

TECHNICAL NOTE: MIGRATING FROM SNAP PAC TO *groov* EPIC

What is *groov* EPIC?

groov EPIC is an Edge Programmable Industrial Controller, or EPIC. It's more than a PLC, a PAC, or a PC. It's essentially a Linux-based processor in a compact industrial enclosure, with local I/O and wide-ranging cybersecurity, programming, and communications options.

In addition to real-time control, EPIC provides the industrial internet of things (IIoT) connectivity many of today's projects require: it securely connects to field sensors and devices, other PLC systems, company software, remote equipment, SCADA and HMI software like Ignition from Inductive Automation®, and cloud services for anything from weather conditions to artificial intelligence assistants like IBM Watson.

Because Opto 22 has manufactured automation products for over 45 years, we were able to use that experience to design a completely new system, from the ground up. The result works for controls engineers, IT personnel, software developers, integrators, and machine designers or OEMs (original equipment manufacturers).

If you already have an Opto 22 SNAP PAC System, you may be looking at *groov* EPIC and wondering how it is different, and whether you should migrate to an EPIC system. What would you gain? What issues might arise? This technical note will help you decide whether, and how, to migrate. If you have any questions or concerns after reading this note, please contact our Pre-sales Engineers:

Phone: 800-321-6786 (toll-free in the U.S. and Canada) or +1-951-695-3000

Email: sales@opto22.com

Why migrate to *groov* EPIC?

The *groov* EPIC edge programmable industrial controller can add a range of new capabilities to your existing SNAP PAC System so that you can much more easily and securely collect, process, display, and exchange data. How does EPIC do that?

First, the industrial *groov* EPIC processor offers **cybersecurity** features that help you build a secure system: a configurable device firewall, two independent network interfaces, user authentication, security certificates, data encryption, and more. See the [groov EPIC Cybersecurity Design and Best Practices Technical Note](#) (form 2310) for details.

Second, *groov* EPIC is **compatible** with SNAP I/O coupled to a SNAP I/O brain or SNAP PAC R-series controller. You can directly address this I/O from a PAC Control strategy running on the *groov* EPIC processor. You don't need to replace I/O units or field wiring; you can continue to use what you already have in place.

Third, because *groov* EPIC includes additional software and communication options, an EPIC can also talk directly to other control systems like Allen-Bradley® and Siemens® PLCs, Modbus® devices, automation software, corporate software, databases, cloud services, and more.

groov EPIC software includes:

- **Programming options**—Choose PAC Control, any IEC 61131-3 language with the CODESYS Development System (yes, even ladder logic), or Secure Shell access to the processor's Linux operating system for building custom-written software applications.
- **Node-RED**—Build simple logic flows to wire together devices, databases, cloud applications, and APIs (application program interfaces) using prebuilt nodes.
- **Ignition or Ignition Edge®** from Inductive Automation®—Use an internal OPC-UA server and drivers for some of the most popular automation PLCs and devices, plus optional Ignition modules.

- **MQTT communications**—For efficient data communications that are easier to set up securely, utilize MQTT with Sparkplug or strings payload either directly from *groov* Manage on the EPIC processor or via Ignition's MQTT Transmission module.
- **groov View**—Build a simple web-based HMI that's usable on cross-platform PCs and mobile devices.
- **PAC Display**—For a traditional Windows HMI, use PAC Display.

For more information about *groov* EPIC features, visit opto22.com and choose Products > [groov EPIC System](#).

Migration paths

groov EPIC is compatible with the SNAP PAC System in many ways, giving you maximum flexibility to expand your existing system:

- You can **add an EPIC as your primary controller** (for example, substituting it for a SNAP-PAC-S1 controller) and keep your existing SNAP PAC I/O units as remote I/O. This option gives you several advantages:
 - **Cybersecurity** has become a critical issue in automation systems. One option for greater security is to add a *groov* EPIC processor in front of your SNAP PAC System. Run your PAC Control strategy on the EPIC instead of a SNAP PAC controller and make sure all communication goes through the EPIC. You gain password protection for your system and other important security features.
 - Your PAC Control strategy can run on the EPIC with minimal changes, and you'll see a noticeable improvement in system speed because the EPIC's CPU is faster than the PAC. For important information on how the CPU works with PAC Project, SCADA, and HMI systems, see the [Optimizing PAC Project System Performance Technical Note](#) (form 1776).
 - You can utilize all of *groov* EPIC's additional software for data communications and visualization. You can more easily share data with diverse legacy equipment, on-premises software, cloud services, and other places where you need it, and you have *groov* View available for building a mobile HMI.
- **If you need to add I/O**, you can use EPIC as remote I/O within a SNAP PAC System and also utilize the EPIC's other capabilities. Your existing SNAP PAC controller running PAC Control R10.0a or higher can communicate with *groov* I/O on the EPIC chassis, just as it communicates with your SNAP I/O units.
- **If you don't need additional I/O but you want EPIC's other capabilities**, you can mount the EPIC on a GRV-EPIC-CHS0 (a chassis that includes no I/O) and use it as part of your SNAP PAC System.

When you migrate, be sure you have the most recent version of *groov* EPIC firmware. New features and issue fixes are constantly being added, so you will want to have the latest version. All updates are included for free with your purchase of a *groov* EPIC processor.

SNAP I/O and *groov* I/O

OEMs who are redesigning machines may prefer a clean install, but for most existing SNAP PAC Systems, we do not recommend replacing installed SNAP PAC I/O units with *groov* EPIC I/O units, because that would require not only rewiring field devices but also completely reconfiguring I/O in your PAC Control strategy.

Since both SNAP PACs and *groov* EPICs can be programmed with PAC Control, you might think you could simply download your PAC Control strategy from a SNAP PAC to an EPIC and have everything work. But although the strategy runs on a PAC or an EPIC, the two I/O systems are fundamentally different. The advanced features in *groov* I/O require that I/O be reconfigured in your PAC Control strategy. It cannot be moved.

If you want to add the EPIC's capabilities to your automation system, the quickest and easiest way is to keep your SNAP I/O and field devices intact and add an EPIC as your main controller. If you need additional I/O, you can mount the processor and I/O on a 4-, 8-, or 16-module *groov* EPIC chassis to meet the need. If you don't need additional I/O, mount the EPIC on a GRV-EPIC-CHS0, which has no I/O slots.

Specification differences in I/O modules

If you plan to use *groov* I/O with field sensors and actuators you have used with SNAP I/O, be sure you compare specifications and determine whether the *groov* I/O modules you plan to use will work for your application.

Pay particular attention to DC inputs. Most SNAP (and earlier G4 and G1) DC inputs are quite sensitive compared to *groov* DC inputs. We designed *groov* I/O to meet the IEC 61131-2 I/O type standards, which were developed to guarantee interoperability among PLCs. Compliance with these standards makes the resulting modules better from a noise immunity standpoint, but they are also more leakage tolerant and less sensitive than SNAP I/O.

For example, before you decide to use a [GRV-IDC-24](#) input module, compare its specifications with those for a [SNAP-IDC5](#). Here are a few key specs that illustrate why you need to compare them:

Spec	GRV-IDC-24	SNAP-IDC5
Input voltage range	15–30 VDC	10–32 VAC/VDC
Turn-on characteristic	15 V, > 2 mA	10 VAC/VDC
Turn-off characteristic	5 V, < 0.5 mA	3 VAC/VDC

You may find that a different *groov* I/O module works better for your application. The [GRV-IACDC-TTL-24](#), for example, offers an input voltage range of 2–16 VAC/VDC, much more sensitive at the lower end.

Bottom line: compare specs to make sure the *groov* I/O you’re considering will work for you. If you have any questions after comparing specs, be sure to [contact Opto 22 Pre-Sales engineers](#) for answers.

Serial communication modules

SNAP serial modules and *groov* serial modules are significantly different, too. While SNAP serial modules are really Ethernet-to-serial converters with dedicated Ethernet tasks, *groov* serial modules are directly connected to the processor via the bus on the chassis.

That means ports on a *groov* serial module work exactly like a port that’s built into the processor. It’s like having the option of multiple built-in serial ports on your GRV-EPIC-PR1 or GRV-EPIC-PR2. (For example, the GRV-CSERI-4 serial module contains four ports. Since serial modules can be placed only in the first four positions on the chassis, using four of these is like having 16 built-in serial ports on the processor.)

