The Foxboro T2750 PAC (Programmable Automation Controller) is a high performance, ultra reliable, and cost effective controller alternative to a PLC (Programmable Logic Controller) in a flexible and configurable package.

**Designed for Maximum Availability**

Using the Foxboro PAC hardware reduces your engineering costs and its high availability maximizes process uptime. Every component of the PAC can be configured in a redundant mode including its built-in data Store and Forward which ensures that critical information is never lost.

The Foxboro PAC redundant processor, power and I/O modules can be hot-swapped without taking your process offline, and with automatic re-initialization.

The controllers and I/O form the basis of a complete distributed control and data recording solution capable of continuous analog, logic, and sequential control.

Combined with secure data recording at point of measurement, the Foxboro PAC system is ideal for regulated industry applications, or any applications where data loss during your manufacturing process is prohibitive.

These powerful features combined with the high MTBF of the system’s processor, I/O, and passive backplane provide extremely high system availability.

**Summary**

The Foxboro PAC System from Invensys enables secure and reliable process control and information recording with complete redundancy options for maximum availability.

The PAC System is a component of the InFusion Enterprise Control System. It is ideally suited for stand-alone applications and for integration into a wider Archestra-based control solution.

**Business Value**

Non-stop control and data acquisition is essential in today’s competitive manufacturing environment. Regardless of the state of the surrounding environment, your process is able to run continuously without data loss which can mean the difference between a successful production run and an expensive scrap or rework.
Data Integrity
When integrity of process information is important the Foxboro PAC System is the obvious choice. The T2750 PAC provides secure data recording at point of measurement. This powerful feature is offered with redundancy simply by plugging in the additional processor module. Again, no additional engineering is required as the system synchronizes itself. The data is held in non-volatile memory in a secure format to inhibit tampering.

‘Store and Forward’ is a self healing data archiving system which automatically stores data during a communication failure with the PAC and then forwards this data to the configured data historian server once communication is reinstated. This logging method is used on pharmaceutical 21 CFR Part 11 compliant projects.

The Foxboro PAC also offers dual redundant data acquisition using tamper-proof files created at the local level, which results in a secure electronic recording system with total data integrity.

If your data has value to you, the Foxboro PAC offering is the most powerful in the market place.

Data Redundant Control Processing
Configuring a second PAC controller as a part of a controller pair automatically protects your process against controller or communications failure. If external or field I/O communications to the active controller, or the active controller itself fail, then the secondary controller automatically takes over providing uninterrupted control and bumpless transfer of the communications, process I/O, and data historian.

Commissioning a redundant capable processor is as simple as plugging in the second processor into a base unit and pressing synchronize - all the rest is automatic. No special cabling is required.

Control and Logic
The Foxboro PAC is capable of analog, logic and sequence control and is self-contained up to a capacity of 256 I/O points per rack. Larger systems can be easily implemented by interconnecting multiple PAC units to form a distributed system, utilizing the in-built peer-to-peer communications.

The PAC hardware supports the level of block structuring normally only found in advanced Distributed Control Systems. The continuous strategy is built up by interconnection of function blocks from a rich library of analog, logic, and advanced elements. Control operations can be programmed in a language appropriate for your I/O type and application including:

- Function Block Diagrams
- Sequence Function Charts
- Structured Text
- Ladder Logic
- Compound blocks

Application Configuration
The LINtools (Local Instrument Network) configuration and engineering station can be launched as a stand-alone application, or from within the IDE to enable easy IEC 61131-3 standard based configuration. Tools for test, documentation, monitoring, on-line reconfiguration, and commissioning are also built into the LINtools package.

The ArchestrA IDE is an Integrated Development Environment from which application objects representing physical PAC elements are configured. It can be used as a part of a larger ArchestrA-based application.

Flexible Batch Processing
Cost-effective batch processing solutions can be implemented by incorporating the Eycon series of visual supervisor displays. The Eycon Batch Manager provides comprehensive batch control allowing an operator with suitable access permissions to load, start, hold, restart, or abort a batch.

For more flexible and extensible batch applications the Foxboro PAC System can be configured with integration into Wonderware InBatch.

Enterprise Extensibility
Thanks to the inclusion of the Wonderware PAC Software (a software component of the Invensys InFusion Enterprise Control System) the Foxboro PAC System is at home in a Wonderware System Platform ArchestrA based application architecture.

The system is scalable (stand alone to distributed architectures) and extensible using System Platform and infrastructure to add capability and value. Wonderware Historian integration provides protection against the loss of process critical data in conjunction with the PAC’s hardware on board data acquisition and storage.
Base Rack and I/O Configuration Options
A range of DIN rail mounting base sizes is available for I/O modules and serial communication interfaces. Multiple bases can be easily interconnected so processors can share interlocking, acquisition, and multi-loop control solutions in distributed and larger scale applications.

I/O modules from the T2550 PAC hardware are also compatible with the T2750 base unit, preserving your investment in Invensys hardware.

Communications
As well as being capable of fully stand-alone operation, the Foxboro PAC System uses ELIN, an Ethernet based Local Instrument Network as the backbone of the control and data acquisition network providing peer-to-peer communications between control nodes.

The Foxboro PAC system supports native device protocols, including Modbus TCP, Modbus Serial Master/Slave, Profinet and OPC. Using Wonderware System Platform opens the PAC to the ArchestrA namespace, with the inherent advantages this provides. Also available for use within a System Platform architecture is a fully featured DAServer. The PAC hardware can also be used with other systems such as PC based SCADA packages, Programmable Logic Controllers, and HMI software including Wonderware InTouch and the Eurotherm Eycon.

Documentation
LINtools provides an electronic documentation facility including the graphical representation of the control strategy and a listing of the block parameters and connections. This can be transferred across the network and output can be to a printer, Postscript, or AutoCAD compatible format. Free-format user annotations can be added to complete your documentation requirements.

