplings and transfer-case differentials are putting an end to tire scrub and wheel hop.

Mitsubishi Motors is a company that knows a thing or two about 4WD and all-wheel drive. It has been at the forefront of the market with the Montero and all-wheel-drive passenger cars for many years. Since its introduction, the Montero has been upgraded continuously and in 1992 was equipped with the Active Trac 4WD system (See Figure 1). Active Trac systems are behind both automatic and manual transmissions. Operating characteristics are the same, but the shift pattern in the manual trans is a mirror image of the automatic version, and the manual trans has a neutral position not found in the automatics. (See Figure 2, page 46). For purposes of this article we will talk about the manual-trans model.

## System Basics

The Active Trac 4WD System is made up of a transfer case equipped with a viscous coupling and center differential, and an auto-freewheel front differential. It is controlled by electronics and vacuum.



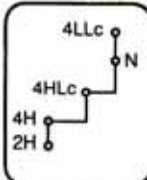
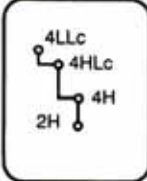
The transfer case for the manual transmission has a 5-position shift pattern.

**2High** – This position is for normal two-wheel operation.

**4High** – This position provides all-wheel drive or full-time 4WD. This range is for use on paved roads and uses a center differential and viscous coupling to equalize torque differences between the front and rear wheels. Shifts can be made into this range “on the fly” at speeds up to 65 mph. When shifting into any 4WD range at speed, it will be necessary to lift the throttle and let the spline loads in the transfer case and front diff relax until the shift is complete. The Active Trac system uses an electronic indicator lamp on the dashboard to inform the driver of 4WD status. Blinking lights will occur during a shift and will continue until the shift is complete (See Figure 3, page 46).

**4HLc** range provides 4WD with the center differential locked, sending equal power to both drive axles. This range should not be used on paved roads,  
*continues page 46*

## Up To Standards

Transfer Shift Pattern	Position	2WD/4WD	High/Low	Center Differential	Driving Conditions
	2H	2WD	High		For driving on a dry ordinary road or highway. (Economical driving position)
	4H	4WD	High	Operating	For ordinary and slippery road driving.
	4HLc	4WD	High	Locked	For driving on rough, sandy or snow-covered roads.
	N (vehicles for manual transmission only)				
	4LLc	4WD	Low	Locked	When an especially large amount of drive power is required, such as in deep snow or in extremely muddy or sandy conditions or low speed off-road

**Figure 2**

		Indicator Lamp Chart																		
Transfer Case Shifter Position		2H	→	4H	→	4HLc	→	4LLc	→	4HLc	→	4H	→	2H	→	→	4HLc	→	→	2H
4WD Indicator	Front Wheel Symbols	OFF	Flash	ON	ON	OFF	ON	OFF	ON	ON	Flash	OFF	Flash	ON	Flash	OFF	ON	Flash	OFF	
	Rear Wheel Symbols	ON																		
	Center Differential Lock Symbol	OFF	Flash	ON	ON	Flash	OFF	Flash	ON	Flash	OFF									
Detection Switches	2-4 Rail Switch	OFF	ON										OFF	ON		OFF				
	2-4 Fork Switch	ON	OFF										ON	OFF		ON				
	Freewheel Engage Switch	OFF	ON										OFF	ON		OFF				
	High/Low Detection Switch	ON				OFF	ON	OFF	ON											
	C/D Rail Switch	OFF	ON										OFF	ON		OFF				
	C/D Fork Switch	OFF	ON										OFF	ON		OFF				

Switch ON = Closed  
Switch OFF = Open

**Figure 3**

as premature tire and driveline wear will occur.

The neutral position gives this unit PTO capability.

The 4LLc mode is the same as the 4HLc mode except that the transfer case will provide an additional gear reduction of about 2-1. This range is for real off-road use.

### Powerflow In The Transfer Case

**2WD** – The power enters the transfer case, the high/low clutch is in high, the 2-4 synchronizer is in 2High, no power is transmitted through the chain and the center diff is locked, putting power to the rear axle. The center diff is locked, but the viscous coupling is inactive and the auto-freewheel differential is in freewheel.