This difference is significant from a usage standpoint. The direct connection means that *an EPIC processor on one chassis cannot control a serial module on a different EPIC chassis*. Also, a SNAP PAC controller cannot control a *groov* serial module. You cannot control the built-in ports on a SNAP-PAC-S1 or S2 controller from another PAC, and for the same reason you cannot control *groov* serial modules from another device.

To control serial devices through a *groov* EPIC processor, you can:

- Use an EPIC processor with serial modules on its own chassis.
- Connect a USB-to-serial converter to a USB port on an EPIC processor itself.
- Use an EPIC processor or SNAP PAC controller to control serial modules on a SNAP PAC rack.

I/O features, PAC Control commands, and OptoMMP addresses

Because *groov* I/O and SNAP I/O are fundamentally different, some I/O features, PAC Control commands, and OptoMMP addresses that you might have used on SNAP I/O are not available on *groov* I/O.

Most SNAP I/O modules are similar to older Opto 22 I/O, such as G4, but *groov* I/O is not. With the new technology available now, we designed *groov* I/O to be much smarter. For example, many capabilities that used to be handled by SNAP brains—such as counting and pulsing—are now more efficiently built into *groov* I/O modules.

When thinking about migration, be sure to check the PAC Control Command Reference and the OptoMMP Protocol Guide to make sure that the commands and addresses you commonly use will apply to new *groov* EPIC systems. The OptoMMP Protocol Guide lists the controllers each memory map address applies to, and the PAC Control Command Reference lists the controllers and brains that an I/O Unit command applies to. You can see where SNAP and EPIC are similar or different and find possible alternatives.

For example, the digital bank and analog bank areas of the OptoMMP memory map work for SNAP I/O, but not for *groov* I/O. These bank read areas were designed for the original SNAP modules, not for higher density modules. You can't use these areas of the memory map for SNAP high-density digital or analog modules with more than two channels, and you also cannot use them for *groov* I/O. But PAC Control includes commands like Move I/O Unit to Numeric Table Ex and Move Numeric Table Ex to I/O Unit, which apply to both higher density SNAP I/O and to *groov* I/O units, allowing you to do similar things.

As another example, some memory map addresses are for configuring features like IP or WLAN settings and are used by PAC Manager, but PAC Manager does not apply to *groov* EPIC. For EPIC, features like these are configured in *groov* Manage, either from the EPIC's integrated touchscreen or from a browser on a computer.

I/O unit events and reactions

I/O unit events—digital events, alarm events, and serial events—can be configured on SNAP I/O units. You have to be careful when using them to make sure they don't conflict with PAC Control logic, but they are available. Also available on SNAP I/O is a series of reactions you can set for those events, including event messages, email notifications, and streaming.

These events and reactions are not available on *groov* I/O units. If you add new *groov* I/O units to your system, the new units will not offer events and reactions. But events and reactions on SNAP I/O units will continue as configured in PAC Manager or OptoMMP. So if you replace your main SNAP controller with a *groov* EPIC but keep your existing SNAP I/O units, any events and reactions on those units will continue.

Modbus Integration Kit for PAC Control

If you use the slave subroutine from the Modbus Integration Kit for PAC Control ([PAC-INT-MB](#)), you'll need to make some adjustments on the port.

A SNAP PAC controller uses port 502 to communicate with Modbus devices. For security reasons, a *groov* EPIC processor doesn't allow the use of TCP ports below 1024. So you will need to select an unused higher port number instead. For details, see [KB87577 on our website](#). Note that this is necessary only for the PAC Control Modbus Integration Kit slave subroutine. It doesn't affect the built-in Modbus/TCP slave functionality or the integration kit master subroutines.

HMIs: PAC Display and *groov* View

Both PAC Display and *groov* View are software programs for developing and running an HMI (human-machine interface) for your system.

PAC Display is a traditional HMI that runs on a Microsoft Windows computer only. It includes features like alarming, trending, logging, security, and a built-in library of 3,000 industrial automation graphics. The HMI can show any data elements you created when programming your PAC Control strategy, such as I/O points and variables.

***groov* View** is a simpler, browser-based HMI that can run on any mobile device or computer from any manufacturer. To build the HMI, you drag and drop pre-built gadgets onto the screen and then tag them. A library of SVG graphics is also available as a free download. Your HMI can show data elements not only from PAC Control but also from CODESYS, Modbus/TCP devices, other manufacturers' PLCs using Ignition Edge, and Node-RED internet data, as well as from *groov* EPIC processors and I/O, *groov* RIO edge I/O modules, SNAP PAC

controllers, and SNAP I/O units. In *groov* View you can also define events and notify operators via email or text message when they occur.