Multi-Setpoint Programmer
Many applications need to vary the process value over time. Temperature control is one such application in which it is very common to ‘ramp’ the process value from one level to another over a set time period using a setpoint program. The PAC provides support for multiple setpoint programs that can be run simultaneously. Each program is capable of profiling up to eight channels with up to 32 segments per profiled channel. In addition to controlling the setpoint during each segment of the profile, the controllers can also be used to activate up to 16 digital events during a segment.

The setpoint program feature enables an operator to select and run a pre-configured setpoint program. A preview facility allows the operator to view the selected program before running it. Once the program is running, the future desired setpoint and historically achieved process values are plotted on the trend screen.

Setpoint Program Wizard
For ease of use, LINtools incorporates a wizard for creating a setpoint program. By following the on screen prompts and editing the parameters as required, a setpoint program can be simply and quickly created with all required blocks automatically created and added to the database.

Setpoint Program Editor
In addition to the setpoint program wizard, programs can be created or edited off-line using the setpoint program editor supplied with LINtools. As an ActiveX, this tool can be inserted in any of your visualization packages.

Redundant Recording and Archiving
The PAC (Programmable Automation Controller) has internal non-volatile flash memory for secure tamper resistant data storage, providing for redundant data logging. In addition all PAC processors support Ethernet connectivity; as such, data stored within the internal flash memory can be configured to periodically archive to primary, secondary and tertiary FTP servers. Archiving files to FTP servers provides a secure, infinite archiving capacity.

The following example provides estimated memory duration based on an 8-way base logging 16 Parameters to a single group.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Estimated Data Storage Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min/Max Off</td>
</tr>
<tr>
<td>1s</td>
<td>11 days</td>
</tr>
<tr>
<td>5s</td>
<td>57 days</td>
</tr>
<tr>
<td>10s</td>
<td>114 days</td>
</tr>
<tr>
<td>20s</td>
<td>228 days</td>
</tr>
<tr>
<td>60s</td>
<td>685 days</td>
</tr>
</tbody>
</table>

Data Historian
The data historian is used to store PV's, message, and alarm information in the internal flash memory in order to generate historical data in the form of a set of secure, tamper resistant history files.

Alarm Management
Alarms are managed and collected within the PAC hardware to provide features such as alarm status and priority, acknowledgement, date and time stamping at the source, as well as suppression and local historian message storage.

HMI Reports
HMI Reports provides an intuitive reporting package to develop and print reports using the secure data from the PAC system. The package includes a report studio for configuring report projects, and a run-time execution module to generate and print reports in many different formats to printers and file servers, and via e-mail. HMI reports are also optionally available as a web portal.
**SPECIFICATIONS**

**Mechanical Details**

<table>
<thead>
<tr>
<th>I/O Module capacity</th>
<th>0</th>
<th>8</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (mm)</td>
<td>66</td>
<td>247</td>
<td>477</td>
</tr>
<tr>
<td>Height</td>
<td>180mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth: 132 - 135 mm with retaining lever raised</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>DIN rail or Bulkhead, can be mounted horizontally or vertically</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIN rail:</td>
<td>Use symmetrical DIN rail to ENS0022:35 x 7.5 or 35 x 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casing:</td>
<td>Without additional protection IP20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilation space:</td>
<td>25mm free space above and below</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Terminal Units**

The I/O modules are mounted on the base using terminal assemblies. Terminal assemblies provide the interface between the input and output signals and the I/O modules. Terminal assemblies and I/O modules are keyed to inhibit insertion of the incorrect module to prevent damage to both equipment and plant.

Individual termination units provide for easy module replacement leaving the field wiring connected. Modules are inserted and removed from the termination unit using a unique, tool-less, locking lever system.

**Test Disconnect Units**

Some terminal assemblies have an optional fuse or link (isolator or disconnect). This provides a series connection between the customer terminals and the I/O module, permitting pluggable fuse or link units to be placed in series with the signal. Fuse and link units are not interchangeable.

**T2750B: Base Unit**

The base unit is fitted with the T2750 PAC I/O controller modules plus additional I/O modules. These modules plug onto terminal units, which provide the wiring interface between the plant or machine and the I/O modules. Bases are available in 3 sizes to suit the number of modules required in a particular system.

Communication between the I/O modules and the processor is effected by the use of a passive internal module I/O bus running along the width of the base.

Each module position is tracked separately for additional security during live replacement of I/O modules.

The base consists of an aluminium extrusion, the internal I/O bus and mounting supports. It is designed to be DIN rail mounted or directly fixed to the bulkhead or mounting plate. Both base and modules can be installed horizontally or vertically.

**T2750 PAC: General Specifications**

- **Supply voltage range:** 24V dc +/-20%
- **VA requirements:** < 80W maximum for fully loaded rack
- **Fuse rating:** 0.5A time lag (Not customer replaceable)
- **IOC hot start time:** 1 hours without external batteries
- **IOC power consumption:** 4.0 W maximum
- **Surge current:** 8A maximum
- **Module power consumption:** See individual module specification

**Environmental**

- **Operating temperature:** 0 to 55°C
- **Storage temperature:** -25°C to 85°C
- **Relative humidity:** 5 to 95% (non-condensing)

**RFI**

- **EMC emissions:** BS EN61326 – 1: 2006 Class A
- **EMC immunity:** BS EN61000-6-2:1999 Installation cat II

**Safety**

- **BS EN61010-1/A2;19931995 Installation cat II, Pollution degree 2**

**Vibration**

- **Vibration:** IEC1131-2 (2007) section 4.2.1
- **Shock:** 20g static shock

**Diagnostic LED’s**

Diagnostic LED’s indicate module diagnostic status.

- **All modules:** A green LED at the top indicates the module is powered and operating correctly.
- **PAC analog modules:** Have red LEDs for each channel to indicate channel failure.
- **PAC digital modules:** Have Yellow LEDs for each channel to indicate the channel state.

**Processor Module**

Primary processor and communications diagnostics are available from the LEDs on the front of the processor module. More advanced diagnostics are available remotely using the LINtools monitor online over Ethernet to review the diagnostic blocks.

