SNAP PAC REDUNDANCY OPTION KIT

Features

- Standalone arbiter monitors and controls the active and backup status of redundant controllers
- Redundancy power switch controlled by the arbiter enables remote rebooting of the controllers
- No other special equipment is required
- PAC Redundancy Manager provides quick and intuitive configuration and monitoring

DESCRIPTION

The SNAP PAC Redundancy Option Kit, part number SNAP-PAC-ROK, provides you the tools you need to develop a control system with an increased level of reliability that can survive single points of failure and improve your system’s mean time between failures (MTBF). In the unlikely event that a controller were to fail for whatever reason, a second identically configured controller takes over with almost no down time. This adds yet another layer of reliability to Opto 22’s extremely reliable distributed intelligence architecture.

The SNAP PAC Redundancy Option Kit includes a SNAP-PAC-SRA arbiter, a SNAP-RPSW redundant power switch, and the SNAP PAC Redundancy Option User’s Guide, form 1831. The PAC Redundancy Manager is included with PAC Control Professional.

To complete a redundant control system, you will also need the following items from Opto 22:

- Two S-series PACs (identical part numbers)
- One or more Opto 22 SNAP PAC Ethernet brain-based I/O units on the same Ethernet network as the controllers
- PAC Project Professional 9.0 or newer installed on a PC connected to the control network
- A PAC Control Professional strategy that makes use of special redundancy features such as checkpoint blocks and persistent/redundant variables.

Advantages

When implemented in a redundant system, the Redundancy Option Kit provides a number of advantages, some of which are unique to Opto 22:

- Either controller can play the role of the active controller or backup controller. No prior designation is required.
- Either controller can switch its role in the redundancy scheme at any time.
- No special cables are required. Standard Cat 5 cable connects the controllers for synchronization.
- No special redundancy controllers are required, just standard S-series controllers.
- No special software is needed.
- Instead of requiring the entire control program to be synchronized, the developer tags specific data for redundancy and places checkpoint blocks at precise points in the logic where synchronization is to occur. This improves system performance and provides flexibility for the developer.
- The SNAP-RPSW redundancy power switch enables remote rebooting of the controllers for tasks such as resetting the controller and updating firmware.

SNAP-PAC-SRA Arbiter

The SNAP-PAC-SRA arbiter is a standalone processor that connects via dedicated RS-485 links to two identically configured SNAP PAC S-series controllers. The arbiter controls which controller is active and which is backup, based on status information returned by each controller in response to the arbiter’s periodic heartbeat requests. LEDs on the arbiter indicate system health.

Part Numbers

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNAP-PAC-ROK</td>
<td>SNAP PAC Redundancy Option Kit. Includes a redundancy arbitration processor (SNAP-PAC-SRA) and a redundant power switch (SNAP-RPSW).</td>
</tr>
<tr>
<td>SNAP-ROKDIN</td>
<td>DIN-rail Mounting Kit for Arbiter or Redundant Power Switch</td>
</tr>
</tbody>
</table>
The arbiter is responsible for the following things:

- Maintains the active/backup status of each controller
- Manages synchronization of strategy and control data
- Sends heartbeat requests at regular intervals to each controller in order to receive status information
- Qualifies the backup controller, which means that the backup controller is ready to take over as the active controller
- When a controller is disqualified, the arbiter tells the controller to reset itself
- Using its supply-voltage output, the arbiter drives normally closed relays in the SNAP-RPSW, thus controlling the power supply of each controller

SNAP-RPSW Redundant Power Switch

The SNAP-RPSW redundant power switch is a relay device designed especially for use in an SNAP PAC redundant system. Connected to the SNAP-PAC-SRA arbiter and both controllers, this switch responds to the supply-voltage output from the arbiter, which allows it to reliably restart a controller in order to bring the controller back up or re-commission the controller after updating firmware.

