

NUCLEAR CAPABILITIES

A guide to extend the life of existing nuclear plants electronic instrumentation.

Drop in form, fit and functional replacements

Same function using modern electronic components

Enhanced IEC compliance built in

PYRAGON
ELECTRONIC INSTRUMENTATION

Extend the life of your nuclear facility with . . .

PYRAGON

ELECTRONIC INSTRUMENTATION

When a longtime manufacturer for the nuclear industry stops producing a critical piece of electronic instrumentation, it puts their customers in a bind. This is where PYRAGON steps in – with over 20 years’ experience providing functionally equivalent drop-in replacements for discontinued products from other manufacturers, while designing solutions that take advantage of modern electronic components and surface mount technology. These improvements enable the new instruments to comply with more stringent IEC requirements, such as transient and RFI specifications per IEC 61000.



Successful Obsolescence Practices

- We have a good understanding of legacy equipment, their installation procedures, and purposes.
- We carefully review the legacy device specifications with the end user and obtain a reference unit when possible.
- We ask the right questions and closely collaborate with your engineering team, and other involved parties such as maintenance or operations.

Reverse Engineering Versus New Design

- Rather than reverse engineer legacy devices, due to advances in electronic components, it typically makes more sense to develop a new design incorporating the same form, fit, and function.
- This approach leverages the advantages of new technologies while preserving the purpose of the original device.
- The result is higher reliability, longer mean time between failures, better stability and accuracy; but, most importantly, extending future support since the design uses new components, rather than obsolete ones.

DC Power Supplies and DC Voltage Regulation Systems

- Although DC power supplies may seem frivolous, they are an integral piece of every system’s puzzle. They power everything from field transmitters to sensors, I/O systems, computer subsystems, relays and a vast number of miscellaneous devices.
- Legacy power supplies often rely on linear technology, which is an outdated design methodology. Newer switching supplies offer higher reliability, better efficiency, less heat dissipation, as well as fewer and smaller electrolytic capacitors (a common failure point).



- When replacing a legacy power supply, it is critical that the new design performs exactly the same as the legacy equipment. With careful design and a strong understanding of the requirements, a newer technology power supply can be designed to meet a legacy application.
- PYRAGON has a long history in redesigning power supplies for the nuclear industry. Our extensive background can apply to similar types of equipment, such as voltage regulation systems.



IEC Compliance

- When obsolescence issues arise, IEC 61000 compliance is often an added requirement to the legacy equipment's specifications. Although the intent is worthwhile, this seemingly simple addition can greatly complicate finding a suitable replacement.
- In order to meet IEC requirements, the device housing and mechanical design must be considered. Replacing legacy equipment often comes with the caveat that the new design maintains the original's form, fit, and function. However, without the ability to modify the form or fit, meeting new IEC requirements becomes quite the challenge.
- PYRAGON has widespread experience with maintaining OEM form and fit while incorporating new IEC requirements. We leverage our in-house test equipment so designs can be checked as they develop, ensuring both a timely and positive end result.

Analog Capabilities

- While digital components are in every modern process, the nuclear industry still relies on analog circuits for redundant backup protection in control systems.
- PYRAGON has vast proficiencies in both designing and manufacturing analog circuits, which allows us to produce complex circuits that are software-free, where, otherwise, software would normally be required. This approach reduces the risks of both scheduling delays and uncertainty of new software (as compared to an analog circuit) and eliminates the need for software compliance requirements.

Software

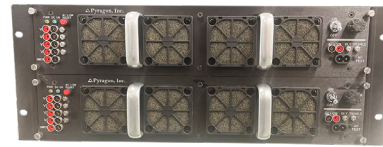
- Though many applications can be solved without the use of software, there are still instances where it must be used.
- PYRAGON has a deep history of developing hardware in partnership with industry-leading, nuclear approved software companies for applications where software is required.

Nuclear QA Program

- CSA-N299.2 approved for the design and manufacture of electronic instrumentation and power supplies.

PRODUCT EXAMPLES

- Power Supplies
- Process Alarms, both Single and Dual
- Isolators, 2 Wire and 4 Wire Power
- Signal Converters, Limiters, Inverters, Adders and Subtractors
- Square Root Extractors
- Manual Loaders
- Keyboard Interface Modules
- Fuel Handling Systems
- Watch Dog Timers
- Battery Systems
- *and many more!*



Power Supplies



Alarm Modules



Isolators

Power Supplies and Voltage Regulation Systems

Power supplies can be stand alone, or redundant with load sharing and/or lead lag configurations. They can be modules within a larger system. These can be single or have multiple outputs. They can be simple or employ such items as AC input line voltage monitoring, high and low voltage alarms and shut down circuitry. PYRAGON has designed and manufactured them all. We've upgraded systems to new technology or where required performed a straight reverse engineering.