**Power on Self Tests**

On power up the T2750 PAC automatically performs Power On Self Tests. These are a series of diagnostic tests used to assess the instrument health. The above LEDs indicate module diagnostic status in case of a problem.
CPU Redundancy
Processor redundancy is available for continuous, logic, and sequence control. A pair of processors operate in primary / secondary configuration with a high speed data link between them providing exact tracking of the control, logic, and sequence databases. Transfer from the primary to secondary processor is bumpless. The non-active processor can be replaced while the system is running and on synchronisation it loads its strategy from the active primary processor.

- Redundant: < 0.6s bumpless transfer for processor and I/O
- Changeover time: dependant on application size
- Synchronisation time: dependant on application size

Processor Switchover
During a processor switch over all outputs remain at the last value. The new primary processor begins executing its application from precisely the same point as the original processor. Each processor has its own Ethernet IP address and each redundant pair uses two neighbouring node addresses on the ELIN network. This enables the system to communicate with the primary while still continuously testing communications to both processors. On processor switchover the ELIN node address is dynamically swapped to allow SCADA applications to display and log uninterrupted data. Change over amongst LIN nodes is transparent.

- The following conditions can cause the processor to switch over:
  - Hardware Failure: Failure of primary controller internal health checks.
  - Hardware Removal: Removing the primary processor will cause the secondary to take immediate control. Removing the secondary will have no effect on control but will cause a system alarm on redundant configured systems.
  - Internal Communications: Primary and secondary controllers continually monitor the communications to the I/O on the local base. Should the primary controller not be able to communicate with the I/O and the secondary can still communicate with the I/O, changeover will occur. If the secondary processor observes a fault in the primary communications, or can see more I/O modules the secondary processor will request a switchover.
  - External Communications: Monitors external controller communications. Should the primary controller not be able to communicate with other declared nodes on the LIN network and the secondary can still communicate with the declared nodes a switchover will occur. If the secondary processor observes that it can see more declared nodes, the secondary processor will request a changeover.
  - Manual Request: A user can request a switchover if a secondary processor is running, synchronised and healthy.
- Removable SD Memory Card: The storage of the cold start application files, the processor firmware, and software licence code is on a secure SDHC card this enables easy transfer from one processor to a replacement.

Power Supply Connection
The duplex terminal unit supports dual power supply connection. In the event of a single power supply failure both processors are still supplied allowing redundant operation to continue uninterrupted.

- Super cap (Processor): Maintains memory/real time clock and enables hot start for up to 1 hour in absence of battery backup input
- Simplex (O base): Battery support for data in SRAM and the Real-Time Clock for a minimum of 72 hour continuous (5 year intermittent use)
- Redundant: Additional terminals for an external battery connection to support SRAM and the Real-Time Clock

External rechargeable battery: Retains memory and real-time clock chip in absence of mains power to extend Warm start capacity > 1 hour.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2750-BBA</td>
<td>Backup Battery Assembly - includes Charger and Battery</td>
</tr>
<tr>
<td>T2750-BBB</td>
<td>Backup Battery Spare / Replacement Battery</td>
</tr>
<tr>
<td>T2750-BBC</td>
<td>Backup Battery Spare Charger</td>
</tr>
</tbody>
</table>

Watchdog Relays
Each processor is fitted with a single watchdog relay.
- Watchdog relay: SPST, 1 per CPU, connected on the terminal unit
- Contact rating (resistive): 24V ac/dc at 0.5A
- Isolation: 30V ac rms or 60V dc

Live Plug-in
Processors and I/O modules can be replaced while powered without any disturbance to the field wiring or other inputs and outputs - reducing downtime and minimising disturbance to other signal conditioning strategies.

<table>
<thead>
<tr>
<th>T2750 PAC—Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Product</td>
</tr>
<tr>
<td>T2750M Programmable Automation Controller</td>
</tr>
</tbody>
</table>

1 - IOC and Software

<table>
<thead>
<tr>
<th>Foundation</th>
<th>Standard</th>
<th>Control</th>
<th>Advanced</th>
<th>Data Logging</th>
</tr>
</thead>
<tbody>
<tr>
<td>-A</td>
<td>Unbounded</td>
<td>0</td>
<td>0</td>
<td>on</td>
</tr>
<tr>
<td>-F</td>
<td>Unbounded</td>
<td>24</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>-H</td>
<td>Unbounded</td>
<td>Unbounded</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>-J</td>
<td>Unbounded</td>
<td>Unbounded</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>-K</td>
<td>Unbounded</td>
<td>0</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>-Q</td>
<td>Unbounded</td>
<td>24</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>-S</td>
<td>Unbounded</td>
<td>Unbounded</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>-T</td>
<td>Unbounded</td>
<td>Unbounded</td>
<td>on</td>
<td>on</td>
</tr>
</tbody>
</table>

2 - SDHC Card

<table>
<thead>
<tr>
<th>A</th>
<th>SDHC card (standard)</th>
</tr>
</thead>
</table>

3 - Ethernet Communications Protocol

<table>
<thead>
<tr>
<th>ELIN</th>
<th>Ethernet Local Instrument Network (LIN) peer-to-peer</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBTM</td>
<td>Modbus-TCP Master communications (includes LIN peer-to-peer)</td>
</tr>
</tbody>
</table>
### Control Specifications

**Continuous Database Resources**
- Maximum Database Size: default max values 800k bytes

**Database Resources**
- Number of database blocks: 2048
- Number of database templates: 170
- Number of template libraries: 32
- Number of external databases: 32
- Number blocks in local Database cached elsewhere: 4096
- Number blocks in remote Databases cached locally: 1024
- Number of server tasks: 6
- Number of field-to-field connections: 4096

**Sequence Control Resources**
- Sequence memory Program data: 400k bytes

**SFC Resources**
- Number of root SFCs loadable: 120
- Number of steps loadable: 1600
- Number of wires permitted going into and out of step: 5360
- Number of transitions: 2400
- Number of wires permitted going into transitions: 3200
- Number of action associations: 6400
- Number of actions: 3200