If you use PAC Display and would like a mobile HMI, note that PAC Display and *groov* View are not compatible. It is not possible to convert a PAC Display project into a *groov* View project. Your best use of *groov* View might be to create a simplified HMI that shows only a few elements that your mobile users require. You'll need to build this *groov* View project independently in a browser.

A note on ports for groov Box users

This note is not directly related to SNAP PACs, but if you've used the *groov* Edge Appliance (*groov* Box) with your SNAP PAC System, be aware that *groov* EPIC listens on port 443 only, not on port 8443.

Comparing system features

Before deciding how you will migrate to *groov* EPIC, check the comparison chart starting below to see the similarities and differences in your current controller versus a *groov* EPIC processor.

We are continually adding new *groov* I/O modules and additional features to the processor, so you may want to subscribe to our blog to find out about changes as they occur. Be sure to update your *groov* EPIC processor and I/O modules with the latest firmware versions for new features and bug fixes.

If you have any questions about migration or features for your specific application, please [contact Opto 22 Pre-Sales engineers](#).

COMPARISON CHART: groov EPIC PROCESSOR AND SNAP PAC CONTROLLERS

Feature	GRV-EPIC-PR1 GRV-EPIC-PR2	SoftPAC (Windows PC required)	SNAP-PAC-S1, SNAP-PAC-S1- FM*	SNAP-PAC-S2	SNAP-PAC-R1, SNAP-PAC-R1- FM*	SNAP-PAC-R2, SNAP-PAC-R2- FM*
Controller format:						
Mounts on chassis/rack with local I/O	X				X	X
Standalone	X		X	X		
Software-based		X				
Software included:						
PAC Project (control programming/HMI)	X	X	X	X	X	X
IEC 61131-3 with CODESYS Development System & Runtime	X					
Node-RED	X					
groov View (mobile HMI)	X					
MQTT communications with Sparkplug or strings payload (configured in groov Manage)	X					
Ignition or Ignition Edge (OPC drivers, MQTT/Sparkplug, other Ignition modules)	X					
Secure Shell access (SSH)	X					
Programming:						
Runs PAC Control strategies	X	X	X	X	X	X

Feature	GRV-EPIC-PR1 GRV-EPIC-PR2	SoftPAC (Windows PC required)	SNAP-PAC-S1, SNAP-PAC-S1- FM*	SNAP-PAC-S2	SNAP-PAC-R1, SNAP-PAC-R1- FM*	SNAP-PAC-R2, SNAP-PAC-R2- FM*
Max charts running at once (+ host task)	64	64	32	32	16	16
Runs IEC 61131-3 programs	X					
C/C++, Java, Python via Secure Shell access	X					
Communication:						
Integral high-resolution color touchscreen	X					
Two independent Ethernet network interfaces	10/100/1000 Mbps	Depends on PC	10/100 Mbps	10/100 Mbps	10/100 Mbps	10/100 Mbps
USB ports	X					
HDMI port	X					
RS-232 serial ports	X ¹		X	X	X	X
RS-485 serial ports	X ¹		X	X		
Node-RED	X					
Bluetooth	X ²					
Protocols:						
TCP/IP, UDP/IP	X	X	X	X	X	X
EtherNet/IP Adapter only			X	X	X	X
EtherNet/IP Adapter or Scanner	X ³					
Modbus/TCP (slave)	X		X	X	X	X
MQTT with strings or Sparkplug for all tags	X					
OPC UA drivers included	X ⁴					
RESTful API	X		X	X	X	X
HTTP/HTTPS	X		X	X	X	X
OptoMMP	X	X	X	X	X	X
SNMP	5		X	X	X	X
FTP server, file system	5		X	X	X	X
FTP client	X	X	X	X	X	X
SMTP (email client)	X	X	X	X	X	X
MQTT/Sparkplug for PAC Control tags	X					
Cybersecurity & networking:						
Two independent network interfaces	X	Depends on PC	X	X	X	X
Standard DHCP IP address assignment	X	X				
Static IP address required			X	X	X	X
WiFi (using approved USB WiFi adapter)	X					
Configurable device firewall	X					
User login required (authentication)	X					
User account management	X					