Related to power supplies are voltage regulation systems. While similar in technology, they are used to regulate variable outputs or supplies such as generators, solar or other green power systems. These are often configured in similar fashion to power supply installations.

Model 45VDC Power Supply System for CANDU

Line Power	120VAC 1Ph
Outputs	
V1	45VDC @ 1A
Alarms	Low DC Voltage
	High DC Voltage
Over Current Protection	
IEC 61000 Series certified	

Model ES1800 Quad output, redundant, sharing power supply system

Outputs	
V1	5VDC @ 75A
V2	28VDC @6A
V3	+12VDC@5A
V4	-12VDC@5A
Alarms	AC Waveform
	Low DC Voltage
	High DC Voltage
Line Power	120VAC 1Ph
Over Current Protection	
IEC 61000 Series Certified	

Power Supply Replacement Example



Old obsolete unit

Process Alarms

In many Nuclear Power Plants (NPP), the process alarms are used for critical point monitoring often in parallel or as part of a voting system within a centralized computer control system. These alarms cover a wide variety of types of processes such as temperatures, pressures, flows and vibration etc. As such, these are critical to the operating safety of the plant. With aging infrastructure, these alarms often need to be replaced but are no longer available from the original manufacturer.

PYRAGON provides the same or higher quality process alarm modules than the original installation. These are often enhanced with significantly improved IEC 61000 capabilities. They offer the same form, fit and functional replacements as with other obsolescence applications.

Fischer & Porter Versa Case 55PA3000 Series

(see chart in this brochure for list of completed models.)

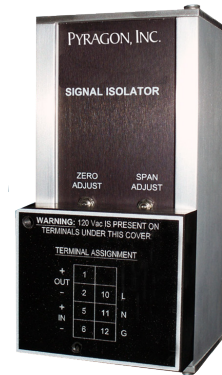


Inputs	4-20 mA DC, 1-5 Vdc
Alarm Types	Hi, Lo, Hi/Hi, Hi/Lo, Hi/Hi, Lo/Lo
	Form C Contacts, DPDT
	Fail Safe and non-Fail Safe
Adjustment	10 Turn Dial
LED	Alarm Status Indication
Isolation	Input to Output to Power
Seismic Approval	18RF-30000, Category B
IEC Approvals	4-2 ESD
	4-3 RF Radiated Susceptibility
	4-4 EFT
	4-5 Surge
	4-6 Conducted Susceptibility
	4-11 Dips and Drops
	4-12 Ring Wave
6-4 RF Emissions	
Power	120/240VAC 50/60 Hz.

Signal Transmitters, Isolators and Conditioners

Transmitters, signal conditioners and isolators are used in a wide variety of applications throughout the plant. These applications involve field and control room mounted transmitters, signal isolators to prevent ground loops as well as a wide variety of specialized function modules that, in more modern, systems would be performed in software. These I/O systems and modules are part of the plant's original control and licensing. By extending the plant life these electronics will have exceeded their useful life. Changing the control methodology to handle these functions digitally is often cost prohibitive.

PYRAGON has and continues to provide replacement solutions that meet the usual form, fit and functional requirements but using modern state of the art components and design techniques. Where required, enhanced IEC 61000 capability is added. This helps extend the life of these electronics to meet the plant life extension goals while leaving the original design methodology intact.