**User Tasks**
- Multiple tasks are available to the user to tune the update rate of I/O response and the control function.
- User Tasks: 4

**User Task Update Rates**

Task 1 - Synchronous to Fast I/O
- Only 10ms I/O types can be assigned to this task (see table below).
- 10ms ≤ N*10ms
- Runs at task 1 rate or integer multiple of task 1 rate

Task 2 - Auxiliary task to task1
- 10ms ≤ N*5ms
- Runs at task 1 rate or integer multiple of task 1 rate

Task 3 - Synchronous to Standard I/O
- 110ms ≤ N*110ms
- All analogue and digital I/O types can be assigned to this task
- Runs at task 3 rate or integer multiple of task 3 rate

**Supported I/O Module Types**

The T2750 PAC shares I/O modules with the T2550PAC and 2500 I/O.

### Continuous Strategy Function Blocks Categories

<table>
<thead>
<tr>
<th>F</th>
<th>S</th>
<th>C</th>
<th>A</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal I/O &amp; Time-proportioning O/P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog alarm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Inversion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensated flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconia Function Block</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural gas concentration data block</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGAB calculation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SOFTWARE LICENSE

<table>
<thead>
<tr>
<th>CATEGORY</th>
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</thead>
<tbody>
<tr>
<td>I/O Block</td>
</tr>
<tr>
<td>User Tasks</td>
</tr>
<tr>
<td>User Task Update Rates</td>
</tr>
<tr>
<td>Supported I/O Module Types</td>
</tr>
<tr>
<td>Continuous Strategy Function Blocks Categories</td>
</tr>
</tbody>
</table>

### Type Description

- **Version modules 2**
- **Maximum update speed**
- **Version modules 2**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Maximum update speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI2</td>
<td>Analog Input 2 channels (all I/O types)</td>
<td>110ms</td>
</tr>
<tr>
<td>AI3</td>
<td>Analog Input 3 channels (mA + 1x PSU)</td>
<td>110ms</td>
</tr>
<tr>
<td>AI4</td>
<td>Analog Input 4 channels (TC, mV, mA)</td>
<td>10ms</td>
</tr>
<tr>
<td>AO2</td>
<td>Analog Output 2 channels (mA or V)</td>
<td>10ms</td>
</tr>
<tr>
<td>DI4</td>
<td>Digital Input 4 channels (logic)</td>
<td>110ms</td>
</tr>
<tr>
<td>DI6, MV</td>
<td>Digital Input 6 channels (115V ac rms)</td>
<td>110ms</td>
</tr>
<tr>
<td>DI6, HV</td>
<td>Digital Input 6 channels (230V ac rms)</td>
<td>110ms</td>
</tr>
<tr>
<td>DI8, LG</td>
<td>Digital Input 8 channels (logic)</td>
<td>10ms</td>
</tr>
<tr>
<td>DI8, CO</td>
<td>Digital Input 8 channels (contact)</td>
<td>10ms</td>
</tr>
<tr>
<td>DI16</td>
<td>Digital Input 16 channels (contact and logic)</td>
<td>10ms</td>
</tr>
<tr>
<td>DO4, LG</td>
<td>Digital Output 4 channels (10mA)</td>
<td>10ms</td>
</tr>
<tr>
<td>DO4, 24</td>
<td>Digital Output 4 channels (100mA)</td>
<td>10ms</td>
</tr>
<tr>
<td>RLY4</td>
<td>Relay Output 4 channels (3 n/o, 1 c/o)</td>
<td>10ms</td>
</tr>
<tr>
<td>RLY8</td>
<td>Relay Output 8 channels (8 n/o)</td>
<td>10ms</td>
</tr>
<tr>
<td>DO8</td>
<td>Digital Output 8 channels (1A per ch)</td>
<td>10ms</td>
</tr>
<tr>
<td>DO16</td>
<td>Digital Output 16 channels (1A per ch)</td>
<td>10ms</td>
</tr>
<tr>
<td>F2</td>
<td>Frequency Input 2 channels</td>
<td>10ms</td>
</tr>
<tr>
<td>ZI</td>
<td>Zirconia Input Module</td>
<td>110ms</td>
</tr>
</tbody>
</table>

### Note:
†The T2750 PAC supports only Version 2

### Setpoint programmer (V5.0 or higher) Resources (max no.)

- **Programs** Limited by available database memory
- Profiled Channels per Program: 8
- Digital Events per Program: 128
- User Values per Program: 32
- Segments per Program: 32

<table>
<thead>
<tr>
<th>No. of Programs</th>
<th>No. of Channels</th>
<th>No. of Digital Events</th>
<th>No. User/per prog (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Program</td>
<td>8</td>
<td>128</td>
<td>16</td>
</tr>
<tr>
<td>2 Programs</td>
<td>2</td>
<td>64</td>
<td>16</td>
</tr>
<tr>
<td>4 Programs</td>
<td>2</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>8 Programs</td>
<td>1</td>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>
Communications

Ethernet Communications
The PAC supports Ethernet LIN (ELIN) protocol that provides secure peer-to-peer communications between bases and to other Ethernet devices over 10/100baseT Ethernet. Simultaneously it can support Modbus-TCP Master or Slave to other Modbus TCP devices.

**ELIN Port**
- Connectors: RJ45 connector per processor
- Network medium: Ethernet Cat5
- Network type: LIN over Ethernet
- Speed: 10/100baseT auto-select
- Network topology: Star connection to a switch
- Line length (maximum): 100 metres, extendible by repeater
- Allocation of IP address: Fixed, DHCP, Link-Local, BootP
- Broadcast storm protection: Integrated in the processor
- LIN address: 8-way switch-bank – Duplex (bits SW2-8)
- Modbus: TCP configurable master or slave
- Max numbers of slaves: 16 Modbus TCP slaves

Serial Communications
Third party devices such as PLCs supporting Modbus can be readily integrated into the ELIN based architecture by direct connection to T2750 PAC control units. The Modbus communications allows a T2750 PAC to be used as a gateway providing access to database elements in any ELIN node.