PAC Project Software

The SNAP PAC Redundancy Option Kit is designed for use with SNAP PAC S-series programmable automation controllers. The controllers run a control program built with PAC Control™ Professional, one component of PAC Project™ Professional software. PAC Project Professional is available for purchase and includes PAC Control Professional for developing control programs, PAC Display Professional for creating human-machine interfaces (HMI)s, PAC Manager for configuring and maintaining SNAP PAC devices, OptoOPCServer™ for OPC connectivity, and OptoDataLink™ for database communications.

PAC Control Professional also provides the following tools for you to use with the Redundancy Option Kit:

- The PAC Redundancy Manager enables you to configure the arbiter, monitor the devices in a redundant system, install firmware on the arbiter and the controllers, and more. (See picture below.)
- A checkpoint block tool, which you use to insert a checkpoint block in your logic wherever you want synchronization to occur
- The Persistent/Redundant variable option that designates whether a variable is replicated to the backup controller
SPECIFICATIONS

SNAP-PAC-SRA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Requirements</td>
<td>8–32 VDC, 4 W</td>
</tr>
<tr>
<td>Memory</td>
<td>16 MB RAM</td>
</tr>
<tr>
<td>Backup battery for real-time clock</td>
<td>Rechargeable (recharges whenever the arbiter has power). 5-year life when power is off.</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0 to 60 °C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40 to 85 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>0–95% humidity, non-condensing</td>
</tr>
<tr>
<td>Wired Ethernet Network Interface</td>
<td>IEEE 802.3 network, 10Base-T and 100Base-TX. Automatic MDC/MDI-X crossover (Ethernet crossover cable not required for direct connection to PC).</td>
</tr>
<tr>
<td>Maximum Ethernet Segment Length</td>
<td>100 meters with Category 5 or superior UTP</td>
</tr>
<tr>
<td></td>
<td>For 100 Mbps at this distance, use Category 5 or superior solid UTP.</td>
</tr>
<tr>
<td>Serial interfaces (2)</td>
<td>RS-485 twisted pair(s), with shield</td>
</tr>
<tr>
<td>Serial data rates</td>
<td>300 baud to 230.4 Kbaud</td>
</tr>
</tbody>
</table>

SNAP-RPSW

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max switch volts</td>
<td>32 VDC</td>
</tr>
<tr>
<td>Max switch current</td>
<td>4 amps DC at 70 °C</td>
</tr>
<tr>
<td>Operating range</td>
<td>VDC</td>
</tr>
<tr>
<td>Switch control (normally closed):</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>8–32 VDC (3 mA–15 mA)</td>
</tr>
<tr>
<td>On</td>
<td>≤ 2 VDC (&lt; 0.5 mA)</td>
</tr>
</tbody>
</table>
SYSTEM ARCHITECTURE

In the following simplified illustration of the redundancy architecture, two SNAP-PAC-S2 controllers are connected via Ethernet to the same I/O. A SNAP-PAC-SRA arbiter is connected to both controllers with dedicated RS-485 links. An Ethernet crossover cable connected to the ENET2 Ethernet ports enables communication between the controllers. A SNAP-RPSW redundancy power switch connected to the arbiter controls power to the controllers. Separate power supplies for the arbiter and each of the controllers are not shown. For more information on connecting power, see “Power Connections” on page 6.

Ethernet, Serial, and Power Switch Connections
## SNAP-PAC-SRA RS-485 SERIAL CONNECTIONS

### Controller-to-Arbiter Wiring

<table>
<thead>
<tr>
<th>SNAP-PAC-S2 #1</th>
<th>Arbiter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial 1</td>
<td>CTR1</td>
</tr>
<tr>
<td>2 TX/RX–</td>
<td>– TX/RX–</td>
</tr>
<tr>
<td>3 Com</td>
<td>C Com</td>
</tr>
<tr>
<td>1 TX/RX+</td>
<td>+ TX/RX+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SNAP-PAC-S2 #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial 1</td>
</tr>
<tr>
<td>2 TX/RX–</td>
</tr>
<tr>
<td>3 Com</td>
</tr>
<tr>
<td>1 TX/RX+</td>
</tr>
</tbody>
</table>

