Specification Sheet

T2750 PAC

Programmable Automation Controller

MODEL



Foxboro T2750 PAC

HIGH PERFORMANCE CONTROL IN A VERSATILE, MODULAR SYSTEM

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 Availabilty

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.

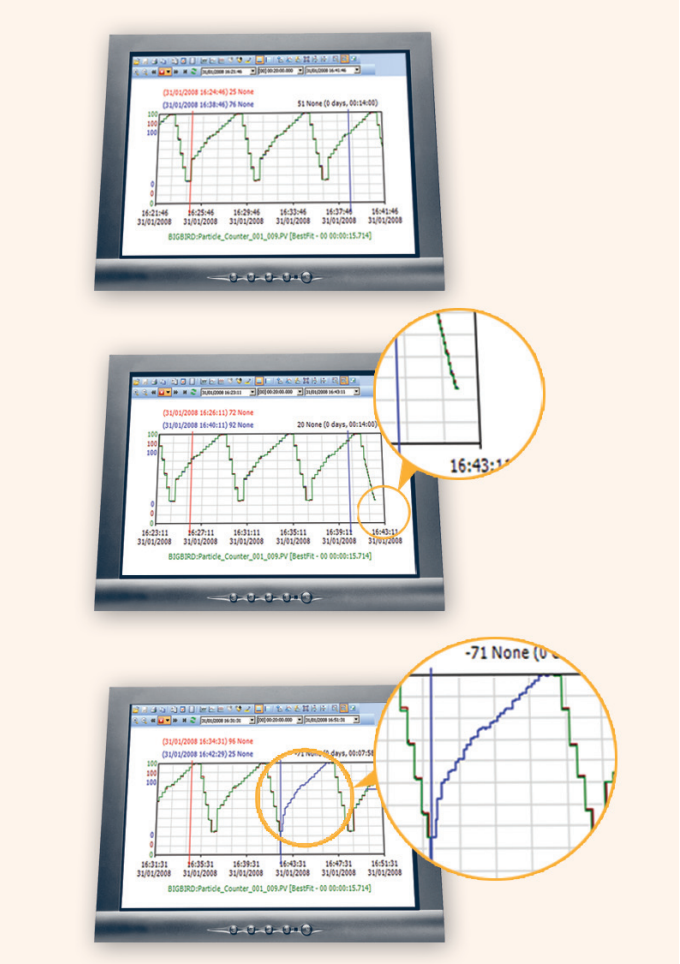
Foxboro®

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 Configurtion
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 Extensibilty
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, Profibus 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.

Recording	Estimated Data Storage Duration	
Interval	Min/Max Off	Min/Max On
1s	11 days	6 days
5s	57 days	29 days
10s	114 days	59 days
20s	228 days	118 days
60s	685 days	353 days

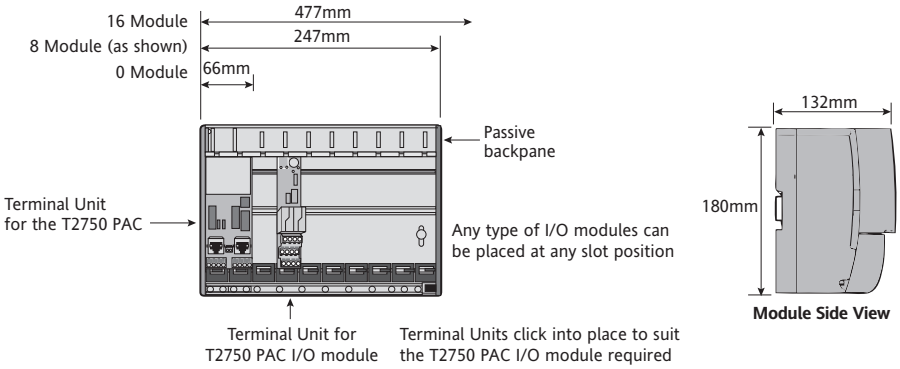
Data Historian
The data historian is used to store PV's, message, and alarm information in the internal flash memory in order to generate historical data in the form of a set of secure, tamper resistant history files.

