



---

**NovaTech**  
**Orion I/O™**

---

# NovaTech Orion I/O Overview

NovaTech Orion I/O™ is an extension of the family of OrionLX™ Automation Platforms for substation automation and incorporates the same security features, software tools and “NCD” configuration as the OrionLX. It is a rack-mountable I/O assembly with four slots—A, B, C, and D—that can be filled with any combination of I/O cards: currently 16-Point Discrete Input Card, 16-Point Discrete Output Card, and 8-Point Analog Input Card. Full population of discrete cards yields 64 I/O in 2 RU (rack units); full population of analog input cards yields 32 analog inputs. See Figure 1 below for rear connections on Orion I/O.

This page is intentionally left blank.



Figure 1 – Rear connections on Orion I/O. Four I/O cards shown populated in slots A, B, C, and D.

Input and output status, point state, time diagnostics, and other module data are provided on an Advanced User Interface of a similar design to the Bitronics® 50 Series and 60 Series metering products. A standard, conventional faceplate is also available.

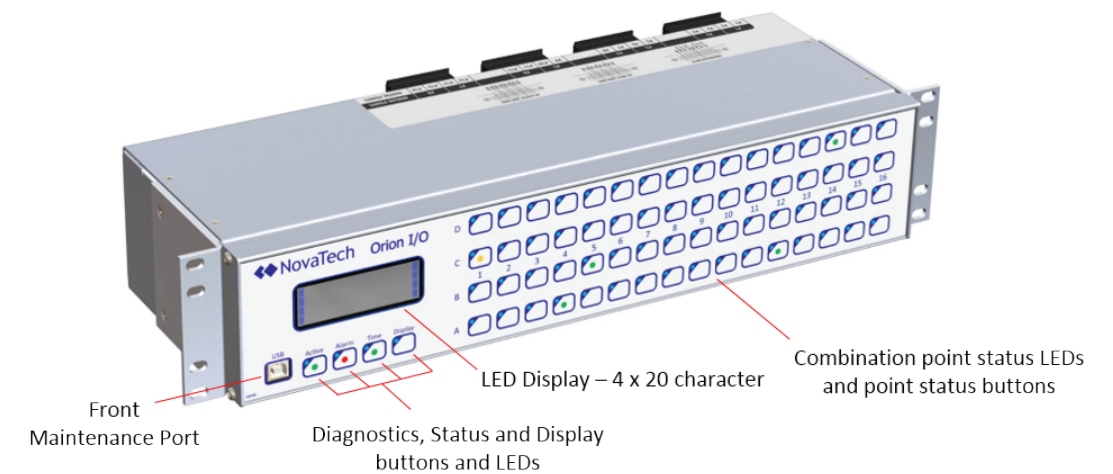


Figure 2 – Advanced User Interface

**Application**

Orion I/O is designed for high performance 12V dc to 125V dc monitoring and control applications in electrical substations including 1ms SOE Recording, circuit breaker TRIP/CLOSE, higher-speed control, and analog transducer monitoring and measurement. Although Orion I/O can stand-alone and operate as an independent RTU, it is usually connected serially or with Ethernet to an OrionLX™ or other substation RTU.

The 16-Point Discrete Input Card in Orion I/O monitors the position, status, or health of substation apparatus such as circuit breakers, reclosers, transformers, tap changers, and capacitor banks. The 16-Point Discrete Output Card energizes TRIP and CLOSE coils in circuit breakers and reclosers, or switches other loads. The 8-Point Analog Input Card monitors and measures transducers signals representing amps, volts, watts, vars, frequency, etc.

**Environmental Immunity**

Operating Temperature:	-40°C to 70°C
Operating Humidity:	5% to 95% non-condensing
Fast transient:	C37.90.1 (2002)
RFI:	C37.90.2 (1995)

**Dimensions and Physical Mounting**

Orion I/O is provided in a two RU (rack unit) aluminum case 19.00" wide x 3.50" high (2 RU) x 7.00" deep. Other dimensions shown below in Figure 3.