### CTR1 and CTR2 Pins

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>TX/RX–</td>
</tr>
<tr>
<td>C</td>
<td>Com</td>
</tr>
<tr>
<td>+</td>
<td>TX/RX+</td>
</tr>
<tr>
<td>not used</td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
</tr>
</tbody>
</table>

**CTR1, RS-485 serial connector**

**CTR2, RS-485 serial connector**
POWER CONNECTIONS

The following diagram shows how power is connected from the power supplies to the arbiter and redundancy power switch, and from the power switch to the controllers.

red/white wire (+)

black/white wire (–)
SNAP-PAC-SRA LEDS

Communication Status LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Indicates</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNK</td>
<td>Link established with Ethernet network</td>
</tr>
<tr>
<td>ACT</td>
<td>Ethernet network activity</td>
</tr>
<tr>
<td>TX</td>
<td>Outgoing serial activity</td>
</tr>
<tr>
<td>RX</td>
<td>Incoming serial activity</td>
</tr>
</tbody>
</table>

System Status LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Indicates</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARB</td>
<td>Arbiter status</td>
</tr>
<tr>
<td></td>
<td>Off = arbiter has failed or is not powered; LED2-6 values are undefined</td>
</tr>
<tr>
<td></td>
<td>Red = arbiter has failed</td>
</tr>
<tr>
<td></td>
<td>Orange = arbiter is starting</td>
</tr>
<tr>
<td></td>
<td>Green = arbiter is online</td>
</tr>
<tr>
<td>SYS</td>
<td>Controller redundancy status</td>
</tr>
<tr>
<td></td>
<td>Red = no controller is active</td>
</tr>
<tr>
<td></td>
<td>Orange = one controller is active, with no qualified backup</td>
</tr>
<tr>
<td></td>
<td>Green = one controller is active, with a qualified backup</td>
</tr>
<tr>
<td>CTR1</td>
<td>Primary controller status</td>
</tr>
<tr>
<td></td>
<td>Red = failed</td>
</tr>
<tr>
<td></td>
<td>Orange-blinking = backup qualified impaired or not qualified</td>
</tr>
<tr>
<td></td>
<td>Orange = backup qualified</td>
</tr>
<tr>
<td></td>
<td>Green-blinking = active impaired or becoming active</td>
</tr>
<tr>
<td></td>
<td>Green = active nominal</td>
</tr>
<tr>
<td>CTR2</td>
<td>Secondary Controller Status</td>
</tr>
<tr>
<td></td>
<td>Red = failed</td>
</tr>
<tr>
<td></td>
<td>Orange-blinking = backup qualified impaired or not qualified</td>
</tr>
<tr>
<td></td>
<td>Orange = backup qualified</td>
</tr>
<tr>
<td></td>
<td>Green-blinking = active impaired or becoming active</td>
</tr>
<tr>
<td></td>
<td>Green = active nominal</td>
</tr>
</tbody>
</table>
SNAP-RPSW REDUNDANCY SWITCH CONNECTORS AND LEDS

A green LED indicates a normal “ON” condition.

**Power out**: Normally on. When off, no power goes to the controller.

**Power in**: On as long as power is received from the power supply.

**Turn off**: Normally on. When a 8-32 VDC pulse is received from the arbiter, the SNAP-RPSW switches off power to the power out terminal, which shuts off the controller. A 2 VDC pulse switches power back on.