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



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.

Mechanical

I/O Module capacity	**0**	**8**	**16**
Width (mm)	66	247	477
Weight no modules (Kg)	0.2	0.7	1.2
all modules (Kg)	0.5	2.1	3.7
Height:	180mm		
Depth:	132 -135 mm with retaining lever raised		
Mounting:	DIN rail or Bulkhead, can be mounted horizontally or vertically		
DIN rail:	Use symmetrical DIN rail to EN50022-35 x 7.5 or 35 x 15		
Casing:	Without additional protection IP20		
Ventilation space:	25mm free space above and below		

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.

ORDER CODE – Redundant Base

T2750B-16R/C16/CDM/-/-	16 module base with earth clamps
T2750B-08R/C08/CDM/-/-	8 module base with earth clamps
T2750B-16R/NON/CDM/-/-	16 module base without earth clamps
T2750B-08R/NON/CDM/-/-	8 module base without earth clamps
T2750B-00R/NON/CDM/-/-	0 module base for additional processors and comms

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 EN61326 – 1: 2006 Industrial Locations

Safety

BS EN61010-1/A2;19931995 Installation cat II, Pollution degree 2
Safety earth and screen connections are made to earth terminals at the bottom of the base

Vibration

Vibration:	IEC1131-2 (2007) section 4.2.1 1.75mm peak amplitude 5-8.4Hz; 1g peak amplitude, 8.4-150Hz 30 minutes dwell at resonance in all 3 planes
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.

PAC Controller module:	A green LED at the top indicates the module is powered and operating correctly
Internal diagnostics:	A red LED indicates failure of the internal self diagnostic routines or an abnormal operating state.
Battery (if installed):	A green LED indicates battery health
Serial communications:	A yellow LED indicates communications activity
Duplex:	Indicates inter processor communications
Primary/Standby:	Two LEDs indicate status information
IP address:	A yellow LED indicates if the unit has resolved its IP address for Ethernet communications
Ethernet link:	A Yellow LED indicate Ethernet link and flashes to show activity
Ethernet Link speed:	A Green LED indicates 100Mbs operation
USB link:	A Green LED indicate USB activity, periodic flashing shows an error
USB over-current indication:	A Yellow LED indicates an over current error

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 switchover 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.

Physical

CPU:	Freescale Power QUICC II Pro processor MPC8313
Bus Size:	32 bit
System Clock:	333 MHz
Logging Capacity:	32MB on board, Log files transferred by FTP or USB.
Removable SDHC Card Size:	32 Mbytes
USB:	Redundant USB 2.0 connected on terminal unit
Control Switches:	Processor front panel
Push Button Switches:	Watchdog reset. Processor synchronisation/ changeover. Processor desynchronisation.

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.

A super capacitor maintains memory for up to 1 hour in the event of complete power failure. This facilitates a hot start of the processors. An external battery can be fitted to extend this back up time on the redundant system.

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 main supply to extend Warm start capacity > 1 hour.

Code	Description
T2750-BBA	Backup Battery Assembly – includes Charger and Battery
T2750-BBB	Backup Battery Spare / Replacement Battery
T2750-BBC	Backup Battery Spare Charger

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.

T2750 PAC–Order Code

Basic Product
T2750M Programmable Automation Controller

1 - IOC and Software

	Foundation	Standard	Control	Advanced	Data Logging
-A	Unbounded	0	0		off
-F	Unbounded	Unbounded	24	off	off
-H	Unbounded	Unbounded	Unbounded	off	off
-J	Unbounded	Unbounded	Unbounded	on	off
-K	Unbounded	0	0	off	on
-Q	Unbounded	Unbounded	24	off	on
-S	Unbounded	Unbounded	Unbounded	off	on
-T	Unbounded	Unbounded	Unbounded	on	on