**RS422/485 Serial Communications**
- Connector: 2 x Shielded RJ45 connector
- Comms medium: RS422 (5-wire) or RS485 (3-wire), jumper select
- Line impedance: 120Ω-240Ω twisted pair
- Line length: 1220m maximum at 9600 bits/sec
- Units per line: 16 maximum (electrical loading expandable by use of buffers)
- Max number of slaves: 64 serial slave devices

**Note:** Use of a communications buffer/isolator is recommended

**Modbus/J-BUS**
- Protocol: Modbus/J-BUS RTU configurable master or slave
- Data rate: Selectable 600-38.4k bits/sec
- Data format: 8 bit, selectable parity 1/2 stop bits
- Modbus data tables: 64, configurable as registers or bits
- Maximum table length: 200 registers or 999 bits
- Redundancy: Modbus communications are supported by the PAC in simplex and redundant mode 3 GWF may be run simultaneously:
  - 1x Modbus TCP master
  - 1x TCP slave
  - 1x Modbus RTU slave or master
- Max (GWF) file size: 20k bytes

**Open Communication**
- Protocol: Device driven
- Data rate: 1200 to 38.4k bits/sec
- Data format: 7 or 8 data bits, none/even/odd parity

**Raw Communications**
- Protocol: Support for simple protocols written by user, using physical connection above.
2500MF-A: Two Channel Analog Input
This analog input module is used to monitor analogue signals from a wide range of plant sensors. The mA and TC inputs each require the appropriate terminal unit. The second channel of the AI2 has a special high impedance range for use with zirconia probe inputs for oxygen measurement.

No of channels: 2
Input types: TC, RTD, Volts, mA, mV, Potentiometer, Pyrometer, Zirconia probe
mV range: -150mV to +150mV at input impedance >100MΩ
mA range: -25mA to +25mA with 5Ω burden in the terminal unit
Volts range: -10.3V to +10.3V at input impedance 303kΩ
RTD support: Support for 2, 3 and 4 wire resistance thermometer devices
Ohms range: 0 to 64Ω 2, 3 or 4-wire lead compensation
Hi Ohms range: 0 to 7kΩ 2, 3 or 4-wire lead compensation
Resolution: Better than 0.001% of range
Linearity: Better than 0.01% of range
Input filtering: OFF to 999.9 seconds
Input accuracy: Electrical input factory calibrated to better than 0.1% of reading
System isolation: 300V RMS or dc (double insulation)
Channel isolation: 300V RMS or dc (basic insulation) between thermocouple channels
Series mode rejection: 60dB (47.63Hz)
Common mode rejection: 120dB (47.63kHz)
Power consumption: 2W

TC Input specification
Linearity types: J, K, L, R, B, N, T, S, C, PL2, PT100, Linear, SqRoot, plus custom
CJC system: Measured by RTD, located beneath the input connector
Initial CJC accuracy: ±0.5°C typical (±1°C maximum)
CJC rejection: Better than 30.1 over -10°C to +70°C

Notes: User calibration options can improve performance, limited only by noise and non-linearity.

AI2 – ORDER CODE
Module
2500MF-A000 Two Channel - isolated universal input
Terminal Unit
2500TF-AT00 Terminal unit for TC with CJC
2500TF-AT00 Terminal unit for mA, V, PT100, Hz inputs
2500TF-AT20 Terminal unit for 5 ohm shunt fitted for mA

2500MF-C: Three Channel Analog Input
Provides three isolated current input channels specifically designed to meet the requirements of modern two wire transmitters. Each channel has its own isolated 24V supply for transmitter excitation. Each channel’s 24V dc supply is protected against short circuit and utilizes a sophisticated trip system in which the module senses over current and cuts the power. After a period the circuit checks for continued circuit malfunction. To allow work on the loop to continue safely the module can be optionally fitted with disconnects to allow isolation of an individual input.

No of channels: 3
Input range: -28mA to +28mA
Resolution: Better than 0.5uA with 1.6 sec filter time
Linearity: Better than 1uA
Initial accuracy: Factory calibrated to better than ±0.1% of reading
Input filtering: OFF to 999.9 seconds
Burden resistance: 60Ω nominal, 50mA max current
Channel PSU: 20-25V dc, current limited 30mA nominal, self-resetting
System isolation: 300V RMS or dc (double insulation)
Channel isolation: 300V RMS or dc (basic insulation)
Power consumption: current input mode - 2.2W
3 powered loops - 4.0W

Notes:
1. User calibration options can improve performance, limited only by noise and non-linearity.
2. Total burden can be increased to 250Ω or HART by cutting a link track on the terminal unit.

AI3 – ORDER CODE
Module
2500MF-C000 Three channel - isolated 4-20mA analogue input with Isolated 24V Tx PSU
Terminal Unit
2500TF-DU00 Terminal unit with dummy cover fitted
2500TF-DU30 Terminal unit with disconnect
2500MF-D: Four Channel Analog Input
This analog input module is used to monitor analog signals from a wide range of plant sensors. The mA and TC inputs each require the appropriate Terminal Unit.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of channels</td>
<td>4</td>
</tr>
<tr>
<td>Input types</td>
<td>TC, mV, mA, Pyrometer mV range: -150 - +150mV at input impedance &gt;100MΩ</td>
</tr>
<tr>
<td>mA range</td>
<td>-25 - +25mA with 5Ω burden in the terminal unit</td>
</tr>
<tr>
<td>Resolution</td>
<td>Better than 0.001% of range</td>
</tr>
<tr>
<td>Initial accuracy</td>
<td>Electrical input factory calibrated to better than 0.1% of reading</td>
</tr>
<tr>
<td>System isolation</td>
<td>300V RMS or dc (double insulation)</td>
</tr>
<tr>
<td>Channel isolation</td>
<td>Ch1 and Ch2 from Ch3 and Ch4</td>
</tr>
<tr>
<td>Series mode rejection</td>
<td>60dB (47-63Hz)</td>
</tr>
<tr>
<td>Common mode rejection</td>
<td>120dB (47-63Hz)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>2W maximum</td>
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<tr>
<td>TC Input specification</td>
<td></td>
</tr>
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<td>CJC system</td>
<td>Measured by RTD, located beneath the input connector</td>
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<td>Initial CJC accuracy</td>
<td>±0.5°C typical (±1°C maximum)</td>
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<tr>
<td>CJC rejection</td>
<td>Better than 30.1 over -10°C to +70°C</td>
</tr>
<tr>
<td>Notes</td>
<td>1. User calibration options can improve performance, limited only by noise and non-linearity. 2. Wiring care and sensor choice should be used to prevent ground loops when using non-isolated TC’s.</td>
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</tbody>
</table>

