



“New electronic controls and clutch configurations are making semi-powershift tractors more capable.”

Gear up for a powershift

Machinery **Tractor transmission**

Developments in tractor transmissions have highlighted differences in the way manufacturers put power to the ground. *CPM* describes the newcomers and reflects on what some of the long-established designs still have to offer.

By Peter Hill

For those who spend much of their day in a tractor seat, the ease and control with which you pass through the gears can readily dictate how the day will go.

The spotlight often falls on CVT transmissions as being the smartest and easiest to use. But new electronic controls and clutch configurations are making semi-powershift tractors more capable, more automated and also easier to operate.

Case IH ActiveDrive 8

Two ranges encompassing most field work applications plus one for transfer and transport activity feature in the new ActiveDrive 8 transmission developed within CNH Industrial for the Case IH Maxxum line.

It's available on the higher-spec Multicontroller versions of the 125hp to 158hp four- and six-cylinder models, which boost to between 145hp and 175hp for pto-powered implements and road travel.

The transmission's range one covers speeds up to 10.2km/h for heavy draft work, while range two is for the main field working speeds. This is said to cover nearly 90% of field and loader applications with no torque disruption from 1.6-18.1km/h under full load thanks to the generous complement of powershift steps.

For road travel, the transmission is designed to start in range three, with a skip-shift function allowing quick progress through the powershift speeds, especially when the auto shift feature is enabled for all 16 ratios in the top two ranges.

A kick-down function over-rides the

transmission automation to get a downshift for quick near-stall recovery or rapid acceleration. The Active Clutch feature disengages the transmission when the tractor is brought to a halt by fully depressing the brake pedal to make life easier at road junctions and when stacking bales with a loader.

Automatic shifting is also available in the field through any set of eight speeds — but not between ranges — and electronic modulation of both shifting and shuttle operation can be adjusted for a faster or slower response according to the task in hand.

Claas Quadrishift

This 16-speed transmission is the sole unit available with Claas Arion 400 Series tractors, which provide a choice of six power outputs from 90-140hp using 4.5-litre John Deere engines.

In its latest form, Quadrishift has gained a number of additional features, including Smart Stop, which enables the tractor to be brought to a halt using only the brake pedal and set off again by releasing it ▶

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New ActiveDrive 8 transmission is a new option for the Case IH Maxxum.

► — handy for loader and round baler work.

Operators can shift between the four powershift steps and four ranges without resorting to the clutch pedal, using just a rocker switch on the multi-function lever or up and down buttons on the side console that are handy when regularly looking around to a rear-mounted implement.

When the Quadtractiv automatic shifting option is taken, the operator continues to manually shift between ranges in field mode by pressing hard on the rocker switch, but on the road, the system takes over range shifts as well.

Overlapping powershift ratios result in a progressive increase in speeds so that engine power and torque characteristics can be exploited within the required speed spectrum.

Deutz-Fahr PS / RCShift

With the introduction of ZF's Terramatic transaxle, Deutz-Fahr 6 Series tractors gained additional ratios and more

powershift steps in each range for added flexibility within key speed bands.

The so-called 'intelligent' transmission, which adapts to the way the tractor is driven to some extent, is available in two forms — PS with manual control using powershift buttons on a range gear lever, and RCShift with manual or automated shifting throughout using buttons on a multi-function handle on the seat armrest console.

On a trio of four-cylinder tractors spanning 126-143hp in the 6 Series, the PS set-up is the sole transmission you can opt for, but both are available on the other four- and all six-cylinder models in the line-up covering 156-226hp.

With the more advanced system, the tractors come with the creep version as standard, serving up 54 forward ratios in all, although there is the option to 'down-size' to the non-creep 30x15 set-up, which is standard on PS models.

RCShift can be controlled manually or with automatic shifting between powershift

steps in the field and right across the speed spectrum on the road, with speed matching also part of the package.

John Deere DirectDrive

This 24-speed powershift with eight powershift steps in each of three ranges uses double-clutch technology first used to provide rapid-fire gear shifting on manual gearboxes in cars.

There are individual clutches to engage and disengage even and odd ratios, with the next ratio in line when changing up or down prepared for the two clutches to be activated simultaneously for what should be a near-seamless mechanical shift.

Automatic clutch sensitivity, speed-matching and start-up gear selection have been added since the novel transmission was first introduced.

Electro-magnetic actuators provide the rapid changes between speeds and ranges, which can be performed manually or in automatic mode, which is selected by moving the stubby shift lever to the right on the CommandArm seat-mounted control console.