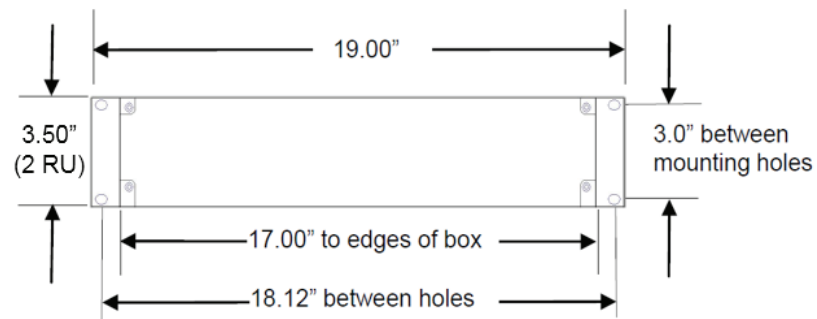


Figure 3 - Orion I/O exterior dimensions

Orion I/O mounts in a 19" rack, or through a rectangular hole in a panel. The aluminum mounting ears can also be repositioned for mounting on any vertical or horizontal flat surface as shown in Figure 4 below:

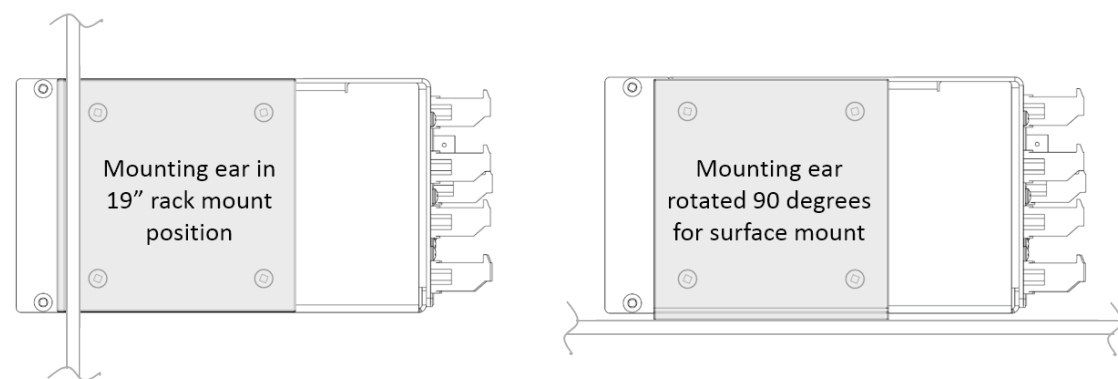


Figure 4 - Mounting ear

**Power Supply**

Two available supplies:

- 48V dc - 250V dc nominal, also 69V ac - 240V ac, 50/60Hz
- 12V dc - 24V dc nominal, no AC (Phase 2)

Note: Designed for operation within +/-20% of nominal

Two additional power connectors are available to power downstream Orion I/O modules as shown in Figure 5 below:

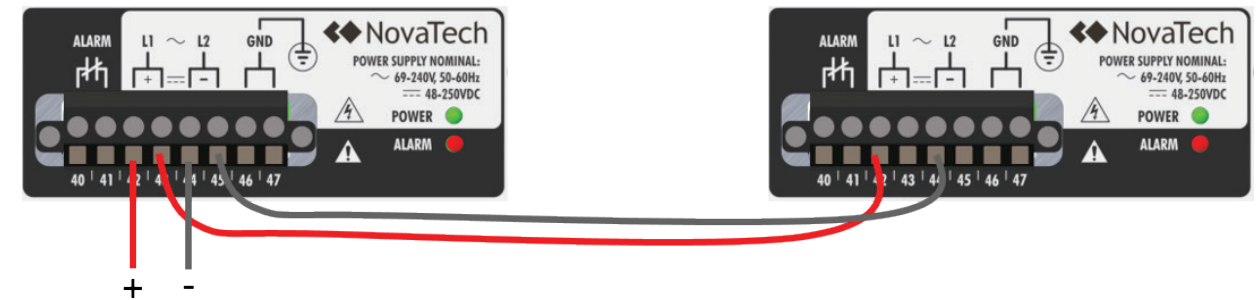


Figure 5 - DC power wiring option for multiple Orion I/O modules

**Ethernet Ports, Serial Ports, and IRIG-B**

Orion I/O provides two copper Ethernet ports (separate NICs). In Phase 2, two LC fiber ports with separate NICs will be optional, as will be copper and LC fiber switch options (one NIC, two ports). A PRP/HSR redundancy option will also be available.