2500MF-E: Two Channel Analog Output
This analog output module provides two isolated analog output channels. Each output can be independently configured for current or voltage mode. To allow work on the individual loop to continue safely, the module can be optionally fitted with disconnects to allow isolation of an individual outputs.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>No of channels</td>
<td>2</td>
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<tr>
<td>Current output</td>
<td>-0.1 to 20.5mA; 10V dc max. Compliance with total burden less than 500Ω</td>
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<tr>
<td>Resolution</td>
<td>Better than 1 part in 10,000 (1µA typical)</td>
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<tr>
<td>Voltage output</td>
<td>-0.1V to 10.1V dc; 20mA max. compliance with total load greater than 550ohms</td>
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<tr>
<td></td>
<td>-0.3 to 10.3 V dc; 8mA max. compliance with total load greater than 1500Ω</td>
</tr>
<tr>
<td>Resolution</td>
<td>Better than 1 part in 10,000 (0.5mV typical)</td>
</tr>
<tr>
<td>System isolation</td>
<td>300V RMS or dc (double isolation)</td>
</tr>
<tr>
<td>Channel isolation</td>
<td>300V RMS or dc (basic isolation)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>2.2W maximum</td>
</tr>
</tbody>
</table>

<table>
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<th>AO2 – ORDER CODE</th>
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<td><strong>Terminal Unit</strong></td>
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<table>
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<td><strong>Terminal Unit</strong></td>
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<tr>
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</tr>
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</tbody>
</table>
2500MF-K: Six Channel AC Voltage Input
The six channel digital input module accepts AC voltage inputs and is available in two factory options optimized for 115V ac or 230V ac ranges.

- No of channels: 6
- Input functions: On/Off or de-bounce
- Frequency: 47Hz-63Hz
- Transient immunity: EN50082
- System isolation: 300V RMS or dc (double insulation)
- Channel isolation: 300V RMS or dc (basic insulation)
- Power consumption: 0.5W maximum

'115V ac' Variant
- Active On state: >95V ac rms, 150V ac rms maximum
- Inactive OFF state: <35V ac rms
- Main input current: More than 2mA required for ‘ON’
- Maximum input current: 8mA

'230V ac' Variant
- Active ON state: >180V ac rms, 264V ac rms maximum
- Inactive OFF state: <70V ac rms
- Min input current: More than 2mA required for ‘ON’
- Maximum input current: 9mA

Inadvertent Use of the Wrong Range
115V type on 230V ac No damage will result. Power dissipation will be higher than desirable for continued use on all 6 channels simultaneously.

THIS IS NOT A RECOMMENDED MODE OF OPERATION

2500MF-L /-M: Eight Channel Logic/Contact Input
This eight channel digital input module accepts eight logic inputs and is available in two factory option formats for voltage or contact-closure input.

- No of channels: 8
- Input functions: On/Off, pulse and de-bounce inputs with input invert
- System isolation: 300V RMS or dc (double insulation)
- Power consumption Logic: 0.6W maximum
- Contact: 1.9W maximum

'Contact' Variant
- Contact closure:
  - ON state: Input resistance threshold <1KΩ typical
  - OFF state: Input resistance threshold >7KΩ typical
  - Wetting current: 4mA typical

'Logic' Variant
- Logic inputs:
  - ON state: Input voltage threshold >10.8V dc, 30V max.
  - OFF state: Input voltage threshold <5.0V dc
  - Input current: 2.5mA approx. at 10.5V; 8mA max. at 30V

2500MF-G: Four Channel Digital Input
The DI4 version 2 module is fully supported by the T2750PAC. For specification see T2550 specification sheet

D6 - ORDER CODE
Module
2500MF-KA00 Six channel high voltage 230 volt ac logic
2500MF-KB00 Six channel high voltage 115 volt ac logic
Terminal Unit
2500TF-LU00 Terminal unit

D8 - ORDER CODE
Module
2500MF-L000 Eight channel - Logic input
2500MF-M000 Eight channel - Contact input
Terminal Unit
2500TF-MU00 Terminal unit with dummy cover fitted
2500TF-MU30 Terminal unit with disconnects
**2500MF-6: Sixteen Channel Digital Input**

This digital input module accepts sixteen inputs, and can be wired either for voltage input or for contact closure.

- **No of channels:** 16
- **Input functions:** On/Off, pulse and de-bounce
- **System isolation:** 300V RMS or dc (double insulation)
- **Channel isolation:** Channels share a common connection
- **Power consumption Logic:** 0.75W maximum
- **Power consumption Contact:** 2.0W maximum

**‘Contact’ Mode**
- Module Internal Isolated
- **Power supply (P):** 16-18V dc
- **Contact closure:** Input resistance threshold <1KΩ typical
- **OFF state:** Input resistance threshold >7KΩ typical
- **Wetting current:** >4mA
- **Wetting voltage:** >12V

**‘Logic’ Mode**
- Logic inputs:
  - **ON state:** Input voltage threshold >10.8V dc, 30V max.
  - Input current: 3.8mA @ 12vdc; 2.8mA @ 24vdc
  - **OFF state:** Input voltage threshold <5.0V dc

**DI16 – ORDER CODE**

- **Module**
  - 2500MF-6000 Sixteen channel – Digital input
- **Terminal Unit**
  - 2500TF-6U00 Terminal unit with dummy cover fitted

---

**2500MF-F: Four Channel Relay Output**

This module provides four relay outputs. The relay contacts are all fitted with removable snubber circuits to reduce contact arcing and prolong contact life.