Feature	GRV-EPIC-PR1 GRV-EPIC-PR2	SoftPAC (Windows PC required)	SNAP-PAC-S1, SNAP-PAC-S1- FM*	SNAP-PAC-S2	SNAP-PAC-R1, SNAP-PAC-R1- FM*	SNAP-PAC-R2, SNAP-PAC-R2- FM*
Data encryption	X					
Security certificate management	X					
Secure VPN creation	X ⁶					
LDAP support	X					
I/O:						
I/O slots on chassis/rack	0-16	0	0	0	4-16	4-16
Analog, discrete, & serial modules	X				X	X
I/O module density	4-24				1-32	1-32
Spring-clamp connectors	X					
Wire sizes accepted	28-14 AWG				22-14 AWG	22-14 AWG
LED: I/O module health	X					
LEDs: Discrete channel status	X				X	X
Compatible I/O units:						
<i>groov</i> I/O	X	X	X	X	X	X
<i>groov</i> RIO edge I/O modules	X	X	X	X	X	X
SNAP PAC R-series	X	X	X	X	X	X
SNAP PAC EB-series	X	X	X	X	X	X
SNAP PAC SB-series			X	X		
Legacy mistic			X	X		
I/O unit features:						
PID logic (maximum 96 PID loops per controller)	X				X	X
I/O unit events & reactions					X	X
UDP streaming of I/O data to host					X	X
Modbus and OptoMMP calculators	X				X	X
Scratch Pad	X	X			X	X
Onboard wiring diagrams	X					
Discrete I/O channel features:						
Channel-to-channel isolation ⁷	X				X	X
Input latching ⁷	X				X	X
On/off status	X				X	X
Watchdog timer	X				X	X
High-speed counting ⁷	X				X	
Quadrature counting ⁷	X				X	
On/off-pulse measurement ⁷	X				X	
Pulse generation ⁷	X				X	X
Frequency/period measurement ⁷	X				X	

Feature	GRV-EPIC-PR1 GRV-EPIC-PR2	SoftPAC (Windows PC required)	SNAP-PAC-S1, SNAP-PAC-S1- FM*	SNAP-PAC-S2	SNAP-PAC-R1, SNAP-PAC-R1- FM*	SNAP-PAC-R2, SNAP-PAC-R2- FM*
TPO ⁷	X				X	X
Digital totalizing ⁷	X				X	X
Analog I/O channel features:						
Thermocouple linearization	X				X	X
Min/max values	X				X	X
Offset & gain	X				X	X
Scaling	X				X	X
Simple moving average	X					
TPO ⁷	X				X	X
Output clamping	X				X	X
Average filter weight	X				X	X
Watchdog timer	X				X	X
Analog totalizing	X				X	X
Ramping (analog outputs)	X				X	X
Specifications:						
Power requirements	7.1 W typical, 9.1 W max	--	8-32 VDC, 10 W to 11.3 W max	8-32 VDC, 10 W to 11.3 W max	5.0 to 5.2 VDC @ 1.2-1.5 A	5.0 to 5.2 VDC @ 1.2-1.5 A
Operating temperature (deg. C)	-20 to 70	--	-20 to 60	-20 to 60	-20 to 60	-20 to 60
Storage temperature (deg. C)	-40 to 85	--	-40 to 85	-40 to 85	-40 to 85	-40 to 85
Humidity (non-condensing)	0-95%	--	0-95%	0-95%	0-95%	0-95%
Approvals	UL/cUL (Cl 1 Div. 2), ATEX (Cat 3, Zone 2), CE, RoHS, DFARS	--	CE, RoHS, DFARS, UL	CE, RoHS, DFARS, UL	CE, RoHS, DFARS, UL	CE, RoHS, DFARS, UL
Warranty	30 months	n/a	30 months	30 months	30 months	30 months
Product Support	Free	Free	Free	Free	Free	Free

1 Requires USB-to-serial adapter

2 Limited to specific Bluetooth adapters and devices

3 Requires CODESYS or Node-RED

4 Requires Ignition or Ignition Edge license

5 Available with custom programming using Secure Shell access (limitations apply)

6 Requires EPIC firmware R1.4.0 or higher

7 Depends on I/O module; see module specifications for features included

* Obsolete Product, contact Opto 22 Pre-Sales engineers for more information.