



Sauer-Danfoss Controllers in Haulers

Summary

Many yarders in New Zealand, and some swing yarders in particular, use air powered control systems. Air over hydraulic parts are sometimes difficult to source when needed for repairs, and are not as reliable and responsive as electric over hydraulic controls. An updated control system based on Sauer-Danfoss equipment has been designed and installed in four swing yarders. The system comprises solenoid controls, a digital signal processor, a display and joystick control. Advantages with the system include increased ease of use and adjustment for different rigging systems, and the potential for recording machine functions and hence performance. An installation costs approximately NZ\$30,000.

Authors

Tony Evanson, Scion and Brett Henderson, BHL

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Introduction

Cable hauler operations are a feature of the New Zealand logging industry and have been for many years. Hauler productivity and its measurement have also been the focus of research efforts, historically by LIRO, and more recently, by Future Forests Research Ltd. Computerised control systems, such as a Sauer-Danfoss control system have the potential to supply information that could be used by equipment managers and planners to better manage hauler operations.

Most haulers in use in New Zealand use control systems based on air over hydraulic principles. These operating systems have remained largely unchanged for some 20 years or longer. In comparison, the operating systems of excavators and harvesters (processors) have moved to electric systems, with associated fine tuning of functions enabling precise movement, and they are tailored ergonomically to the task. Operators of these machines have required the controls and seating design to reflect the time spent operating the machine and the skills required to operate the machines efficiently.

In Europe, computerised control systems for haulers have been available for some years. An Austrian-made truck-mounted 2-man cable

hauler/processor system, the Forsttechnik Synchrofalke, has a computerised carriage control system capable of automatically moving the carriage back to previous break-out point. The hauler can also be operated by remote control (Heinimann et al, 1998).

A Danfoss Control system for a swing yarder

A controller, also known as a Digital Signal Processor is a programmable computer that controls and coordinates machine functions. A controller system combines the programmed controller, display and sometimes the controls, in this case, joysticks.

Sauer-Danfoss is a US company making controllers that have been used in harvester equipment such as Waratah. More recently these controllers have been installed in swing yarders in New Zealand. Four installations of the system (two Madill 122's and two Madill 123's) have been carried out in the past three years by a Rotorua-based technician, Brett Henderson. Hardware and programming has been supplied by Electric and Mechanical Services (EMS) Rotorua. Both Madill and Thunderbird swing yarders can be fitted with the system, and there is also the potential for installation on tower haulers.



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Fig.1 The Sauer-Danfoss controller display.



Fig. 2 A Sauer-Danfoss joystick.

The controller system consists of:

- A Sauer-Danfoss Plus+1 MC050-010 Controller unit
- A Sauer-Danfoss DP600 Series Graphical Terminal Display (Fig. 1)
- A Sauer-Danfoss JS 6000 Joystick base (Fig.2).

Technical specifications are available at the Sauer-Danfoss website www.sauer-danfoss.com

Controller

The controller is a ruggedised Digital Signal Processor that powers solenoid controls directly

and is short-circuit and reverse-polarity protected.

Display

The soft display buttons (Fig. 1) enable menu-based navigation to monitor:

- Electrical inputs and outputs
- Change of operating modes
- Checking for electrical faults
- Manual energising of required electrical outputs.

The main screen can also display transmission gear selections, and can be set to display engine warning systems using the CANbus J1939 protocol.

With manual mode, the operator can operate the air and hydraulic coils directly, allowing for flexible operation and testing of circuits.

Operating modes

The operator can use the display screen to select different operating modes by pushing the appropriate button e.g., dropline, grapple or highlead. The controller selects the output functions and timings to suit the rigging system used.

Joystick base

The joystick controls (Fig. 2) can be supplied with varying numbers of buttons to suit the desired functions.

Results

A contractor who has had the system installed on two Madill 122 and 123 yarders claimed the systems to be simpler and easier to operate, having less downtime due to actuator problems, and more reliable overall than the manufacturer's control system.

Installation and hardware cost is approximately NZ\$30,000 depending on the degree to which controls require conversion from air to electric activation.



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In terms of hauler daily costs, as an example, the addition of the controller system would add an estimated \$13/day assuming 10 year economic life of the system. Costs are based on Informe Harvesting 2008 (Forme Consulting Group Ltd).

Features of the use of controllers in haulers include (as claimed by the designer):

- Safety – If the control system loses power or fails, the drum brakes are automatically applied. Brakes can only be released if the operator accepts the operating conditions displayed. The operator can apply service brakes and gear-lock the hauler drums with two service buttons on the display.
- Commonality and good availability of parts
- A simple system with fewer moving parts
- Changes of rigging systems are easily made. The controller system ensures that the systems work properly.
- Good responsiveness of controls

For the operator:

- The system is easy to use
- System information is displayed on-screen
- Controls are standard, and an operator can easily convert to a another controller-equipped hauler
- The system has a diagnostic feature and a memory – useful for detecting intermittent faults

In swing yarders, the controller system enables variable speed reversing and allows the lowering and raising of a carriage as the dropline is paid out or retrieved, potentially improving cycle times.

In discussion, one operator said the system gave him more control and the breaker-outs liked the system because they felt safer with the built-in safety features.

To date, a tower hauler has not been fitted with a controller, but this is feasible, and operators could be trained on this system to operate a swing yarder.

Conclusions

Sauer-Danfoss-based control systems are being used in New Zealand in a number of swing yarders. Features include:

- A joystick control.
- A menu-based display screen for selecting operating modes.
- Electric over hydraulic controls.

Controller systems, such as the Sauer-Danfoss system, have the potential to:

- accept, process and display additional inputs (eg. butt and top counts or haul distance)
- hold this and other data in memory for download.
- provide useful management and planning information for contractors and/or managers.

References

Heinimann, Hans R., Visser, Rien J. M. and Stampfer, Karl. (1998): Harvester-cable Yarder System Evaluation on slopes - A Central European Study in Thinning Operations. In COFE (Council on Forest Engineering) Proceedings. "Harvesting logistics: from woods to markets" ed. Schiess P. and Krogstad F., 41-46. Portland, OR, 20-23 July.

Forme Consulting Group Ltd. (2008): Informe Harvesting 2008, Independent Harvesting Survey.