**4WH** – This is the all-wheel-drive mode. Power flows to the transfer case with the high/low clutch in high, the 2-4 synchronizer in 4 high, the center diff unlocked and the viscous coupling operational. The center diff drives both axles. If one set of wheels slips, the viscous unit modifies normal center-differential reaction and directs power to the axle with the MOST traction. The auto-freewheel front differential has engaged the front axle.

**4WHLC and 4WLLc** – Power enters the transfer case, and the high/low clutch is in high or low depending on shifter position. The 2-4 synchronizer is in 4WDLc, and the center diff is locked. The viscous coupling is not operating, and the torque is split 50/50 between front and rear axles (See Figures 4 & 5, page 48).

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## The Auto-Freewheel Front Differential

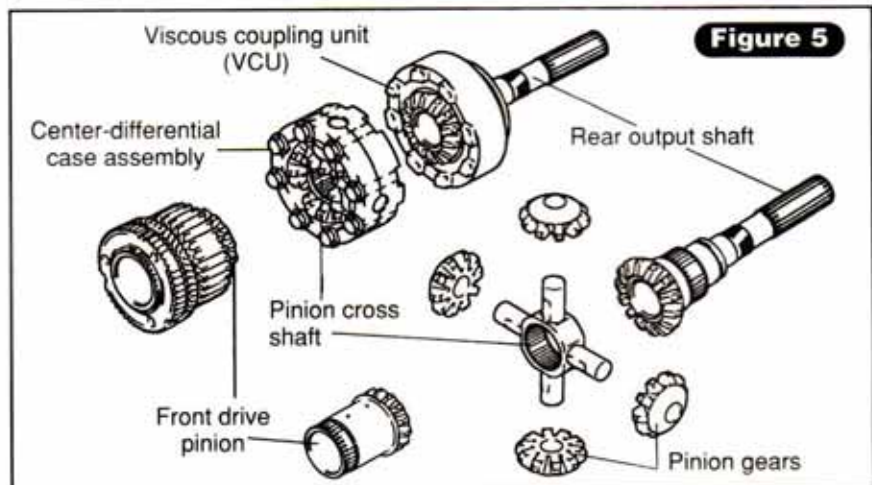
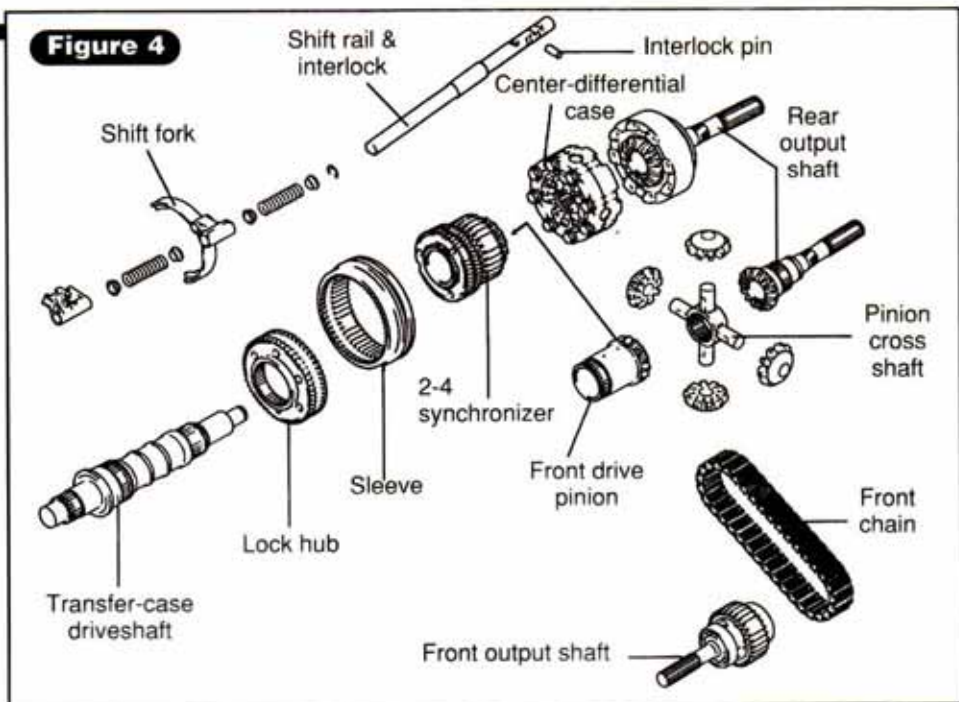
After the transfer case puts power through the front driveshaft, there must be a way to transmit power through the front differential. Mitsubishi does not use locking hubs. It has designed a sliding clutch that locks the axle to transmit power. The clutch is nothing more than a synchronizer sleeve that is operated through an electronic and vacuum control system. The clutch fork is operated by vacuum through a two-port vacuum diaphragm that engages or retracts the sliding clutch when vacuum is applied to one side of the actuator. A vacuum reservoir is mounted on the diff housing to ensure a constant vacuum pressure with varying throttle opening. A one-way checkvalve is between the intake manifold and the vacuum system to ensure constant vacuum at the reservoir. The two solenoids, A and B, port vacuum to each side of the actuator, depending on signals from switches mounted on the transfer case. The hose and solenoids are color coded to make vacuum routing easy. If this system seems familiar, it is very similar to the system used to operate the input synchronizer for 5th gear on the KM 160- and 180-series transmissions in the Mitsubishi, Hyundai and Dodge Colt front-wheel-drive cars (See Figures 6 and 7 on page 49, 8 and 9 on page 50).