Orion I/O is also available with one RS-232/485 serial port. Webpage software provides selections for full or half duplex, and termination resistor. IRIG-B can be received from an OrionLX RTU on RS-485 terminals. A second serial ST fiber port will be available in Phase 2.

Screw terminals are provided to accept unmodulated IRIG-B. Precision Time Protocol (PTP) will be available in Phase 2.

Figure 6 below shows Ethernet ports, serial port terminal, and IRIG-B terminals.

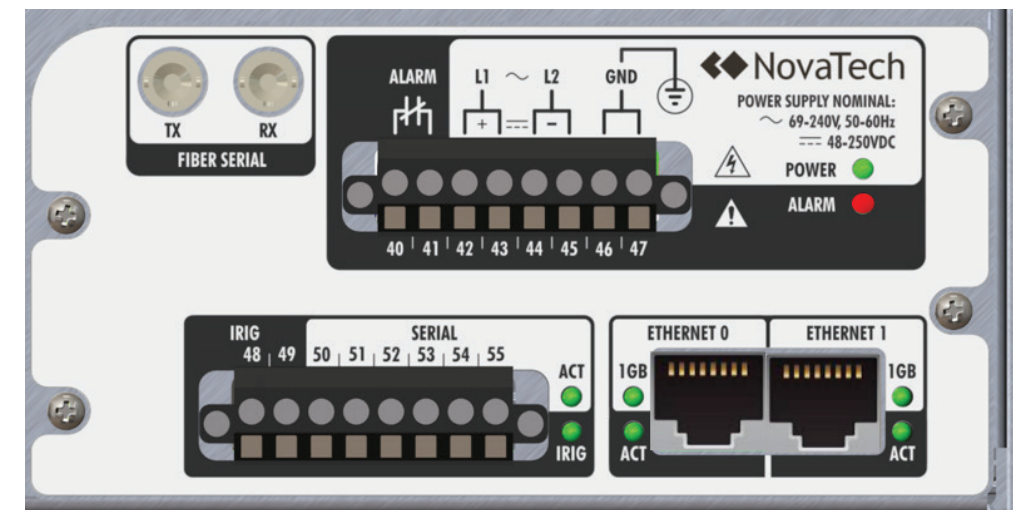


Figure 6 - Communication ports, IRIG-B terminals, power terminals, and alarm terminals

### 16-Point Discrete Input Card

- 16 electrically isolated circuits
- High speed; suitable for 1ms SOE recording
- I/O Terminals to Case: 2000V ac, 1min
- I/O Channel to Channel: 2000V ac, 1min
- ON-state, De-bounce, and Chattering Contact filters
- Single design accommodates either higher voltage range (“HV”) or lower voltage range (“LV”)
- HV: nominal 125V dc. Maximum 145V dc, always OFF at 75V dc
- LV: nominal 12V dc to 48V dc. Maximum 60V dc, OFF at 9V dc
- HV or LV range selection for card through webpage selection.

Circuit diagram for isolated and bussed wiring below in Figures 7 and 8 below:

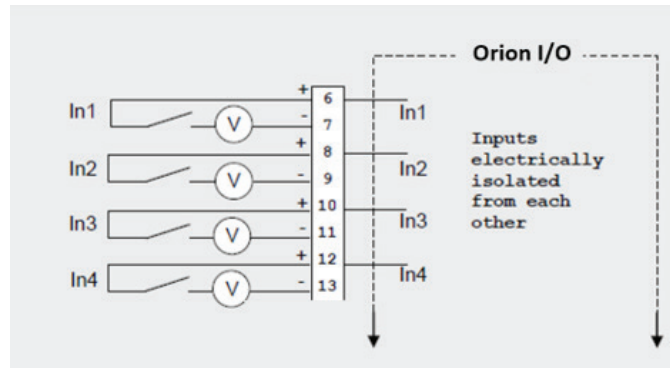


Figure 7 - Independent/isolated wiring

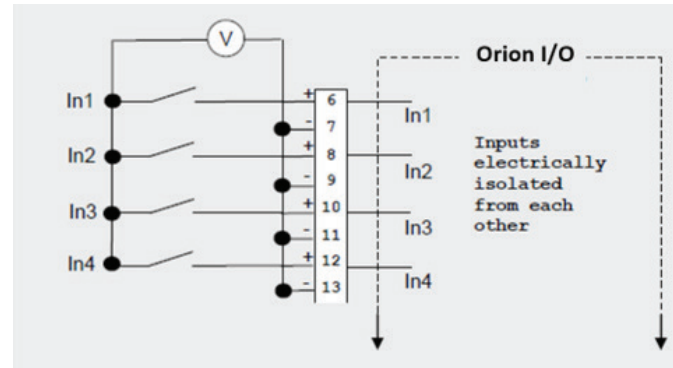


Figure 8 - Bussed wiring for common wetting voltage

### 16-Point Discrete Output Card

- 16 electrically isolated normally open (NO) or normally closed (NC) outputs. Card ordered as NO or NC.
- Tripping duty, substation-grade relay outputs
  - › Resistive: 30A
  - › Continuous Carry: 5A
  - › Break Inductive @ 48V dc: 700mA
  - › Break Inductive @ 125V dc: 200mA
- Option for breaking high-current, high-inductive loads in Phase 2
- Design accommodates “Dual Path” control for improved security

Circuit diagram below in Figure 9:

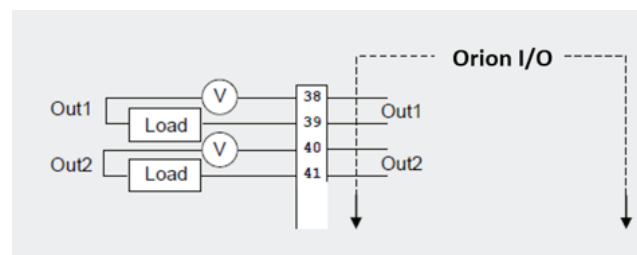


Figure 9 - Output wiring

### 8-Point Analog Input Card

- Eight isolated transducer input circuits
- Three ranges available; per channel
  - › -2mA to +2mA
  - › -10V to +10V
  - › +4mA to +20mA

Wiring as shown in Figure 10 below:

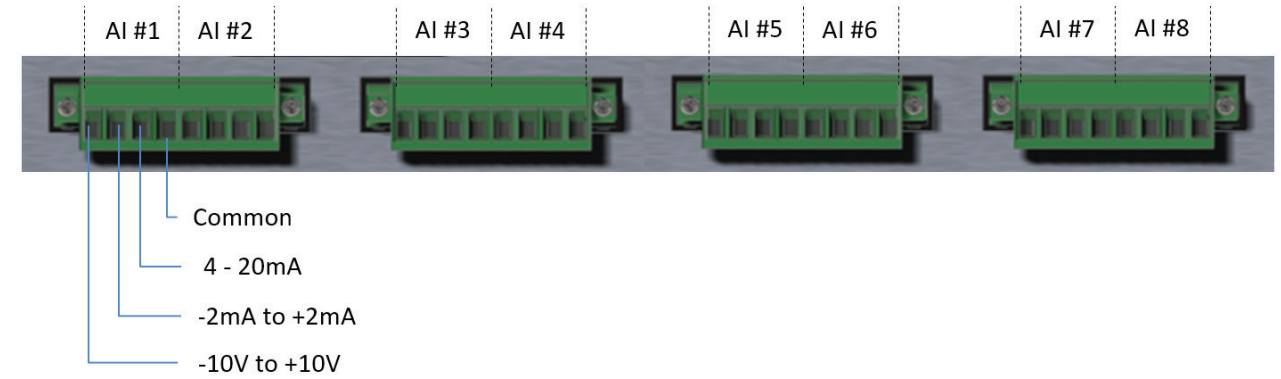


Figure 10 - Analog input wiring

### Points Numbering and Labeling

All wiring terminals are numbered, plus points are numbered for both 16-point Cards and 8-point cards.

