

Aviation hydraulics testing set uses real-time Ethernet

Test-Fuchs, one of the leading manufacturers of test systems for the aerospace industry, relies on real-time Ethernet technology for its high-precision test equipment. Using new, modular test stands, hydraulic components from all types and classes of civilian aircraft can be tested. Each base module within the testing system has its own control. These CPUs are synchronised through a Varan multi-manager system.

TESTING SYSTEMS for over 90 different types of aircraft have been built to date and used in locations all over the world. Test-Fuchs, located in Gross-Siegharts, Austria, has now been using the Varan Ethernet bus system in various projects for two years. Among other applications, test stands incorporating the technology have been used for the cargo loading system of the Airbus A400M, flight control components for Air France as well as motors and generators up to 800kW for the French navy. The Ethernet component forms an essential part of the measuring, control and regulation system.

The modular test stands perform the function test for rotating parts such as hydraulic motors and pumps as well as linear components employed as the flight control actuators. The test procedure deals with a maximum hydraulic flow of 127 litres/min at a pressure rating of 420 Bar. All measuring stations in the system are equipped with their own measurement and regulation hardware and are synchronised through Varan. The design also permits the connection of additional stations while the system is actually working.



Test stand for linear hydraulic components and servo valves

Each base module has its own intelligence and the decentralised configuration of the measuring units simplifies programming. The entire system is scalable and additional options may be added later with little effort. The system set-up permits the full computing power of the PLC to be available to the individual modules.

The entire system is operated at an isochronous scan time of 200µs. The Varan technology guarantees that all measured values throughout the measurement units are synchronously recorded, the corresponding



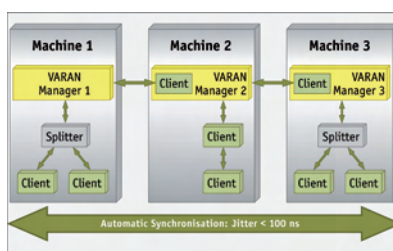
PHOTO: AIRBUS INDUSTRIE

calculations for the regulation algorithm are performed and the set values are generated – regardless of which CPU they are assigned to. Looked at on a per-control basis, 10 real PID regulators can be operated in addition to the recording of several hundred measuring channels within this cycle time. Thus systems with thousands of synchronously processed measuring and set value channels and hundreds of PID controllers can operate in what amounts to hard real-time.

System synchronisation

With the Varan multi-manager system, crosslinking and synchronising a system or the entire machine park in hard real-time is possible without use of distributed clocks. To synchronise the bus participants, a simple PLL mechanism is used. At the start of each bus cycle, a synchronisation signal is sent to all participants. This method reduces jitter to less than 100ns, a level of deterministic performance which is guaranteed. Varan also uses inherently short data packets and thus can repeat messages in the same bus cycle if an error occurs. This mechanism guarantees absolute data security in a network as part of the basic function.

Data from all units of the machine system is exchanged in hard real-time. As with bus participants in an individual network segment, the same timing is also provided across segments. Once again, the jitter which occurs during data



exchange between the function groups will always be below 100ns.

The machines are cascaded within the Varan network, which means that each individual machine represents a simple client for the higher-level system and the data exchanged between machines can be freely defined. This communication is established using a DPRAM mechanism which may be scaled as desired. Individual processing units may be configured in line, star or complex tree structures and determined by the system designer.

Cross-system hot plugging

Through the hot plug capability of the Varan, entire machines can be connected during full real-time operation of the system. The newly connected component is identified automatically and accepted into the network according to validity, without affecting the operation of the total system. This automatic registration mechanism is made possible through the obligatory electronic type labelling for each bus participant. This tag contains all the required information such as VendorID, DeviceID and additional identification. In the single networks, different cycle times are also possible. The failure of a network segment, in a respective machine, is detected within the bus cycle.

The addresses of the individual bus participants are assigned automatically with up to 65,280 bus participants per network segment. With the cascading of networks structures, expansion is thus almost unlimited. Each machine is assigned one IP address only, whereby administration is reduced to a minimum.

The entire production process can be integrated into a company network without additional security measures. Unauthorised access from the company network can under no circumstances bring production to a standstill. This is because, in a Varan network, office world data is divided into small packets and tunnelled through the Varan network without interpreting the contents. Additional security, such as firewalls, are unnecessary.

(From Sigmatek)

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