### Electronic Controls

We have seen how the various components work on the Active Trac System, but they must be controlled to apply in the proper sequence for correct operation. This is handled through electronic controls.

### Transfer Case Electronics

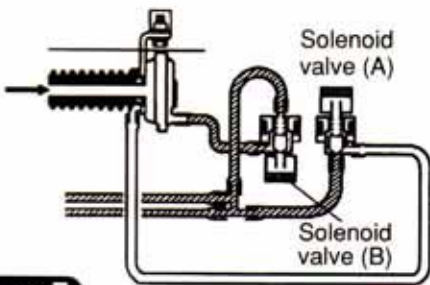
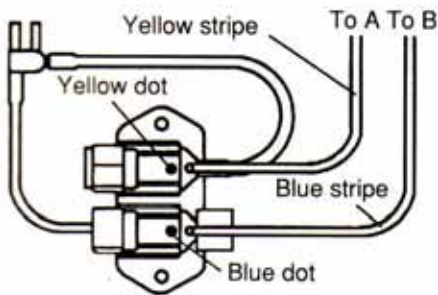
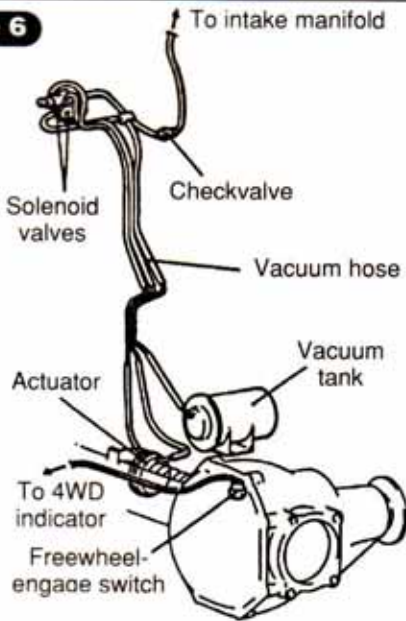
The transfer case has five electric switches (See Figures 10, page 50 and 11, page 52). These switches signal the electronic control unit that a 4WD shift has been made; the ECU in turn illuminates the dashboard indicator lamps to advise the driver of the status of 4WD operation. The switches provide continuity to permit the porting of vacuum at the auto-freewheel front diff to engage the front axle and



complete the shift to four-wheel drive. On the front diff are three electronic components: solenoids A and B, and the freewheel-engage switch (See Figures 12 and 13, page 57). The solenoids port vacuum to the vacuum actuator to engage or disengage the front axle, and the freewheel-engage switch signals the ECU that the front axle is operational and sends a signal to modify ABS operations when the vehicle is in four-wheel drive.

**Note:** A great amount of time is wasted on electronic units because of missed diagnosis or a lack of understanding of the operational theory of the unit. Many transmissions and transfer cases are taken apart only to reveal no visible faults internally; the problem was in the operating system external to the unit. The Active Trac System is no different and no more complicated if you understand how it works. Save the pictures and charts in this article for reference as a diagnostic guide, and always try to obtain a service manual for the unit you are working on.