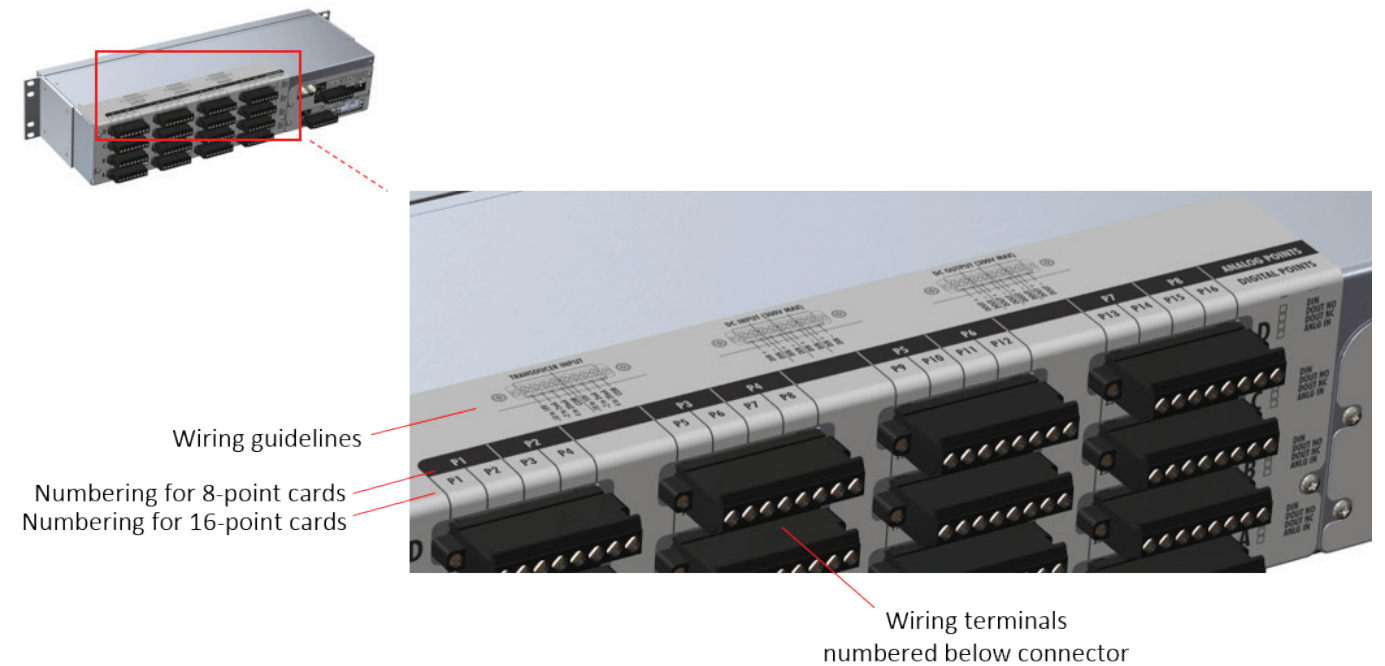


Figure 11 - Label with point and terminal numbers



**Advanced User Interface**

This optional front panel provides the following at the touch of a button:

- Point name (default assigned point name or Alias name)
- Discrete point state (e.g. “Open”, “ON”, etc) and the time point last changed
- The I/O cards in slots A, B, C and D in Orion I/O module
- The name of the Active NCD file and firmware version
- User-defined message
- Time diagnostics

The Advanced User Interface uses similar touch-sensitive buttons as the Bitronics 50 series and 60 Series meters.

