CLAIMS

1. A system comprising:

a programmable logic control (PLC) module;

an input/output (IO) network bus coupled to the PLC module and provided at a plurality of facets of a mainframe;

a plurality of network connectors coupled to the I/O network bus and located at the plurality of facets;

a first process chamber attached to a first facet of the plurality of facets;

a chamber interface IO sub-module attached to the first facet and coupled to a first network connector of the IO network bus and to a process chamber IO controller of the first process chamber, wherein the chamber interface IO sub-module is to:

convert interlock relay signals, received via dry contact exchange with the process chamber IO controller, to digital signals;

combine the digital signals into network packets adapted for communication using a protocol of the IO network bus; and

transmit the network packets to the PLC module over the IO network bus.

2. The system of claim 1, wherein the PLC module includes a first interlock bus port, further comprising:

a second PLC module of a second mainframe, the second PLC module comprising a second interlock bus port, and wherein the PLC module and the second PLC module are safety PLC modules; and

an interlock connector to couple the first interlock bus port to the second interlock bus port over an interlock bus.

3. The system of claim 1, wherein the IO network bus is a single Ethernet cable to which is attached a plurality of network bus T-connectors, at least one of which is located at each of the plurality of facets.

4. The system of claim 1, further comprising at least one of:

a load lock IO controller coupled to the PLC module over a first local IO bus;

a transfer chamber IO controller coupled to the PLC module over one of the first local IO bus or a second local IO bus; or

a pump IO coupled to the PLC module over one of the first, the second, or a third local IO bus.

5. The system of claim 1, wherein the IO network bus comprises:

a second plurality of network connectors, the system further comprising a sub-module IO controller attached to one of the second plurality of network connectors, the sub-module IO controller to control one of a load lock heater, an integrated mass flow system, a point-of-use pump, a via slit valve, or a remote control switch.

6. The system of claim 1, further comprising:

a clean dry air (CDA) supply ring positioned around a perimeter of the mainframe and comprising a plurality of CDA quick disconnects located at the plurality of facets; and

a first slit valve assembly coupled to the first facet, the first slit valve assembly comprising:

a chamber slit valve comprising a position sensor; and

an electro-valve (EV) manifold coupled to a CDA quick disconnect of the CDA supply ring and to the chamber slit valve; and

wherein the chamber interface IO sub-module is coupled to the EV manifold and the chamber slit valve, the chamber interface IO sub-module further to relay a position value of the chamber slit valve from the position sensor to the PLC module over the IO network bus.

7. The system of claim 6, wherein the EV manifold comprises one or more EV, and wherein the chamber interface IO sub-module is further to relay a control signal, received over the IO network bus from the PLC module, to the EV manifold to control slit valve pneumatics by driving the one or more EV.

8. The system of claim 6, further comprising additional slit valve assemblies coupled to additional facets, of the plurality of facets, at which additional process chambers are attached to the mainframe.

9. The system of claim 6, wherein the first slit valve assembly further comprises a CDA poly line connected to the EV manifold, wherein the CDA quick disconnect connects the CDA poly line to the CDA supply ring.

10. The system of claim 6, wherein the IO network bus comprises a network connector at the first facet, and wherein the first slit valve assembly further comprises a network drop cable attached to the chamber interface IO sub-module, wherein the network connector connects the network drop cable to the IO network bus.

11. A slit valve assembly comprising:

a chamber slit valve comprising a position sensor;

an electro-valve (EV) manifold comprising an EV coupled to the chamber slit valve;

a clean dry air (CDA) poly line coupled to the EV manifold and to be coupled to a CDA supply ring of a mainframe; and

a chamber interface input/output (IO) sub-module coupled to the position sensor, the EV manifold, and to be coupled to an IO network bus of the mainframe, the chamber interface IO sub-module to:

relay a position value of the chamber slit valve from the position sensor, over the IO network bus, to a programmable logic control (PLC) module of the mainframe; and

relay a control signal, received over the IO network bus from the PLC module, to the EV manifold to control slit valve pneumatics by driving the EV.

12. The slit valve assembly of claim 11, wherein the chamber interface IO sub-module comprises an interlock cable connector that is to be coupled to a process chamber IO controller comprising a plurality of interlock relays, the chamber interface IO sub-module further to:

convert interlock relay signals, received via dry contact exchange with the process chamber IO controller, to digital signals;

combine the digital signals into network packets adapted for communication using a protocol of the IO network bus; and

transmit the network packets to the PLC module over the IO network bus.

13. The slit valve assembly of claim 11, wherein the chamber interface IO sub-module further comprises an interface connector that is to receive an emergency off (EMO) cable, which is coupled to an EMO switch of a process chamber, wherein the chamber interface IO sub-module is further to:

convert an EMO signal, received via dry contact exchange with the EMO switch, to a digital EMO signal;

convert the digital EMO signal into a network packet adapted for communication using a protocol of the IO network bus; and

send the network packet to the PLC module.

14. The slit valve assembly of claim 11, further comprising a control cable coupled between the position sensor and the chamber interface IO sub-module.

15. The slit valve assembly of claim 11, further comprising a network drop cable coupled between the chamber interface IO sub-module and the IO network bus.

16. The slit valve assembly of claim 11, further comprising a service slit valve coupled to the EV manifold and comprising a second position sensor, the second position sensor coupled to the chamber interface IO sub-module, wherein the EV manifold is a four-position EV manifold to control both the chamber slit valve and the service slit valve.

17. A system comprising:

a first safety programmable logic control (PLC) module comprising multiple local input/output (IO) ports and a first interlock bus port;

a first single local IO bus coupled to a first local IO port of the multiple local IO ports;

multiple IO sub-modules coupled to the first single local IO bus, wherein each IO sub-module of the multiple IO sub-modules is to perform an interlock handshake with the first safety PLC module over the first single local IO bus;

a second safety PLC module comprising multiple local IO ports and a second interlock bus port; and

an interlock connector to couple the first interlock bus port to the second interlock bus port over an interlock bus.

18. The system of claim 17, wherein the multiple IO sub-modules comprise a first set of IO sub-modules of a first machine, the system further comprising:

a second single local IO bus coupled to a second local IO port of multiple local IO ports of the second safety PLC module; and

a second set of IO sub-modules, of a second machine, coupled to the second single IO bus.

19. The system of claim 18, further comprising:

a first PLC controller of the first safety PLC module to control IO devices via the first set of IO sub-modules over the first single local IO bus and control IO device via the second set of IO sub-modules over the interlock bus and the second single local IO bus; and

a second PLC controller of the second safety PLC module to control IO devices via the second set of IO sub-modules over the second single local IO bus and control IO devices via the first set of IO sub-modules over the interlock bus and the first single local IO bus.

20. The system of claim 18,

wherein the first safety PLC module comprises:

a first Ethernet for Control Automation Technology (EtherCAT)-in port coupled to an EtherCAT master device over a first EtherCAT network cable; and

a first EtherCAT-out port;

wherein the second safety PLC module comprises a second EtherCAT-in port coupled to the first EtherCAT-out port over a second EtherCAT network cable; and

further comprising a PLC controller of the second safety PLC module to send a safety control signal to one of the first set of IO sub-modules of the first machine over the second EtherCAT network cable.