**NOTE**: The arbiter has its own power supply. If power is lost to the arbiter, power continues to be supplied to both controllers, and the active controller remains in control.
NOTE: The Arbiter and the Redundant Power Switch can be mounted on a panel or a DIN rail. For DIN-rail mounting, purchase one DIN-rail mounting kit (part number SNAP-ROKDIN) for each device. The DIN-rail clip adds an additional 0.375 inches (0.95 cm) to the device’s height.
More about Opto 22

PRODUCTS
Opto 22 develops and manufactures reliable, easy-to-use, open standards-based hardware and software products used worldwide. Industrial automation, process control, building automation, industrial refrigeration, remote monitoring, data acquisition, and Industrial Internet of Things (IIoT) applications all rely on Opto 22.

**groov Edge Appliance**
Visualization, data handling, and connectivity in a compact, industrial box: that's the groov Edge Appliance. Included are:
- groov View for building and viewing operator interfaces on PCs and mobile
- Node-RED for building simple logic flows
- Ignition Edge® from Inductive Automation®, for OPC-UA drivers and MQTT/Sparkplug IIoT communications.

**SNAP PAC System**
Developer- and IIoT-ready, the SNAP PAC System connects physical assets to databases and applications using open standards. The SNAP PAC System consists of four integrated components:
- SNAP PAC controllers
- PAC Project™ Software Suite
- SNAP PAC brains
- SNAP I/O™

**SNAP PAC Controllers**
SNAP PAC programmable automation controllers handle a wide range of digital, analog, and serial functions for data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

For IIoT applications and easier integration with company systems, standalone and rack-mounted SNAP PACs include a built-in HTTP/HTTPS server and RESTful API (application program interface). The REST API gives you secure, direct access to I/O and variable data using your choice of programming languages. No middleware, protocol converters, drivers, or gateways needed.

Based on open Ethernet and Internet Protocol (IP) standards, SNAP PACs make it easier to build or extend a system without the expense and limitations of proprietary networks and protocols.

**PAC Project Software Suite**
Opto 22’s PAC Project Software Suite offers full-featured, cost-effective control programming, HMI (human machine interface), OPC server, and database connectivity software.

Control programming includes both easy-to-learn flowcharts and optional scripting. Commands are in plain English; variables and I/O point names are fully descriptive.

PAC Project Basic offers control and HMI tools and is free for download on our website, www.opto22.com. PAC Project Professional, available for purchase, adds a SoftPAC software-based controller, OptoDataLink, OptoOPCServer, options for controller redundancy or segmented networking, and support for legacy Opto 22 serial mistic™ I/O units.

**SNAP PAC Brains**
While SNAP PAC controllers provide central control and data distribution, SNAP PAC brains provide distributed intelligence for I/O processing and communications. Brains offer analog, digital, and serial functions, including thermocouple linearization, local PID loop control, watchdog, totalizing, and much more.

**SNAP I/O**
I/O provides the local connection to sensors and equipment. Opto 22 SNAP I/O offers 1 to 32 points of reliable I/O per module. Analog, digital, and serial modules are mixed on one mounting rack and controlled by a SNAP PAC brain or rack-mounted PAC.

**QUALITY**
Founded in 1974, Opto 22 has established a worldwide reputation for high-quality products. All are made in the U.S.A. at our manufacturing facility in Temecula, California.

Because we test each product twice before it leaves our factory, rather than only testing a sample of each batch, we can guarantee most solid-state relays and optically isolated I/O modules for life.

**FREE PRODUCT SUPPORT**
Opto 22’s California-based Product Support Group offers free, comprehensive technical support for Opto 22 products from engineers with decades of training and experience. Support is available in English and Spanish by phone or email, Monday–Friday, 7 a.m. to 5 p.m. PST.

Support is always available on our website: how-to videos, user’s guides, OptoKnowledgeBase, self-training guide, troubleshooting, and OptoForums. In addition, hands-on training is available for free at our Temecula, California headquarters, and you can register online.

**PURCHASING OPTO 22 PRODUCTS**
Opto 22 products are sold directly and through a worldwide network of distributors, partners, and system integrators. For more information, contact Opto 22 headquarters at 800-321-6786 (toll-free in the U.S. and Canada) or 951-695-3000, or visit our website at www.opto22.com.