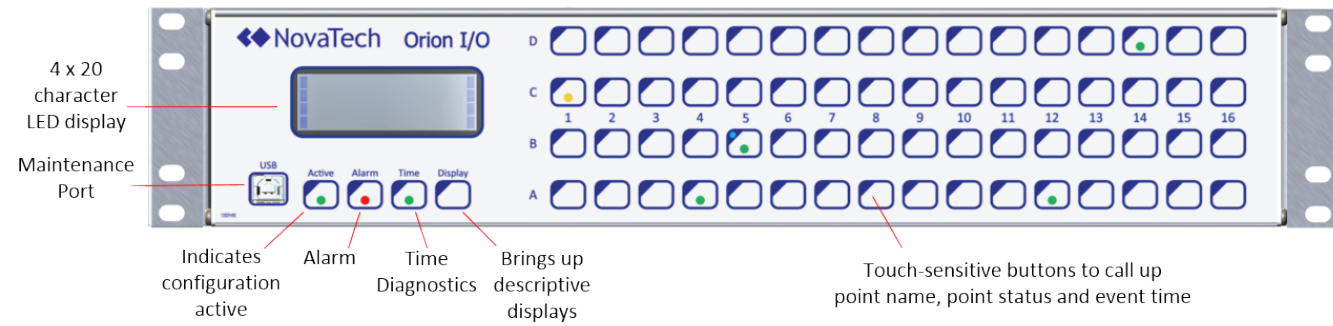


Figure 12 – Advanced User Interface

```
SULLIVAN SUBSTATION
MODULE 27
```

User-defined message

```
CARD D: 8 AI
CARD C: 16 DO
CARD B: 16 DI
CARD A: 16 DI
```

I/O cards in slots A, B, C, and D

```
Sullivan_Sub_IO17.nc
d
SERIAL #00231
FIRMWARE 9.1
```

Active NCD file, serial number, and firmware

```
BRKR_237@ORION_IO
10-27 13:09:23.412
OPEN
```

Point data, including point name, point status, and event time

```
MaxErr -2147483648
EstErr -2147483648
Quality 16
Reachability 242
```

Time diagnostics

Figure 13 – Available status and diagnostic displays on the Advanced User Interface

**Standard Faceplate**

This faceplate provides basic indication of point status, time accuracy, LED test, and OrionLX operating conditions as shown in Figure 14 below.

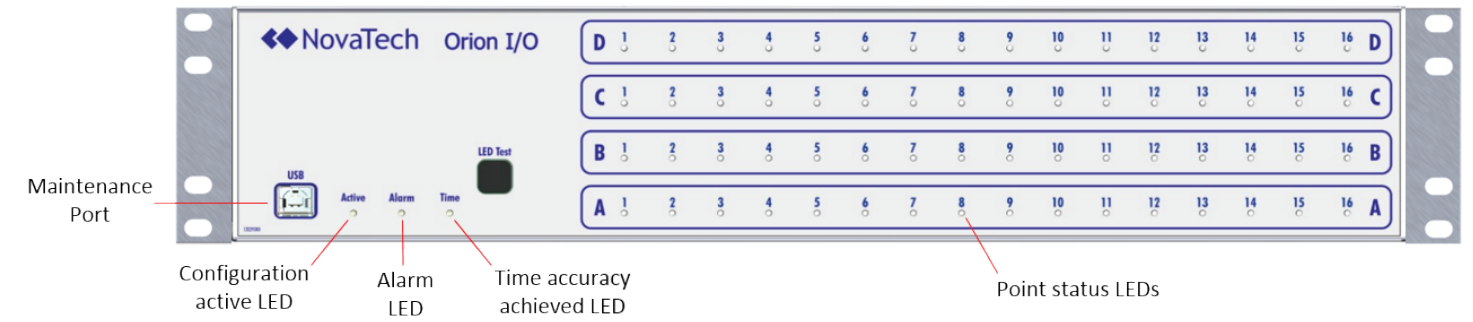


Figure 14 – Standard Faceplate

**Security**

Orion I/O offers the same suite of security features as the OrionLX, including:

- Linux operating system
- Trusted Platform using Secure Boot for Whitelisting
- Secure protocols: HTTPS, SSH, SFTP
- Strong passwords and password rules
- Remote Authentication with LDAP
- User Groups with specific administer-assigned privileges
- Built-in Firewall
- Automatic backup of complete Orion I/O configurations
- Security event logging with “Syslog”