**Figure 6**



**Figure 7**

All five switches on this Mitsubishi transfer case perform vital functions. It is critical that we understand how they work. Three of the switches have separate checkballs under them. Leaving out or losing the balls during repairs will create problems that were not present before the work was done. All switches on this unit are off (no continuity) when the ball is pressed onto the switch. When a shift rail is moved to engage a transfer-case component, a notch in the rail allows the ball to move away from the switch and the switch closes (per-

*continues next page*

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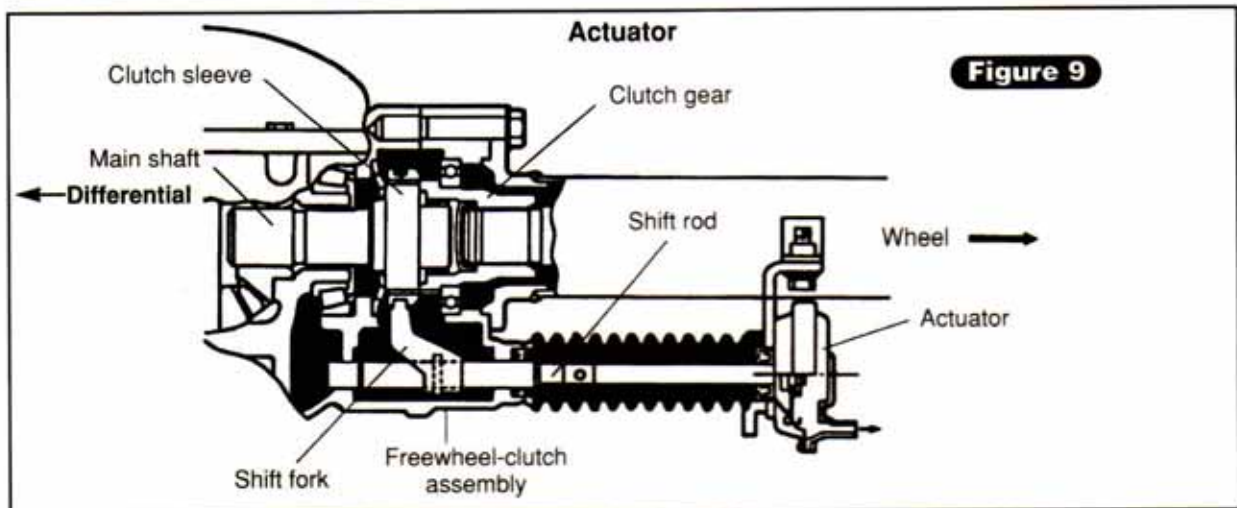
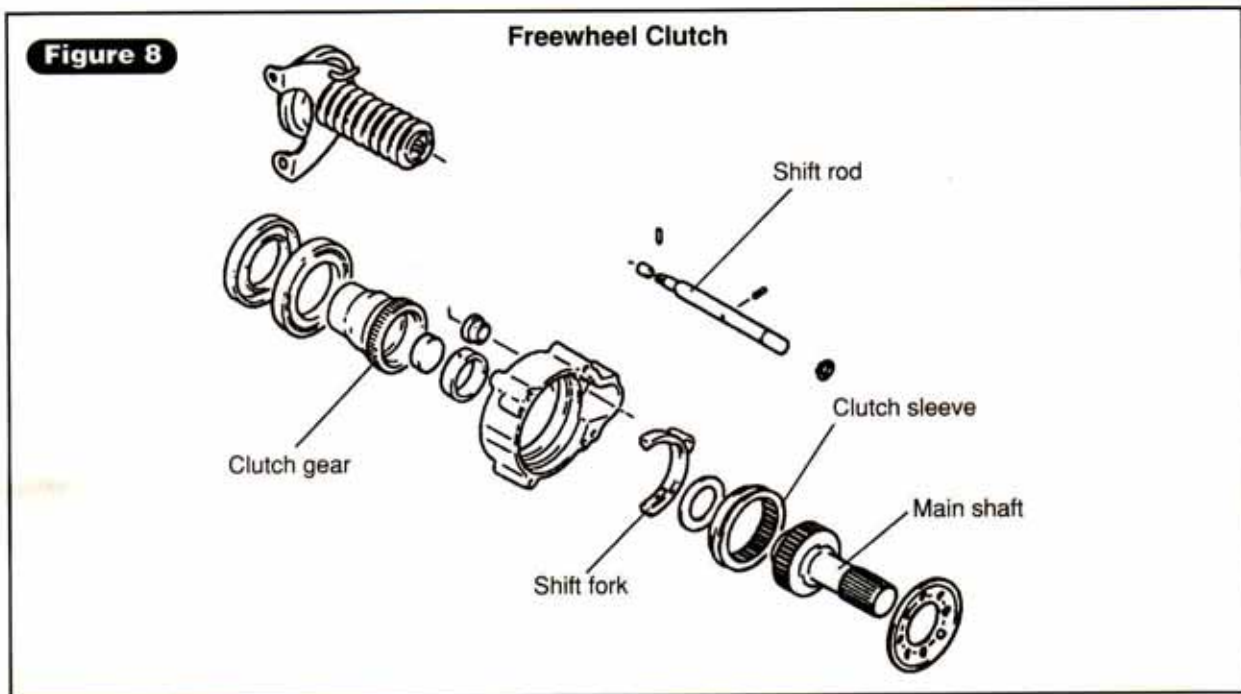
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mitting continuity). The switches and their functions follow:

Center-diff rail switch – Brown connector, separate ball, operated by the 2-4 shift rail

Center-diff fork switch – brown connector, built-in ball, operated by the 2-4 synchronizer shift fork

2-4 rail switch – black connector, separate ball, operated by the 2-4 shift rail

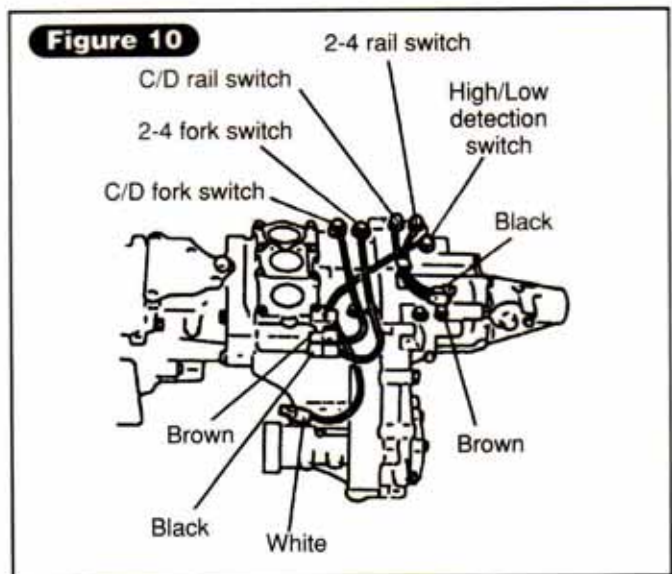
2-4 fork switch – black connector, built-in ball, operated by the 2-4 shift fork

High/low detection switch – white connector, separate ball, operated by the high/low shift rail.

The only thing we know for sure is that change is inevitable; nothing stays the same. The Active Trac System has been on the road since 1992, and more of them will begin to show up in our shops.

