INTERFACES DEDICATED TO PROCESSES CONTROL

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Controlling tasks are very common in many areas, for example the control functions associated with buildings, the factory automation control, the production and control of energy, the chemical industries...

These tasks are genrally managed by process controlers or industrial micro computers linked to a supervisor and sometimes a dedicated computer.

At the control level, sensors and actuators are the means of controlling the physical processes, and are monitored and driven by the process controller interfaces.

- 90% of system failures are due to the wiring or the sensors/actuors. Wiring may be reduced by the use of a field BUS and the distributed interfaces.
- Considering the remaining 10% of failures, 90% of them are due to the input/output interfaces.

Thus, if the reliability of the interfaces and the diagnostic functions are improved, the availability of the system increases (working time/wirking time + stopping time). A good means to achieve that is to use integrated self protected interfaces allowing a telediagnostic from the controller. The devices have integrated on the same silicon chip the safety and diagnostic functions and the power switch.

A better availability is achieved by mixing integrated interface with field BUS, decreasing the first 80% of errors, and the installation cost of the system.

A FAMILY OF INTEGRATED INTERFACES

The family of new circuits are dedicated to drive any type of inductive and resistive loads.

Their main characteristics are :

* No indeterminate states up on power on.
* Short circuit protection with the positive supply and ground by current limitation.
* Over heating protection.
* Protected against overloads.
* Alarm output with delay.
* Open ground protection.
* Output voltage can be lower than ground for fast inductive load demagnetisation.
* Differential input for universal logic compatibility.
* Output paralleling capability.

Generally, hybrid or discrete circuits are used for these interface functions in process controller. Using integrated devices is cost effective and provides a better thermal protection because of the integration of the temperature sensor. As consequence, overload protection is totally reliable. Integrated interfaces are available in high side and low side configuration, for a range of current from 0.5A to 2A. They operate with a supply voltage range of + 8V to + 32V, a typical block diagram of one of these devices, the UAB/UAF 1780, is shown in Figure 1.

APPLICATION CIRCUIT OF THE UAB/UAF 1780

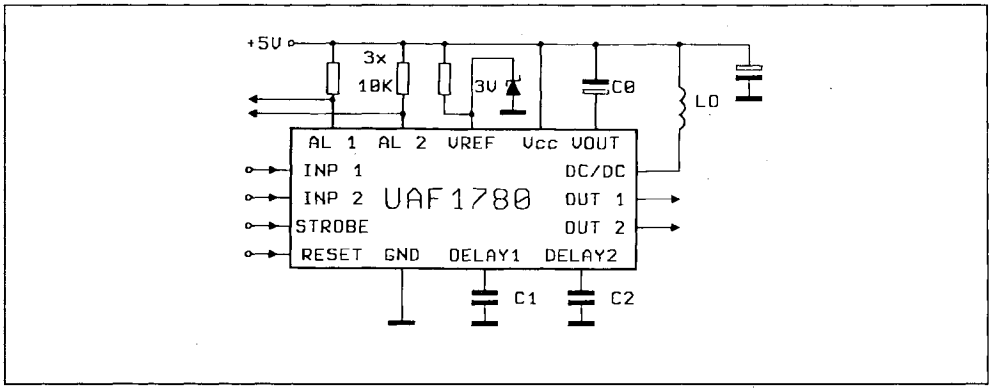
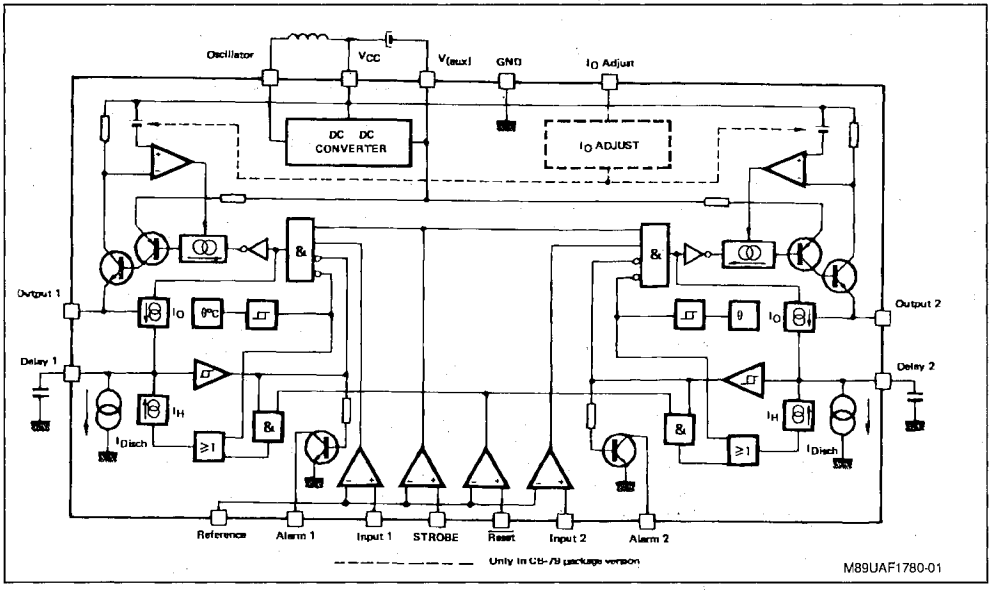