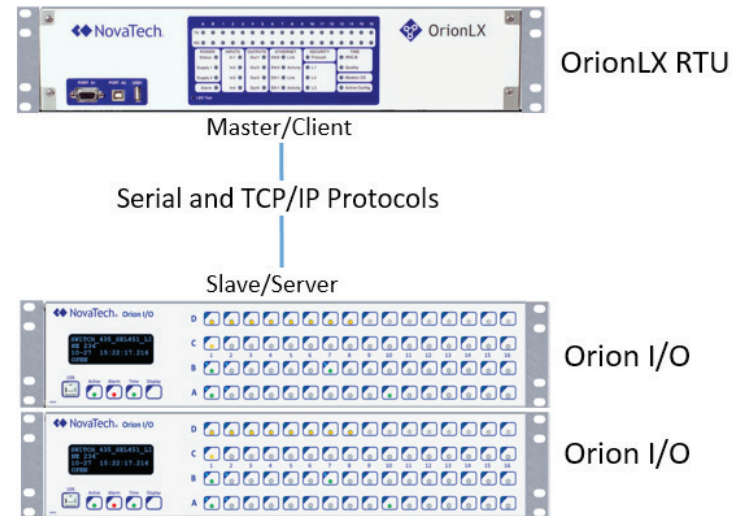
Security Monitoring Points indicating who is connected (by username) and how they are connected (HTTPS, Front Port, SSH, etc.). These points can be mapped to SCADA or to an alarm log.

**Conformal Coating Option**

A high dielectric (560 volts/mil) silicon-based coating is available for Orion I/O. Coatings are inspected to meet IPC-A-610.

**SCADA and RTU Protocols**

Part #	Slave or Server Protocol
42	DNP3 Serial Slave
44	DNP3 IP Server
46	L&G 8979 Serial Slave
47	Modbus Serial Slave
49	Modbus TCP/IP Server
67	IEC 60870-5-101 Serial Slave
68	IEC 60870-5-104 TCP Server
70	SPS Serial Slave
71	SES-92 Serial Slave



**Math and Logic Options**

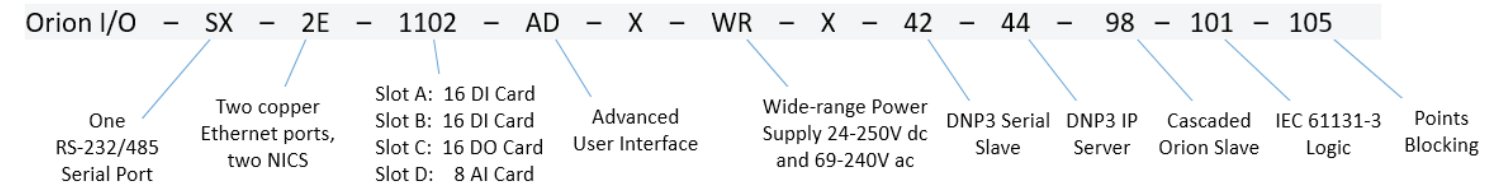
Part #	Opt. Software Modules	Description
35	LogicPak	LogicPak provides pre-configured logic functions for commonly-used routines: AND, OR, Negate, Primary/Secondary, Local/Remote, Delay and KYZ.
99	Advanced Math & Logic (.lua)	Performs all functions in the original Orion Math & Logic plus includes advanced functions such as poll modification, string manipulation, arrays, File I/O (open text file, extract data or make changes, close and re-save). This package is based on the Lua programming language and executes much faster and uses less CPU processing than the standard Math & Logic Module.
101	IEC 61131-3 Math and Logic	Includes: LD-Ladder Diagram, FBD-Function Block Diagram, ST-Structured Text, IL-Instruction List and SFC-Sequential Function Chart