- **No of channels:** 4 (3 normally open + 1 changeover)
- **Max current rating:** 2A at up to 240V ac; 0.5A at 200V dc, increasing to 2A at 30V dc (resistive)
- **Min ratings:** AgCdO contacts offer best operating life switching more than 100mA 12V
- **Fuse (option):** 3.15A, 20mm ceramic, time lag (T), in terminal unit
- **System isolation:** 300V RMS or dc (double insulation)
- **Channel isolation:** 300V RMS or dc (basic insulation)
- **Contact life:** >10 million operations @ 240V ac, 1A rms
  - >600,000 operations @ 240V ac, 2A rms
- **Mechanical life:** >30 million operations
- **De-rating:** The above ratings summarise the performance with resistive loads. With complex loads further de-rating may be required
- **Power consumption** 1.1W maximum

**Relay De-rating**

**AC Voltage**

As the AC load becomes more “difficult” a more significant de-rating factor is required. The graph opposite shows the derating to be applied in terms of contact life, assuming the load requirement is predefined.

- **F1:** Worst case
- **F2:** Typical

**DC voltage**

DC operation is also limited for difficult loads, particularly where there is significant inductance. Here the working current must be limited as shown where the load time constant (L/R, in ms) is the significant factor.

**RLY4 – ORDER CODE**

- **Module**
  - 2500MF-F000 Four channel isolated relay output
- **Terminal Unit**
  - 2500TF-T000 Terminal unit
  - 2500TF-T040 Terminal unit with four 3.15a fuses
2500MF-8: Eight Channel Relay Output
This module provides eight relay outputs. These outputs may require external snubber circuits (application dependent).

No of channels: 8 normally open
Max current rating: 2A at up to 240V ac; 0.5A at 200V dc, increasing to
2A at 50V dc (resistive)
Min ratings: AgCdO contacts offer best operating life switching
more than 100mA 12V
System isolation: 300V RMS or dc (double insulation)
Channel isolation: 300V RMS or dc (basic insulation)
Contact life: >10million operations @ 240V ac, 1A rms
>600,000 operations @ 240V ac, 2A rms
Mechanical life: >30 million operations
De-rating: The above ratings summarise the performance with
resistive loads. With complex loads further de-rating
may be required
Power consumption: 2.5

Relay De-rating
AC Voltage
As the AC load becomes more “difficult” a more significant de-rating factor is
required. The graph opposite shows the
derating to be applied in terms of contact life, assuming the load requirement is
predefined.

F1: Worst case  
F2: Typical

DC Voltage
DC operation is also limited for difficult
loads, particularly where there is
significant inductance. Here the working
current must be limited as shown where
the load time constant (L/R, in ms) is the
significant factor.

2500MF-N: Eight Channel Digital Output Module
The DO8 digital output module provides eight logic outputs, which are typically used for
control, alarms or event outputs.

Each channel has a 24V output with 0.75A capability (subject to a maximum of 4A total
per module) and can be used for driving solenoids, relays, lamps, fans, thyristor units,
single phase Solid State Relays (SSRs), or some three phase SSRs.

Voltage supply (external): 18-30V dc
Leakage current off state: <100uA
Current output:
Channel maximum: 0.75A/channel
Module maximum: 4A total (500mA/channel, all channels ON)
Output voltage: >Voltage supply (Vs) less 3V
System isolation: 300V RMS or dc (double insulation)
Channel isolation: Channels share a common connection
Power consumption: 0.6W maximum

2500MF-JE & HE: Four Channel Digital Output Module
The D04 version 2 module is fully supported by the T2750PAC. For specification see
T2550 specification sheet.

DO8 – ORDER CODE
Module  
2500MF-NE00 Eight channel digital output 1A/channel;  
Max 4A/module
Terminal Unit  
2500TF-SRU00 Terminal unit with dummy cover fitted

RLY8 – ORDER CODE
Module  
2500MF-8000 Four channel isolated relay output
Terminal Unit  
2500TF-T000 Terminal unit
2500MF-7: Sixteen Channel Digital Output Module

The DO16 provides higher packing density and lower cost per channel. The sixteen digital output module provides sixteen short-circuit protected outputs, which are typically used for control, alarms, or event outputs.

Each channel can drive up to 0.7A and can be used for driving solenoids, relays, lamps, fans, thyristor units, single phase Solid State Relays (SSRs), or some three phase SSRs.

- Voltage supply (external): 24Vdc +/- 20%
- Leakage current off state: <10uA
- Current output: channel maximum: 0.7A/channel
- Module Thermal Cut-off: 90±3°C, restart: 88±3°C
- Short Circuit Protection: 0.7A to 1.7A per channel
- Output voltage: >Voltage supply (Vs) less 1V
- System isolation: 300V RMS or dc (double insulation)
- Channel isolation: Channels share a common connection
- Power consumption: Module 0.6W maximum

2500MF-P: Two Channel Frequency Input

Provides two isolated frequency input channels and selectable voltage output for loop, wetting current, or sensor supply. Each input channel may be independently configured for magnetic, voltage, current, or contact sensor types.