2 - SDHC Card

A	SDHC card (standard)

3 - Ethernet Communications Protocol

ELIN	Ethernet Local Instrument Network (LIN) peer-to-peer
MBTM	Modbus-TCP Master communications (includes LIN peer-to-peer)

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 Dbase cached elsewhere	4096
Number blocks in remote Dbases 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 I –	Synchronous to Fast I/O Only 10ms I/O types can be assigned to this task (see table below).	10ms ≤ N*10ms
Task 2 –	Auxiliary task to task1 Runs at task 1 rate or integer multiple of task 1 rate	10ms ≤ N*5ms
Task 3 –	Synchronous to Standard I/O All analogue and digital I/O types can be assigned to this task	110ms ≤ N*110ms
Task 4 –	Auxiliary task to Runs at task 3 rate or integer multiple of task 3 rate	110ms ≤ N*5ms

Supported I/O Module Types

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

Type	Description	Maximum update speed Version modules 2†
AI2	Analog Input 2 channels (all I/O types)	110ms
AI3	Analog Input 3 channels (mA + Tx PSU)	110ms
AI4	Analog Input 4 channels (TC, mV, mA) 1	10ms
AO2	Analog Output 2 channels (mA or V)	10ms
DI4	Digital Input 4 channels (logic)	110ms
DI6_MV	Digital Input 6 channels (115V ac rms)	110ms
DI6_HV	Digital Input 6 channels (230V ac rms)	110ms
DI8_LG	Digital Input 8 channels (logic)	10ms
DI8_CO	Digital Input 8 channels (contact)	10ms
DI16	Digital Input 16 channels (contact and logic)	10ms
DO4_LG	Digital Output 4 channels (10mA)	10ms
DO4_24	Digital Output 4 channels (100mA)	10ms
RLY4	Relay Output 4 channels (3 n/o, 1 c/o)	10ms
RLY8	Relay Output 8 channels (8 n/o)	10ms
DO8	Digital Output 8 channels (1A per ch)	10ms
DO16	Digital Output 16 channels (1A per ch)	10ms
FI2	Frequency Input 2 channels	10ms
ZI	Zirconia Input Module	110ms

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

No. of Programs	No. of Channels /per prog (max)	No. of Digital Events /per prog (max)	No. User/per prog (max)
1 Program	8	128	32
2 Programs	4	64	16
4 Programs	2	32	8
8 Programs	1	16	4