In manual mode, the A, B or C range is selected by pressing the appropriate button on the CommandArm before using the lever to pulse up and down the eight steps.

Deere regards DirectDrive as combining the handling comfort and infinitely variable speed control provided by its AutoPowr IVT and similar hydro-mechanical stepless transmissions, with around 4% better power delivery efficiency translating into a potential improvement in fuel consumption.

However, DirectDrive is available on five models in the 6R line-up as an alternative to AutoPowr and the Quad powershift transmission in its various incarnations — the medium size 160/192hp 6145R and 171/202hp 6155R, and three large frame versions up to the 237/259hp 6215R.

Kubota Powershift

For the latest versions of Kubota's first foray in the arable tractor market, Kubota has switched the M7002 Series tractors to a new version of the ZF Terramatic semi-powershift that can be had with a creep option.

That increases the total number of ratios from 30x15 to 54x27 with six powershift steps in each of five ranges, with two speeds overlapping with each step up the ranges, and also a choice of 40km/h and 50km/h top speeds.

There are three models, all powered by large-volume 6.12-litre four-cylinder Kubota ►



In its latest form, QuadriShift on the Claas Arion 400 Series has gained Smart Stop clutch operation through the brake pedal.

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Four-cylinder Kubota M7002 tractors use ZF's Terramatic transmission for the semi-powershift option.

► engines serving up 130hp, 150hp and 170hp for draft work with cultivators and the like, and 150hp, 170hp and 175hp for trailer towing and mobile pto applications.

The transmission is operated using buttons on the multi-function handle that sits at the front of a seat-mounted console.

Landini Robo-Six

The blue Italian marque may be best known for its livestock tractors but the Landini 7 Series, available since 2014, shows why it is the second best-selling brand in its home market.

For its Stage IV / Tier 4 Final make-over, the latest 7 Series gets the Robo-Six semi-powershift transmission, which not only increases the permissible gross vehicle weight thanks to a more robust transaxle but also adds new features.

These include Stop & Action clutch control, that allows the operator to stop the tractor on the brakes and move off simply by releasing the brake pedal and applying a few revs.

So far, the Landini 7 Series Robo-Six has



The lesser version of the semi-powershift transmission in Deutz-Fahr 6 Series tractors has button shifting on a range gear lever.

been released in six-cylinder form with a 6.7-litre FPT engine nestling in a cast chassis and delivering outputs from 151hp for draft work and 166hp for pto/transport applications to figures of 206hp and 225hp, respectively for the top model.

Smaller four-cylinder versions to replace the current Landini 6 Series are anticipated and they too will replace the 24x24 Roboshift (four powershift steps in six ranges) with the new 30x15 Robo-Six (six powershift steps in five ranges).

Massey Ferguson Dyna-6

It's been a long time since there was powershift transmission news for Massey Ferguson tractors but that is a measure of the enduring capabilities of the Dyna-6 design used across a large swathe of the MF line.

It serves up six powershift steps — Dynashifts in MF speak — within each of six ranges for a total of 24 speeds forward and reverse, with nine speeds catering for different field work applications, implements and situations, and generous ratio overlap providing plenty of speed flexibility in each range.

Add the AutoDrive feature where it's optional or engage it where standard and shifts become automated, typically resulting in useful performance and fuel consumption gains over manual control, according to Massey Ferguson comparisons.

There are field and road modes, which alter the shift trigger dynamics, or operators can stick to making their own judgements using the 'T' shaped controller on the seat-mounted console.

Logically, this is pushed forward to

up-shift, pulled back to down-shift, with range changed achieved in the same way while pressing a range-shift button.

Alternatively, the unique Power Control lever to the left of the steering wheel remains available to perform Dynashift and range changes, as well as to select powershuttle forward and reverse and neutral, leaving the right hand free for the hydraulic and other controls.

The Dyna-6 design's versatility is evident from its application across a wide power band — from the 95-130hp outputs of the MF 5700 S line-up, through the 130-200hp MF 6700 S series, to the six-cylinder MF 7700 S family with power outputs from 150-280hp and all their variants.

McCormick P6-Drive

The introduction of the new P6-Drive semi-powershift transmission has brought about a step up in power, performance and gross vehicle weight for the ►

Committed to CVT

Don't expect Fendt or JCB to come up with a powershift tractor any time soon — the German marque pinned its mast to the continuously variable transmission concept a good many years ago and uses variants of the Vario hydro-mechanical powersplit drive system throughout its 77-517hp wheeled tractor range.