**Software Options**

Part #	Opt. Software Modules	Description
57	WEBserver XML	Includes XML protocol to transfer data into custom webpages to be served out from Orion I/O. Also include two Inkscape plug-ins to simplify page animation and to simplify graphics creation with Pre-Drawn Libraries.
60	Accumulator Freeze	Enables Orion I/O to process freeze commands from the master, or to auto-generate freeze commands. Includes logging and reset functions.
95	Alarm / Archive / Retentive (AAR)	Stores both discrete and analog events based on time (e.g. every 15 minutes) or change (e.g. ON-OFF or analog change out of deadband). Alarm Annunciation functionality includes defining alarm states, defining alarm messages. Pre-engineered "Archive" and "Alarm" webpages included.
98	Cascaded Orion Slave	Simplifies the integration of multiple Orion I/O modules and the OrionLX RTU appear as a single system. This s/w module is for the Orion I/O (up to 10). The "Cascaded OrionLX Master" s/w module is for the OrionLX RTU.
105	Points Blocking	Enables Orion I/O points or groups of points to be manually "blocked" from reporting state changes to the RTU. Useful during commissioning and maintenance.
106	Configuration Backup Manager	Software module for Orion I/O that accesses settings and other configuration data, places these data in a file and saves them to the Orion I/O memory. Saved files can be manually accessed, or automatically transferred to a FTP server.
108	Tile Annunciator	Pre-engineered, multiple page, animated alarm tile webpage served out from Orion I/O

**Orion I/O Model Number**

**Orion I/O Model Number Example:**



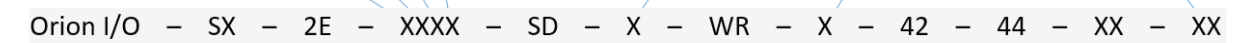
Slot A I/O Card	Slot B I/O Card	Slot C I/O Card	Slot D I/O Card	I/O Card Slot Description
				Combination Card, High-Interrupt Output Card, NC points and Wetted Input Card in later phases.
2	2	2	2	8 AI Card
1	1	1	1	16 DI Card; input range set HV or LV in software (HV=125V dc, LV=12-48V dc)
0	0	0	0	16 DO Card
X	X	X	X	No I/O cards standard

Note: Any I/O Card can be ordered in any slot

Time Synchronization	Description
	Optional IEEE 1588 PTP in later phase

Conformal Coating	Description
	Optional coating for all boards in later phase

Software Options	Description
35	LogicPak
57	WEBserver XML
60	Accumulator Freeze
95	Alarm and Archive (AAR)
98	Cascaded Orions Slave
99	Advanced Math & Logic
101	IEC 61131-3
103	61850 Server and GOOSE
105	Points Blocking
106	Config. Backup Mgr.
108	Tile Annunciator



Serial Port Selections	Description
SX	Standard one serial RS-232/485 port only
	Optional two serial ports: RS-232/485 port and ST fiber port in later phase

Ethernet Port Selections	Description
2E	standard two copper ports, two NICs
	Fiber ports, built-in switch and redundancy options in later phases

Front Panel User Interface	Description
SD	Standard Faceplate
AD	Optional Advanced User Interface

Power Supply	Description
WR	Standard 24-250V dc and 69-240V ac
	Optional 12-24V dc supply in later phase

Serial Slave Protocol	Description
42	Standard serial DNP3 Slave
67	Alternative standard serial IEC 60870-5-101 Slave

TCP/IP Server Protocol	Description
44	Standard DNP3 IP Server
68	Alternative standard IEC 60870-5-104 TCP Server

Other Serial and TCP Protocols	Description
46	L&G Serial Slave
47	Modbus Serial Slave
49	Modbus TCP/IP Server
67	IEC 60870-5-101 Serial Slave
68	IEC 60870-5-104 TCP/IP Server
70	SPS Serial Slave
71	SES-92 Serial Slave
103	IEC 61850 Server



---

**[novatechweb.com](http://novatechweb.com)**

---

Copyright © 2017 NovaTech, LLC. All rights reserved.  
All brand and product names mentioned in this document  
are trademarks of their respective owners. NovaTech and  
Bitronics are registered trademarks of NovaTech, LLC.  
Orion I/O and OrionLX are trademarks of NovaTech, LLC.  
The information in this literature is subject to change  
without notice and is not to be construed as a warranty.  
AN\_OrionIO\_042417