



The OrionLX can now be ordered with the five IEC 61131-3 programming languages.

### Background on IEC 61131-3

IEC 61131-3 is the international standard for programmable logic controller (PLC) programming languages and specifies the syntax, semantics and display for five languages:

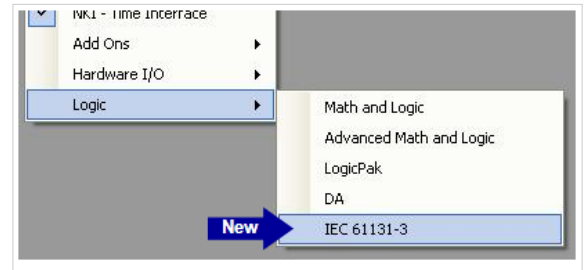
- **Ladder Diagram (LD):** The traditional PLC “Ladder Logic” with contacts, coils, timers, counters, etc; often used in discrete interlocking.
- **Function Block Diagram (FBD):** Uses “functions” between input variables and output variables. These functions are sets of elementary building blocks, selected from a standard library, or user-defined. Blocks are connected to other blocks by connection lines to create logic.
- **Structured Text (ST):** A text-based high level language that syntactically resembles Pascal. Complex statements and nested instructions are supported:
  - Iteration loops (REPEAT-UNTIL; WHILE-DO)
  - Conditional execution (IF-THEN-ELSE; CASE)
  - Functions (SQRT(), SIN())
- **Instruction List (IL):** An efficient, text-based, low level language that resembles assembly.
- **Sequential Function Chart (SFC):** A language to model complex program such as DA scenarios with second contingencies, load-checking and multiple alternate sources. The SFC program is made up of sections of logic developed in the languages above (“Steps”), connected to other Steps by conditions which must be fulfilled before proceeding (“Transitions”). Steps can be processed sequentially and in parallel.

Multiple language support in IEC 61131-3 enables the control program developer to select the language that is best suited to a particular task. For example, an application with discrete interlocking may be best addressed with Ladder Diagram, while algorithms may be best addressed with Structured Text. Different languages can be combined in a OrionLX control scheme, enabling operators to view what is important to them – e.g. the state of contacts in an interlocking scheme – without having to also see formulas and data transfer instructions which may be confusing.

### Typical Applications for OrionLX with IEC 61131-3

In most applications, the OrionLX contains both real-time and non-operational data from nearly all devices in the substation, making it ideal as a computational engine for multi-zone monitoring and control, including:

- Tie breaker control
- Load shed schemes



*IEC 61131-3 is now available in the OrionLX along with the other four Math & Logic Tools*

- Load reduction schemes with regulators
- Distribution Automation
- Force relay settings changes, disable reclose or ground
- Circulating VAR minimization in paralleled transformer TCUL schemes
- Larger machine control and monitoring; cap banks, phase shifting transformers, synchronous condensers

### Full Integration with NCD

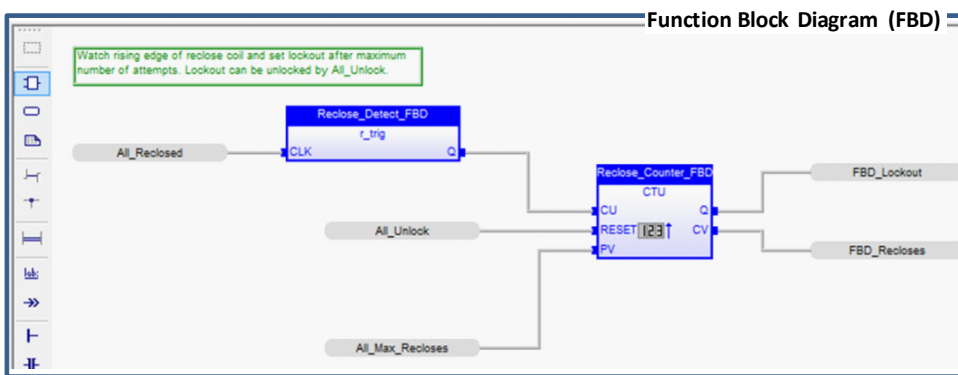
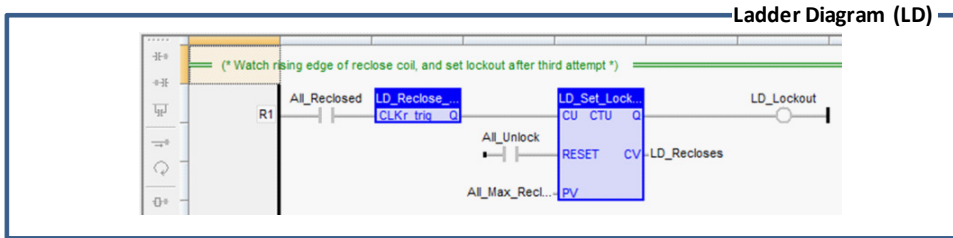
Orion IEC 61131-3 is fully integrated in the Orion NCD (NovaTech Communications Director) configuration software. All points and records accessed from IEDs by Orion (SCADA data, fault data from SEL® Short Event Summaries, etc) or points generated internally (diagnostic data, comms data, etc) are available for use in OrionLX IEC 61131-3 math and logic schemes. As with all NCD configuration, no typing is required when inserting data points into IEC 61131-3 logic schemes. The four other OrionLX math and logic tools, Math and Logic (#83), Advanced Math and Logic (#99), LogicPak (#35) and DA Logic (#82) can co-exist with Orion IEC 61131-3.

### Offline Simulation and Secure Online Viewing of Logic Execution

OrionLX IEC 61131-3 includes an offline simulator to view logic execution *exactly* as it will appear when running online in the OrionLX. In the three IEC 61131-3 graphical editors; Ladder Diagram, Function Block Diagram and Sequential Function Chart, users can pinpoint which portions of the code are not executing by viewing the actual logic flow. Force functions, step and sweep functions, variable watch windows, call stacks, and other tools further enhance debugging. Online viewing of logic, and transfer of logic configurations, is accomplished through secure, password-based authentication, firewall and encrypted protocols.



Examples of logic developed in three OrionLX IEC 61131-3 languages appear below. The lockout scheme depicted here is similar in all three.



**Structured Text (ST)**

```

// detect the rising edge of the Reclose point
ST_Reclose_Detect (All_Reclosed);
ST_tmp := ST_Reclose_Detect.Q;

//increase reclose counter
IF ST_tmp = TRUE THEN
  ST_Recloses := ST_Recloses + 1;
END_IF;

//set lockout
IF ST_Recloses >= All_Max_Recloses THEN
  ST_Lockout := TRUE;
END_IF;

//clear lockout
IF All_Unlock = TRUE THEN
  ST_Recloses := 0;
  ST_Lockout := FALSE;
END_IF;

//access all global reclose counters and add them up on rising edge of LD_Lockout
ST_rising_edge (LD_Lockout);
ST_tmp2 := ST_rising_edge.Q;
IF ST_tmp2 = TRUE THEN
  Total := ST_Recloses + FBD_Recloses + LD_Recloses;
END_IF;

```

### Ordering Information

OrionLX IEC 61131-3 (order code #101) can be ordered on any OrionLX of Firmware Release 7.0 or later, using NCD3 version 3.21 or later.

### Contact:

NovaTech, LLC  
Orion Utility Automation  
13555 West 107th Street  
Lenexa, KS 66215

T: 913.451.1880  
F: 913.451.2845  
E: [orion@novatechweb.com](mailto:orion@novatechweb.com)  
[www.novatechweb.com](http://www.novatechweb.com)