For JCB, the same transmission hardware but with bespoke control software has transformed the smaller Fastrac models offering 175-235hp outputs while underpinning the performance credentials of the 306hp and 348hp Fastrac 8000 Series.

Both manufacturers argue that CVT offers the best combination of power efficiency, with multiple modes optimising the engine/transmission partnership for different applications and situations, while also serving up good operating comfort and ease of control.

Hydro-mechanical powersplit drive suits the JCB Fastrac's field and transport activities.



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Dyna-6 is controlled by a small 'T' handle on Essential-spec MF tractors (left) and by moving the multi-function lever on Exclusive-spec versions.

► second-generation McCormick X7 Series tractors in six-cylinder guise.

There are five models, all powered by an FPT-produced Betapower engine that now delivers Power Plus outputs for transport and pto-powered implements, which in the case of the two most powerful models includes static as well as mobile pto equipment.

As previously, the engine is mounted stress-free in a cast chassis attached to a new ZF transaxle that brings about an increase in permitted gross vehicle weight and features updated rear axle components to handle more power.

The range now tops out at 225hp with Power Plus from the X7.690 P6-Drive and starts at 151hp/160hp from the X7.650 P6-Drive, with all versions being available to simpler Efficient spec and the full-feature Premium specification, which adds electric valves, more headland functions and an optional touch screen display.

This can be used to configure certain elements of the six-powershift 30x15 or 54x27 with creep P6-Drive transmission,



Like other New Holland transmissions, Dynamic Command is operated using the seat-mounted force-response control stick.

which uses Smart APS to shift automatically on the road to match target engine speeds set by the operator to prioritise either performance or fuel economy.

A dedicated ECU handles the calculations, with shift patterns altered according to engine speed and load to obtain the best acceleration and efficiency.

New Holland Dynamic Command

This all-new 24x24 semi-powershift CNH transmission for New Holland T6 Series tractors provides eight-step powershift flexibility within overlapping ranges configured to minimise inter-range shifting for common applications.

Dynamic Command also has a number of automated features, including Ground Speed Management that leaves the transmission to provide a consistent working speed while using the highest ratios and lowest engine speeds possible to minimise fuel consumption.

The transmission is an option on four T6 models with 125-155hp outputs from four-cylinder FPT engines for draft work, and 145-175hp when 'boosted'.

It's also an option for the six-cylinder T6.180 with 158hp boosting to 175hp for mobile pto implements and high-demand hydraulics, and a more limited output above 22km/h for transport work.

Two clutches shift between the eight powershift steps, each mounted on shafts carrying the four odd or four even powershift gears, and an adjustable engine speed threshold is available to fine-tune the Auto Shift feature for different applications.

The shifting process disengages an odd ratio as an even ratio is engaged and there is electronic shifting between the

three ranges, with Smart Range Shift selecting the most appropriate one.

Fully pressing the accelerator pedal initiates a Kick Down shift to get the engine spinning for a quick response to driver demand for speed, while brake pedal clutch activation — Dynamic StartStop — is included.

Valtra Versu

Although Valtra's Versu 30x30 transmission with five powershift steps has been around for some time, it's been given a new lease of life with the introduction of the SmartTouch armrest console.

This has a touch screen display to set new and existing transmission functions and a multi-function control stick that regulates ground speed.

Together with new electronic transmission and clutch management, this combination results in the unique ability to operate the tractor as if it has a CVT drive — push the stick forward to accelerate through the auto-shifting powershift gears, pull it back to slow down.

This 'drive lever' mode leaves the driver free to find the most comfortable seating position for different operations.

Auto shifting between selected ranges is also possible by pressing the relevant icons on the transmission set-up screen of the SmartTouch display, which itself is selected by pressing the icon on the graphic representation of the tractor.

The operator can select auto shifting between ranges B and C or C and D individually, or both to cover a wider band of ground speeds.

In addition to the usual engine speed and load parameters, auto shifting can also be influenced by adjusting the degree of engine braking required using an on-screen slider with a scale of 1 to 5 settings.

The new HillHold feature is activated by holding the tractor on the brakes, applying 'park' using the shuttle lever and then forward or reverse; with the brake pedal released, the tractor will then only move off once accelerator pedal is used to deliver more revs.

Once on the move, Auto Traction can be used to operate the transmission clutch through the brake pedal at road junctions or when performing repetitive manoeuvres using a loader or round baler.

The Versu transmission with SmartTouch is available across the latest Valtra N Series 135hp to 185hp four-cylinder tractors and T Series six-cylinder models from 155hp to 271hp. ■

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