Fisher Model
LS121



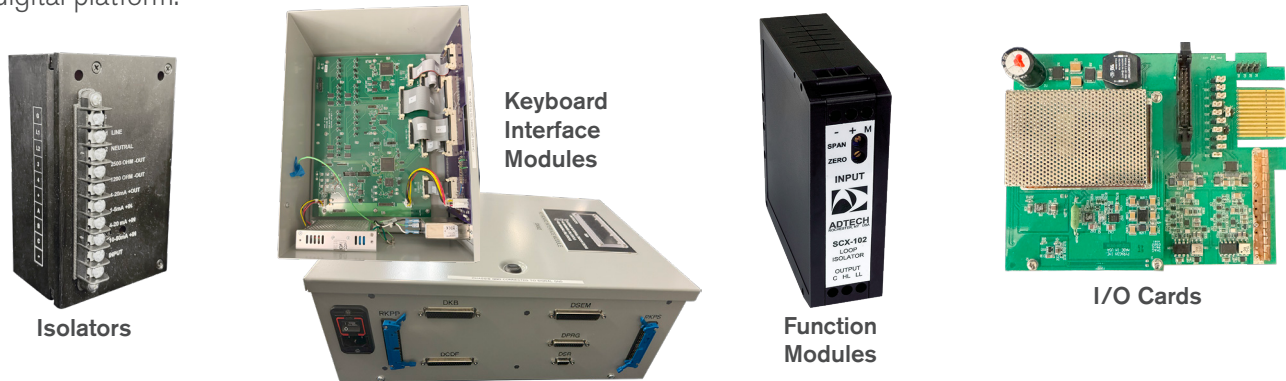
AGM Model
DCT-TA4000-13



AGM Model
DCT-TA4027

And Many More

In the world of digital controls, non-software based analog systems still play a significant role in the control of an NPP. These cover a wide range of applications. These applications face the same obsolescence issues as all the rest of the electronics in a plant when the operating license is extended. These cover hundreds of types of applications where the replacement solution is not conducive to upgrading the control scheme to a digital platform.

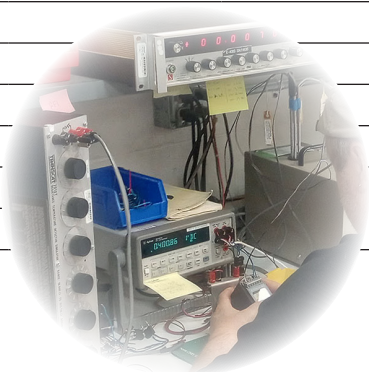


Manufacturers Module Cross Reference Guide

Manufacturers		Power Supplies	Process Alarms	Temperature Transmitters	Manual Loaders	Isolators	Signal Converters	Function Modules Adders, Subtractors, Integrators	Signal Inverters Limiters
ABB			X		X				
AGM						X	X	X	X
CTS Power		X							
Fisher Controls						X			
Fischer and Porter	Scan Line Series			X			X	X	X
	Versa Case		X		X				
Foxboro			X					X	
Hi-Tech Power		X							
RIS			X					X	
Transmation			X	X			X	X	

Manufacturer and Model Replacement Matrix

MFR	MODEL			FUNCTION
AGM	ACM-TA-4005			Adder/Subtractor
	DCA-TA-4000			Isolator/Signal Limiter
	DCA-TA-4006			Square Root Extractor
	DCT-TA-4027/DCT-TA-4047-2			Signal Inverter/Converter
	SSM-A-4010L			Low Selector
	SSM-A-4010M			Median Selector
	SSM-A-4010H			High Selector
CTS	5600-A7			45V Power Supply
Fisher Controls	LS-121			Isolator/Signal Converter
Fisher & Porter	B55PA1000BAX-NXXX	B55PA3132BA2-NS452	B55PA3132BA2-NS483	Process Alarms Versa Case Model Numbers
	B55PA2000BA1-NS318	B55PA3132BA2-NS453	B55PA3132BA2-NS484	
	B55PA3131BD2-NS441	B55PA3132BA2-NS454	B55PA3132BA2-NS486	
	B55PA3131BD2-NS443	B55PA3132BA2-NS455	B55PA3132BA2-NS489	
	B55PA3131BD2-NS444	B55PA3132BA2-NS480	B55PA3132BA2-NS490	
	B55PA3131BD2-NS444	B55PA3132BA2-NS481	B55PA3132BA2-NS491	
	B55PA3131BA2-NS450	B55PA3132BA2-NS482	B55PA3132BD2-NS498	
	B55PA3132BA2-NS451			
	Model 53ED3000			Manual Loader Station, Basic, with Auto/Manual, with A?M and Bias
53MC5000			Controller I/O boards and Isolators	
Foxboro	63U			Series of single and Dual Alarm Modules
	66AT-0			Square Root Extractor
HC Power Inc.	HS-1014-C1511			Dual Redundant Sharing Power Supply
	PS2-C15111			Power Supply Module for HS1014
Rochester Instrument Systems	PTA-215			Single/ Dual Process Alarm
	ET-1215			Process Alarm
	SC-1330			Square Root Extractor
	SC-4326			Temperature Transmitter
Scan Line Case	50AS2000			Adder/Subtractor
	50EM3B32BGB			mV Converter
	50EM4B32BGB			mV Converter
	55ES3B12AA			Signal Selector
	50ER3511BA			RTD Transmitter
Transmaton	210A/220A/510A/520A			
	310A/320A			Single Dual Thermocouple Alarm
	321A			Thermocouple Alarm in Nema Housing
	330T/330IT			Millivolt Transmitter
	350T			RTD Transmitter
	610T/610T-27			Thermocouple Transmitter
	900F			Square Root Extractor





With a wealth of experience in electronic design and manufacturing, we can address your obsolescence issues with modern design approaches and state of the art components while keeping the original control scheme intact.

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