Figure 1 : UAF 1780 Structure.



APPLICATIONS

A local peripheral was designed for use by a micro computer or process controllers. The circuit uses four UAB/UAF 1780 which are dual integrated interfaces delivering up to 1A without heatsink and more than 2A with. The interfaces are driven and monitored by a Z86E11 micro controller whose UART allows the communication link with a serial field BUS.

Figure 2 shows the block diagram of the system.

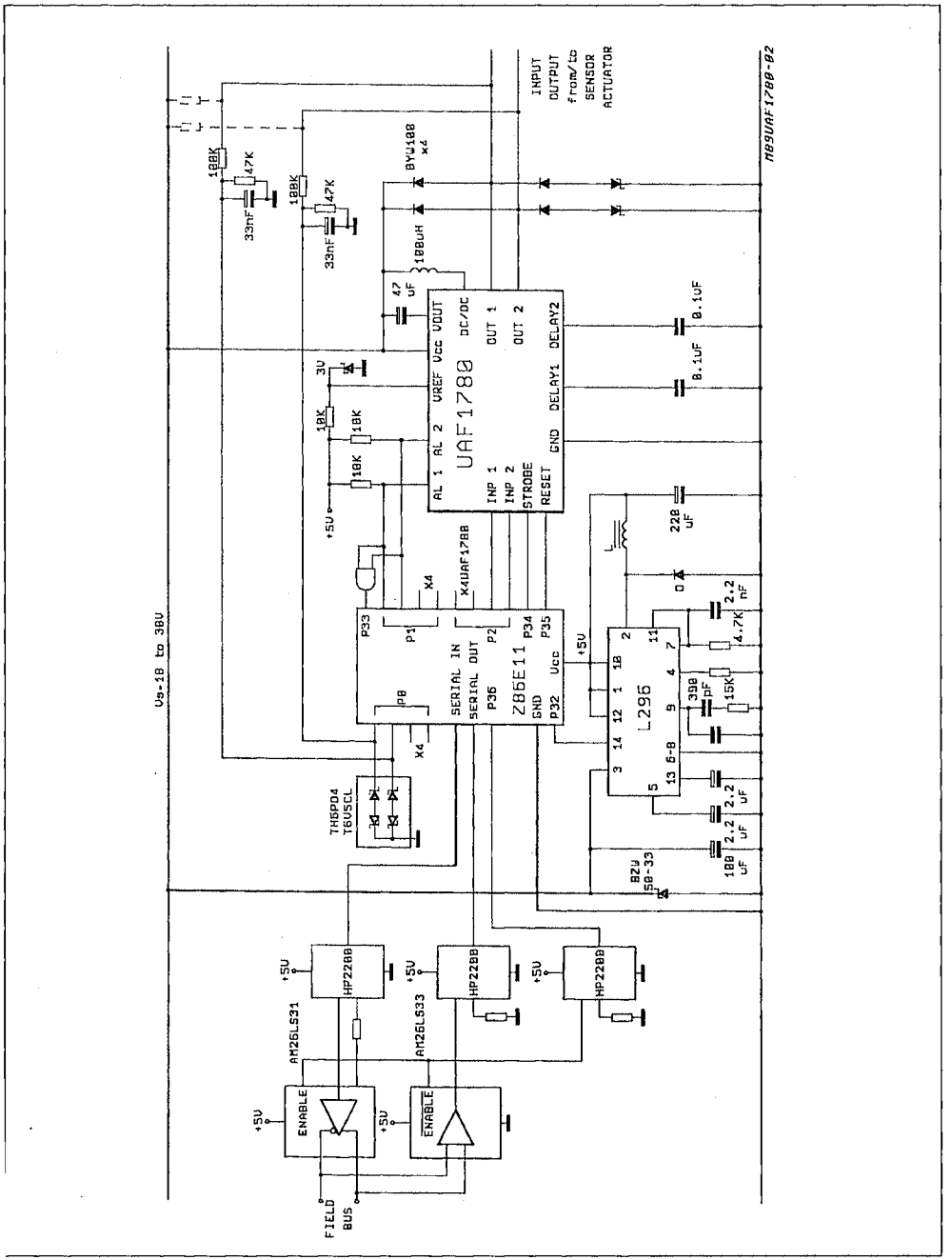
The configuration of the output of the integrated interface allows each output to be used as on input (via P_0) if desired. Only one of the four UAF 1780 is showed on the figure.