Continuous Strategy Function Blocks Categories

F = Foundation, S = Standard, C = Control, A = Advanced

SOFTWARE LICENSE	CATEGORY				
I/O Block	F	S	C	A	Description
AI_UIO, AO_IUO	✓				Universal I/O & Time-proportioning O/P
DI_UIO, DO_UIO	✓				
FI_UIO, MOD_UIO	✓				
MOD_DI_UIO, MOD_DO_UIO	✓				
TPO_UIO, VP_UIO	✓				
CALIB_UIO	✓				Analog calibration
Communications					
GW_CON	✓				Gateway configuration block
GW_TBL	✓				Gateway table block
RAW_COM	✓				Open communication
Conditioning					
CHAR, UCHAR	✓				Characterisation
AN_ALARM, DIGALARM	✓				Analog alarm
INVERT		✓			Analog Inversion
FILTER, LEAD_LAG		✓			Filter
RANGE		✓			Range
FLOWCOMP		✓			Compensated flow
ZIRCONIA	✓				Zirconia Function Block
GASCONC				✓	Natural gas concentration data block
AGA8DATA				✓	AGA8 calculation
Control					
AN_CONN, DG_CONN	✓				Analog & Digital connection block
ANMS, DGMS		✓			Analog & Digital manual stations
SIM		✓			Simulation
SETPOINT		✓			Setpoint
TC_SEL		✓			Thermocouple Select
TC_LIFE			✓		Thermocouple Life
MAN_STAT		✓			Manual station
MODE		✓			Mode block
PID_LINK, TUNE_SET		✓			PID linking block, Tune set block
PID, 3_TERM, LOOP_PID			✓		Control block
Timing					
TIMER, TIMEDATE	✓				Timer & Time/date event
DELAY		✓			Delay
TPO	✓				Time-proportioning output
RATE_ALM	✓				Rate alarm
RATE_LMT		✓			Rate limit
TOTAL, TOTAL2, TOT_CON		✓			Totalization
DTIME		✓			Dead-time
SEQE		✓			Sequence
SEQ			✓		Sequence
Selector					
ALC	✓				Alarm collection
SELECT, SWITCH		✓			Selector, Switch
2OF3VOTE		✓			Best-average
Logic					
PULSE, LATCH, COUNT		✓			Pulse & Latch & Count block
AND4, OR4, XOR4 NOT,		✓			AND, OR, Exclusive-OR, NOT
COMPARE		✓			Compare
Maths					
ADD2, SUB2, MUL2, DIV2		✓			Add, Subtract, Multiply, Divide
EXPR, ACT_2A2W3T		✓			Expression
ACTION, DIGACT,			✓		Action blocks
ACT15A3W, ACTUI818			✓		
Control Module					
VLV1IN, VLV2IN, VLV3WAY		✓			Valve control modules
MTR3IN		✓			Control module
DUTYSTBY, AN_ALM_2		✓			Control module
Diagnostic					
ALL Diag Blocks	✓				Diagnostic block
Recorder					
RGROUP	✓				Recording group
Programmer					
PROGCHAN, SEGMENT		✓			
PROGCTRL	✓				
SPP_RAMP		✓			
Batch					
RECORD, DISCREP		✓			Record & Discrepancy block
SFC_MON, SFC_DISP		✓			SFC monitor & display blocks
SFC_CON			✓		SFC control





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

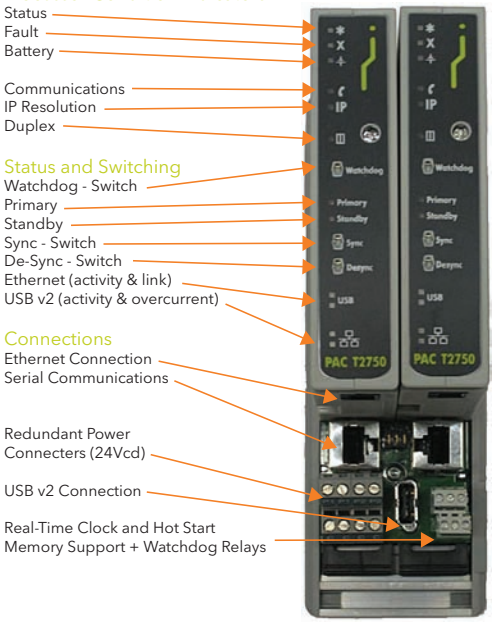
Open Communication

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

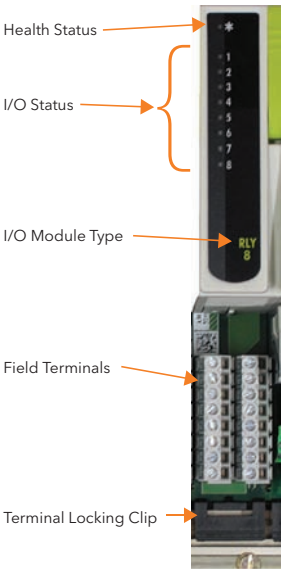
Raw Communications

Protocol:	Support for simple protocols written by user, using physical connection above.

Processor Condition Indicators



Module Condition Indicators





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 640Ω 2, 3 or 4-wire lead compensation
Hi Ohms range:	0 to 7kΩ 2, 3 or 4-wire lead compensation
Pot range:	0% to 100% 'rotation' of 100Ω to 7kΩ pot
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 maximum

TC Input specification

Linearisation 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

Note: 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 Mv, V, PT100, Hiz 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 utilises 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 (equivalent: 16 bits)
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.