- No of channels: 2
- System isolation: 300V RMS or dc (double insulation)
- Channel isolation: 100V RMS or dc (basic insulation)
- Power consumption: 3.7W maximum

**Frequency Measurements**
- Range: Logic: 0.01Hz-40KHz, debounce off
- Magnetic: 10Hz-40KHz
- Resolution: 60ppm
- Accuracy: ±100ppm, reference: ±160ppm overall
- ±0.05% drift over 5 years

**Pulse Counting**
- Range: Logic: dc - 40KHz, debounce off
- Magnetic: 10Hz-40KHz

**Magnetic Sensor Input Specification**
- Input range: 10mV-80V p-p
- Absolute maximum input: ±10V
- Input impedance: >30kΩ

**Logic Input Specification**

**VOLTAGE**
- Input range: 0-20V
- Absolute maximum input: 50V
- Input impedance: >30kΩ
- Threshold: 0.20V (0.5V steps), ±0.2V hysteresis
- Accuracy: ±0.4V or ±7% of range, whichever is the greater
- Sensor break level: 50-310mV ±10%
- Sensor short circuit: N/A
- CURRENT
- Input range: 0-20mA
- Absolute maximum input: 30mA
- Input impedance: 1kΩ
- Threshold: 0.20mA (0.5mA steps), ±0.2mA hysteresis
- Accuracy: ±0.4mA or ±7% of range, whichever is the greater
- Sensor break level: 0.05-0.31mA ±10%
- Sensor short circuit detect: when <100Ω; restored when >350Ω
- CONTACT
- Input range: N/A
- Absolute maximum input: N/A
- Input impedance: 5kΩ
- Threshold: 0.20V (0.5V steps), ±0.2V hysteresis
- Accuracy: ±0.4V or ±7% of range, whichever is the greater
- Debounce: 5, 10, 20, 50mS

Note: with debounce on, max frequency is limit and resolution is 600ppm

**Output Specification**

Voltage: Selectable as 8, 12, or 24V dc at10mA
Maximum current: 25mA
Voltage drop at full load: 1V @ 25mA
Accuracy: ±20%

F12 - ORDER CODE

**Module**
- 2500MF-P000 Two channel digital Frequency input
- 2500TF-U000 Terminal unit with dummy cover fitted

**Terminal Unit**
- 2500TF-NU00 Terminal unit
2500M-R: Zirconia Input
Input Types: Analog voltage, Channel 1 - mV (TC), and Channel 2 - (2V Zirconia probe)

Thermocouple Input Specification (Ch1 ONLY)
Input Range: 77mV to +100mV
Calibration Accuracy: ±0.1% of electrical input, ± 10μV
Noise: 5μV p-p with 1.6s Filter
Resolution: <2μV with 1.6s Filter
Sensor Break Detect: 250nA break high, low or off
Input Impedance: 10MΩ

Cold Junction Sensor Specification (Ch1 ONLY)
Temperature Range: -10°C to +70°C
CJ Rejection: < 30:1
CJ Accuracy: ± 1.3°C, ±0.5°C typ. (Automatic cold junction compensation)

Zirconia Input Specification (Ch2 ONLY)
Input Range: -10mV to +1800mV
Calibration Accuracy: ± 0.2% of electrical input
Noise: 0.1mV p-p with 1.6s Filter
Resolution: <50μV with 1.6s Filter
Sensor Impedance Measurement: 0.1kΩ to 100kΩ ±2%
Input Impedance: >500MΩ
Input Leakage Current: ±4.0nA max, ±1nA typical

General Specifications
Power consumption: 1.8W maximum
Common mode rejection: >80dB, 48 - 62Hz
Series mode rejection: >60dB, 48 - 62Hz
System isolation: 300V RMS or dc (double insulation)
Channel isolation: 300V RMS or dc (basic insulation)

ZI - ORDER CODE
Module
2500MF-R000  Zirconia Input

Terminal Unit
2500TF-Z000  Terminal unit
Ordering Code
PAC Series Composite Coding

<table>
<thead>
<tr>
<th>Model</th>
<th>2750</th>
<th>Processors, Base &amp; I/O</th>
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<tbody>
<tr>
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<td>.R</td>
<td>2 IOCs for Redundant operation</td>
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<tr>
<td></td>
<td>.S</td>
<td>1 IOC for Simplex operation</td>
</tr>
<tr>
<td>2 Base Size</td>
<td>A</td>
<td>16 I/O module positions</td>
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<td>8 I/O module positions</td>
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<td>Simplex processor only</td>
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PAC Licence Upgrade Code

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<td>STD+Modbus Master &amp; Raw Comms</td>
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6 Terminal Unit Connectors
| A | RJ45 Modbus and USB |

7 Disconnects and Fuses
| ELIN | ELIN, FTP, SNTP, Modbus Slave |
| MBMT | STD+Modbus Master & Raw Comms |

8 to 23 Module & Terminations
| B | 2 ch - T/C mV Input with CJC |
| C | 2 ch - PT100, HiZ Input |
| D | 2 ch - mA Input |
| E | 3 ch - 4-20mA with Tx PSU |
| G | 4 ch - non isol T/C, with CJC |
| H | 4 ch - non isol mA Input |
| J | 4 ch - non isol mA Input |
| K | 2 ch - mA, V Output |
| M | 4 ch - 24V Digital Input |
| P | 6 ch - 230 volt ac Input |
| Q | 6 ch - 115 volt ac Input |
| R | 8 ch - Logic Inputs |
| Y | 8 ch - Contact Inputs |
| 6 | 16 ch - Contact or Logic Input |
| T | 4 ch - Logic Output 10mA max |
| V | 4 ch - 24 volt dc Output |
| Z | 8 ch - Digital Output |
| 7 | 16 ch - Digital Output |
| X | 4 ch - Relay Output |
| 8 | 8 ch - Relay Output |
| 3 | 2 ch - Frequency Input |
| 5 | Zirconia Input |
| A | Blank Terminal Unit |
| 0 | No Terminal or Blank Unit |

3 Required Software
<table>
<thead>
<tr>
<th>I/O Blocks</th>
<th>Standard</th>
<th>Control</th>
<th>Advanced</th>
<th>Logging</th>
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</tbody>
</table>

4 Communications Software
| ELIN | ELIN, FTP, SNTP, Modbus Slave |
| MBMT | STD+Modbus Master & Raw Comms |