- In output configuration, the interface controls and minotors the load. The feedback signal to the port P_0 means that the state of the output can be monitored increasing the diagnostic capability
- In input configuration, the interface is off and the signals are read via the P_0 port.

List of items :

* UAB/UAF 1780 : Intelligent full protected power switch
* Z86E11 : 8 bits microcontroler
* TRANSIL TH6P04T6V5CL : Octal protection zener in DIL package
* L296 : High current switching regulator with reset output
* AM26LS31 : High speed differential line driver
* AM26LS33 : Differential line receiver
* TRANSIL BZW5033 : Transcient voltage suppressors 5Kw/1msec
* BYW100/100 : High efficiency ultra fast diodes V_{RRM} = 100V trr = 25/60nsec Vf = 0.85V

Figure 2 : Block Diagram of the Peripheral.



MAIN CHARACTERISTICS OF THIS PERIPHERAL

a) Inductive load demagnetisation :

The ability of the integrated interfaces output to sustain negative voltage up to 30V, provide a very fast demagnetization of inductive loads.
The size of the Zener diode depends on its voltage, the load current and the commutation frequency.

b) Noise and spike immunity.

The interfaces are supplied directly from the local 24V line. Because they withstand voltage spikes of up to 60V for 10ms, a transil is an effective protection for supply disturbances.

The outputs are protected by diodes connected to the ground and to supply to ensure the interface outputs are not subjected to parasitic voltage spikes.

c) Interrupt priority register.

–The first priority is given to the switching regulator L296 which warns the micro controller when there is an interruption in the supply voltage. This regulator provides simultaneously two auxiliary supplies one of which is isolated and used for the field BUS interface AM26LS31.

–The second priority is used for the communication with the host computer via the UART.

–The third priority is used to monitor the default signal of the UAF1780 interfaces.

d) Field BUS interface :