No of channels:	4
Input types:	TC, mV, mA, Pyrometer mV range: -150 - +150mV at input impedance >100MΩ mA range: -25 - +25mA with 5Ω burden in the terminal unit
Resolution:	Better than 0.001% of range
Input filtering:	OFF to 999.9 seconds
Initial accuracy:	Electrical input factory calibrated to better than 0.1% of reading Burden resistor 5Ω ±1% (fitted to terminal unit)
System isolation:	300V RMS or dc (double insulation)
Channel isolation:	300V RMS or dc (basic insulation) Ch1 and Ch2 from Ch3 and Ch4
Series mode rejection:	60dB (47-63Hz)
Common mode rejection:	120dB (47-63Hz)
Power consumption:	2W maximum

TC Input specification

Linearisation types:	J, K, L, R, B, N, T, S, C, PL2,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:
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.

AI4 – ORDER CODE

Module

2500MF-D000	Four channel – T/C, mV, mA input

Terminal Unit

2500TF-FT00	Terminal unit for 4 channel TC with CJC
2500TF-FM00	Terminal unit for 4 channel mV
2500TF-FV00	Terminal unit for 4 channel mA



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.

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

AO2 – ORDER CODE

Module

2500MF-E000	Two channel isolated mA, volts

Terminal Unit

2500TF-NU00	Terminal unit
2500TF-NU30	Terminal unit with disconnect





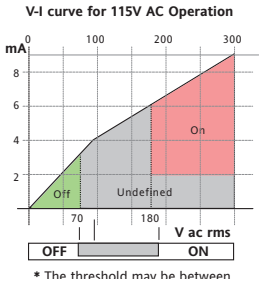
2500MF-K: Six Channel AC Voltage Input

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

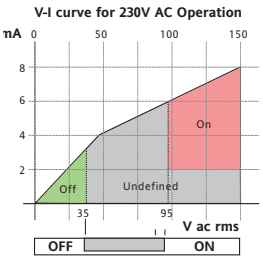
Active On state:	>95V ac rms, 150V ac rms maximum
Inactive OFF state:	<35V ac rms
Main input current:	More than 2mA required for 'ON'
Maximum input current:	8mA



defined at the threshold

'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-G: Four Channel Digital Input

The DI4 version 2 module is fully supported by the T2750PAC. For specification see T2550 specification sheet

DI6 – 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

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)
Channel isolation:	50V RMS or dc (basic insulation) between pairs [1&2] to [3&4] to [5&6] to [7&8]
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

DI8 – 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:	
ON state:	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.
OFF state:	Input voltage threshold <5.0V dc
Input current:	3.8mA @ 12vdc; 2.8mA @ 24vdc

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 50V 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:	>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	1.1W maximum

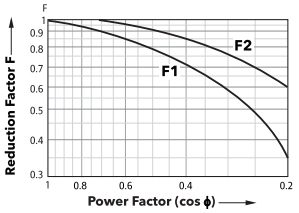
Relay De-rating

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

Reduction factor for inductive ac loads

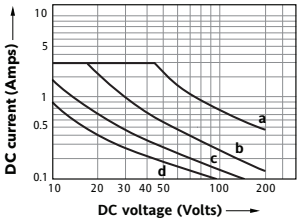


Contact life = resistive contact life x reduction factor

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.

Max dc load breaking capacity



a = resistive **b** = 20ms **c** = 40ms **d** = 60ms

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

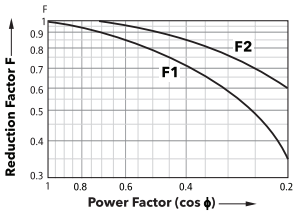
Relay De-rating

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

Reduction factor for inductive ac loads

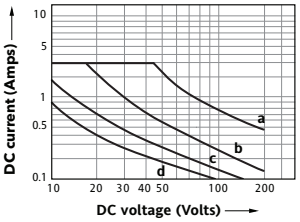


Contact life = resistive contact life x reduction factor

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.