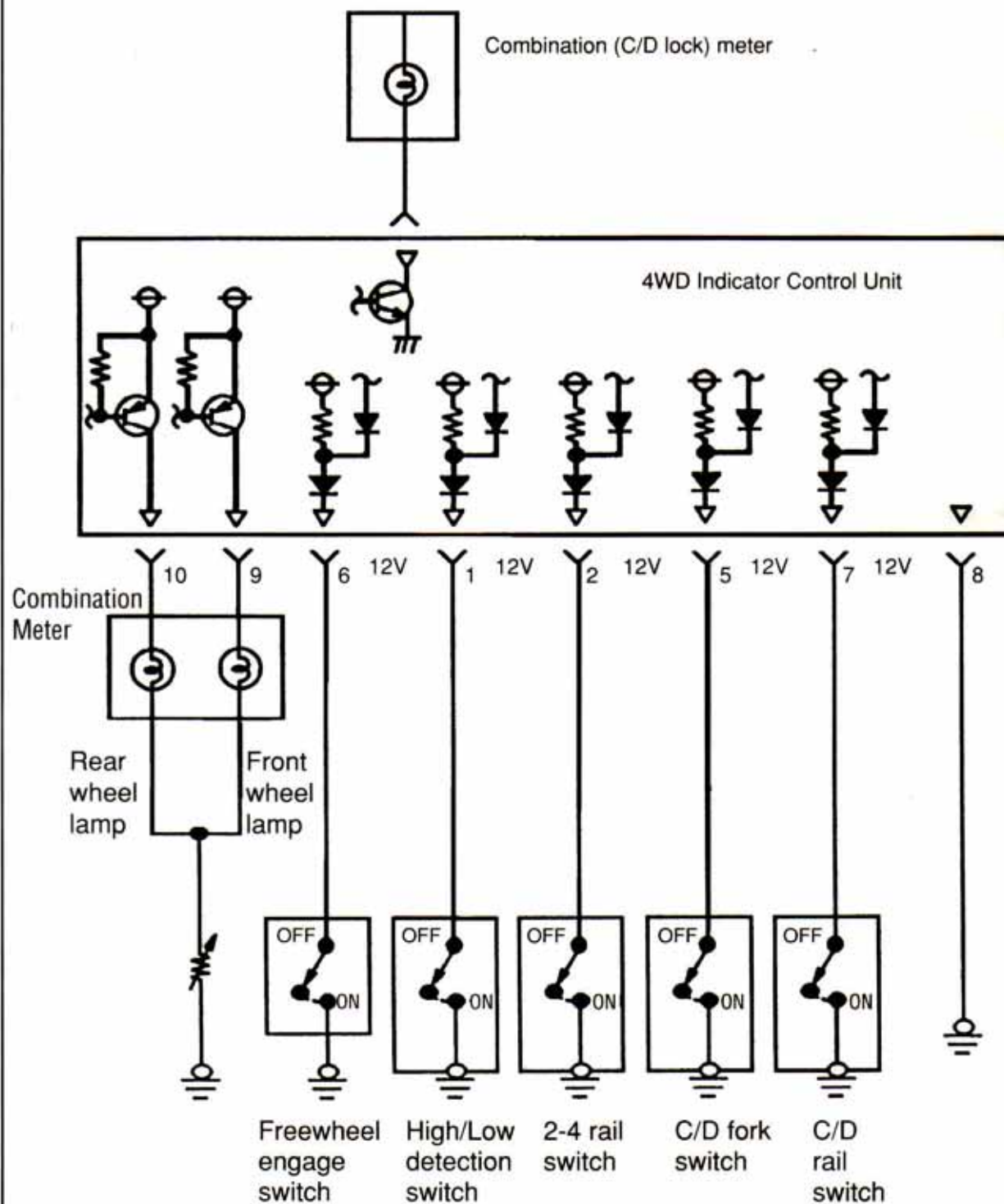
Understanding how they work will create additional shop profits and satisfied customers.