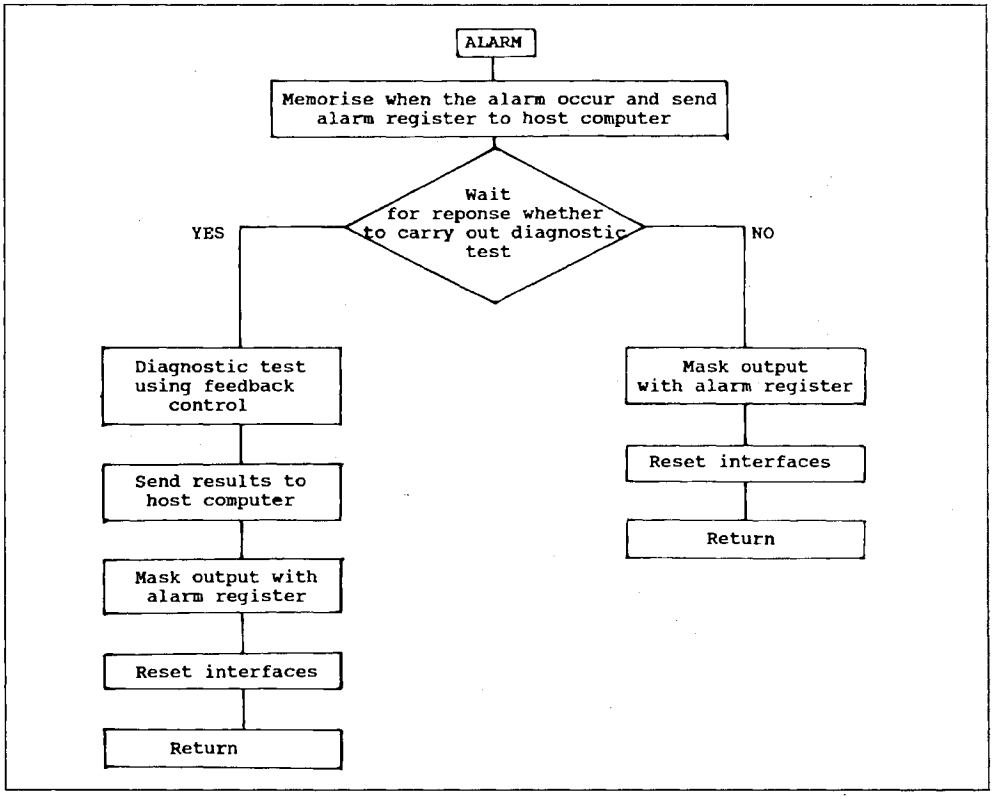
The galvanic isolation of this peripheral requires only three opto couplers because of the multiplexing of the INPUT/OUTPUT and alarm signal.

e) Efficiency :

The high efficiency of these integrated interfaces is due to an integrated DC/DC converter which reduces the on state voltage of the output Darlington stage.

DIAGNOSTIC CONTROL

When alarm output is enabled, the following processus is started.

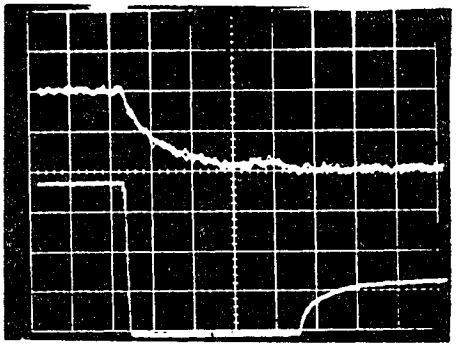


INTERFACE BEHAVIOUR

a) Inductive load.

Figure 3 shows the turn-off commutation with an inductive load, the demagnetisation zener diode used was 10V. This diode provides a current path for the load demagnetisation and a protection against negative spikes induced from in the wiring.

Figure 3 : I load : 0.4 A/div
V out : 10 V/div.

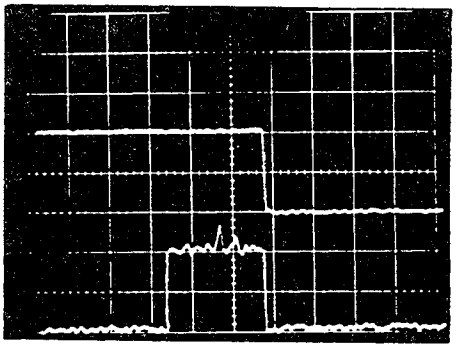


t : 20 msec/div.

b) Short circuit behavior :

Figure 4 shows the output current and the alarm signal in case of short circuit. The current is internally limited for a preset delay, after which a low level is applied on the alarm output and the current switched off. This device can be reactived by the reset input.

Figure 4 : V alarm : 2 V/div
I load : 2 A/div.



t : 1 msec/div.

c) Over heating detection :

Figure 5 shows the output current and alarm signal in case of over heating detection. When the silicon chip reaches 150°C, the current is switched off and the alarm output actived. If the reset input is low, the switch restarts after the thermal hysteresis cycle and a preset delay. If the reset is high, the switch will remain off and the alarm low.

CONCLUSIONS

This family of integrated full protected interfaces provides more reliability in process control. Due to the alarm output, the real time diagnostic function can easily be multiplexed with a low cost micro controller.

The set of devices used for this application is optimized and provides a high immunity against all disturbances from the line voltage, the wiring and the loads.

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