Max dc load breaking capacity



a = resistive **b** = 20ms **c** = 40ms **d** = 60ms

RLY8 – ORDER CODE

Module	
2500MF-8000	Four channel isolated relay output
Terminal Unit	
2500TF-T000	Terminal unit



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-S)RU00	Terminal unit with dummy cover fitted



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 Plant side 850W maximum

DO16 – ORDER CODE

Module

2500MF-7E00	Eight channel digital output 1A/channel; Max 4A/module

Terminal Unit

2500TF-SRU00	Terminal unit with dummy cover fitted



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:	±100V
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%

FI2 – ORDER CODE

Module

2500MF-P000	Two channel digital Frequency input

Terminal Unit

2500TF-U000	Terminal unit with dummy cover fitted
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

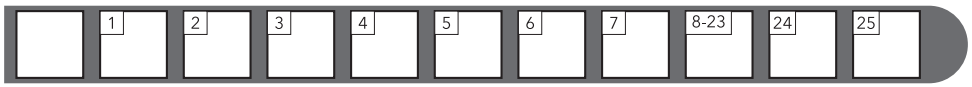
Module

2500MF-R000	Zirconia Input

Terminal Unit

2500TF-Z000	Terminal unit

Ordering Code
PAC Series Composite Coding



	Model
2750	Processors, Base & I/O

1	Redundant
-R	2 IOCs for Redundant operation
-S	1 IOC for Simplex operation

2	Base Size
A	16 I/O module positions
C	8 I/O module positions
F	Simplex processor only

3	Earthing System
0	Two earth clamps fitted
1	Earthing for 8 Module Base
2	Earthing for 16 Module Base

4	Software				
	I/O Blocks	Standard	Control	Advanced	Logging
A	Unbounded	0	0	Off	Off
F	Unbounded	Unbounded	24	Off	Off
H	Unbounded	Unbounded	Unbounded	Off	Off
J	Unbounded	Unbounded	Unbounded	On	Off
K	Unbounded	0	0	Off	On
Q	Unbounded	Unbounded	24	Off	On
S	Unbounded	Unbounded	Unbounded	Off	On
T	Unbounded	Unbounded	Unbounded	On	On

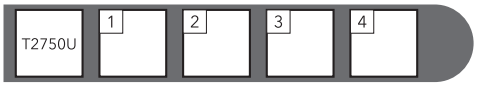
5	Communications Software & Hardware
1	ELIN, FTP, SNTP, Modbus Slave
2	STD+Modbus Master & Raw Comms

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 mV 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

PAC Licence Upgrade Code



	Model
T2750U	Licence Upgrade Only

1	Existing Software				
	I/O Blocks	Standard	Control	Advanced	Logging
-L10	Unbounded	0	0	Off	Off
-L60	Unbounded	Unbounded	24	Off	Off
-L80	Unbounded	Unbounded	Unbounded	Off	Off
-L90	Unbounded	Unbounded	Unbounded	On	Off
-D10	Unbounded	0	0	Off	On
-D60	Unbounded	Unbounded	24	Off	On
-D80	Unbounded	Unbounded	Unbounded	Off	On
-D90	Unbounded	Unbounded	Unbounded	On	On

2	Communications Software
ELIN	ELIN, FTP, SNTP, Modbus Slave
MBMT	STD+Modbus Master & Raw comms

3	Required Software				
	I/O Blocks	Standard	Control	Advanced	Logging
L10	Unbounded	0	0	Off	Off
L60	Unbounded	Unbounded	24	Off	Off
L80	Unbounded	Unbounded	Unbounded	Off	Off
L90	Unbounded	Unbounded	Unbounded	On	Off
D10	Unbounded	0	0	Off	On
D60	Unbounded	Unbounded	24	Off	On
D80	Unbounded	Unbounded	Unbounded	Off	On
D90	Unbounded	Unbounded	Unbounded	On	On

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

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