



## Elzet80

### TSM - the rail mount modular control computer

**TSM is ELZET80's modular computer for small series applications or those that need many or a varying number of I/Os. It directly mounts to the rails of a control cabinet. Software-wise you can regard it as a PLC that can be programmed in C or our famous multitask BASIC "MSRBASIC".**



- Modular design without bus boards or cradles. Accomodates up to 14 i/o modules.
- Plug-in screw connectors for all i/o (except where screening is required) inclusive of ground and supply (3 terminals for every digital input).
- Extended temperature range, burn-in-tested for use under environmental temperatures between -20°C and +70°C.
- Watchdog on every output module shuts off outputs if not refreshed every 50ms. Alerts CPU and sets LED on.
- All 24V i/o isolated.
- Checks for external voltage on every module.
- LED indicators for every in- and output, for internal and external supply voltages and watchdog.
- DC/DC on CPU supplies all i/o- modules with 6,3V that are post-regulated on every module to 5V with low-drop regulators.
- 8 bit parallel bus, with special sequencer for handshake operation between CPU and i/o.
- Module IDs to check i/o configuration by software.
- Rotary switches for address settings

### TSM modules

**TSM-I/O-modules snap to standard DIN rails and use small flat cable connectors to interconnect. They have a depth of 126mm while the width varies from a minimum of 57mm to 180mm for the widest module.**

- Rail mount I/O- extension modules that are interconnected with short flatcable connectors. Active bus termination on both ends.Parallel, multiplexed address/data-bus,total length up to 1.5m, BiCMOS high power drivers.
- No bus board necessary.
- Supply voltage regulated on each module with low drop regulators from a 6.3V primary DC voltage available on the bus. Address setting with rotary switch.
- Phoenix Combicon pluggable screw terminals for all digital i/o. (terminal blocks not included).
- Usually, two or three terminals (ground, signal,+24V) are provided for immediate peripheral connection.
- Software readable module id to detect configuration from the CPU.
- Software detection of missing external voltage (24V) for each module.

- Watchdog circuit to reset all outputs if not refreshed regularly.

Up to 14 i/o-modules may be connected to the CPU, provided there is enough current available from the power supply. 3A (at 25°C) are the limit for TSM-CPU while 4A are available on TSM-CPU900. Please add up the worst case current consumption given in the description for each module to find out about the maximum i/o-configuration for your application.

## Addressing

From the viewpoint of the TSM-CPU900 the modules are accessed as memory locations with each module occupying 4 bytes in the basic address space. This gives immediate access to 32 digital i/o-ports. Although the CPU makes a standard memory access, the TSM bus transfer is translated by hardware into an interlocked sequence of address, acknowledge, and data (see below).

FIFO buffers are used where more data has to be transferred (as for example with 4SSI or 2RS232). Beside the four addresses (address set switch  $\times 4$ , i.e. 00 to 3FH ) that each module occupies in the data address space there are another four bytes per module for status information (data address space plus 80H , i.e. 80 to BFH ). This area is called the ID address space and returns on the base id address of the module (switch  $\times 4 + 80H$  ) a module code (unique codes for the different i/o modules) in the lower six bits while bit D6=1 signals missing external voltage (24V) and D7=1 is an error condition (usually watchdog).

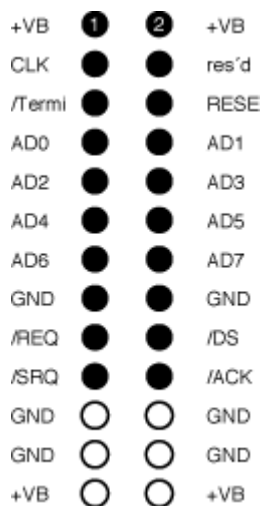
## Safety precautions

A TSM bus can reach the length of 1 1/2 m with the full number of i/o-modules, which requires some measures to guarantee fault-free operation under industrial operation conditions. Most of these precautions are built-in like the use of multilayer boards for low inductance ground distribution, active termination on both ends of the bus or watchdog circuits with output modules. The watchdog requires output values to be refreshed all 50ms by system software (mCAT and MSRBASIC take care of this), otherwise, all outputs on the affected module are switched off and D7 on ID-address 0 is raised. An orange LED on each output module alerts the operator of a watchdog condition.

A stable operating voltage of 5V is generated on every module from the raw voltage of 6.3V available on the bus. Special low drop regulators guarantee operation even after 1,5m of bus length.

## Bus cabling

TSM i/o-modules are interconnected using short 20p flat cable connectors. These 20 wires carry a multiplexed 8 bit address-/data bus plus handshake and control lines and two supply voltage wires each.



As a new cradle profile has become available, starting 1997 we changed the TSM construction. While we used to surface mount all parts that not needed user access below the board, now everything is mounted on top and hidden under a stainless steel cover. This allows machine soldering for the connectors (reliability improvement) and gives mechanical and EMI protection. At the same time we introduced 26pin bus cables for the new modules: For heavily loaded buses (rare cases using more than 10 high current modules, so TSM operates near or beyond current limit) there have been problems with the supply voltage drop due to connector series resistance. To eliminate these problems, the new TSM-CPU900 and all new I/O modules (see module table) now are equipped with 26pin bus connectors offering 4 more pins for ground and two for additional 6,3V connections.

20 to 26pin adapter cables are supplied with the new modules to allow mixed use of both connector types. The TSM bus is actively terminated to a 3.7V threshold voltage on the CPU and on the far side with a termination connector. Software can detect whether the terminator is plugged in or not.

### Distribution of i/o over some rails

Some applications require a narrow arrangement of the modules which raises the need to distribute them over more than one rail. For grounding and EMI reasons it is necessary to use shielded flat cable for all connections where the modules are not immediately joined. ELZET 80 provides standard cables with 1m length for this use, other lengths are made to order. Not more than two lengths of 1m are recommended on one CPU.