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## Switches

**Figure 11**

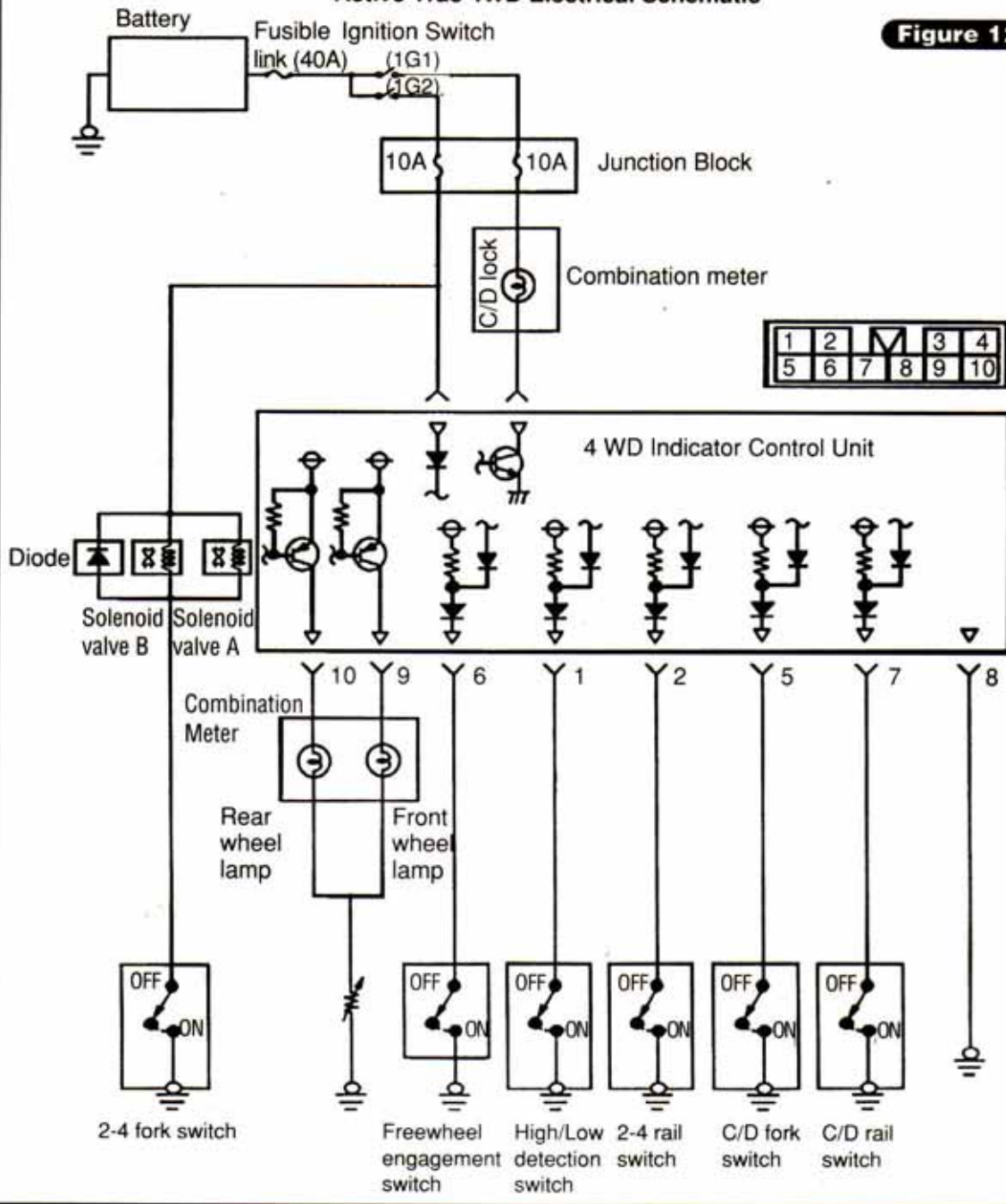


When ON, these five Active Trac 4WD transfer case switches provide a ground path for 4WD indicator control unit circuits.

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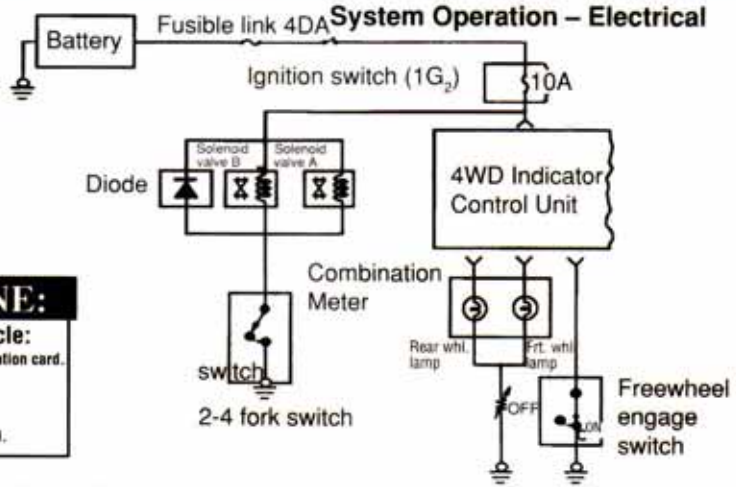
**Active Trac 4WD Electrical Schematic**

**Figure 12**



**Figure 13**

**System Operation - Electrical**



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 87 Useful information.  
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