This section specifies Communication and Control for View® Smart Windows in CSI format for use by design professionals in Project Manuals. Edit by deletion based on your project requirements. Please call 408-263-9200 or visit www.view.com for more information.

SECTION 27 10 00 ‒ INSTRUMENTATION AND CONTROL FOR SMART WINDOWS

1. GENERAL
	* + 1. SUMMARY
				1. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
				2. Section Includes: Instrumentation and Control for Manufacturer’s Smart Window system. Work by the low voltage electrical subcontractor includes, but is not limited to, installation of the Smart Window system’s wiring and controls.
				3. Related Requirements:

Section 08 80 00 – Smart Glazing

Section 25 13 00 - Integrated Control Network for Smart Windows

Section 26 09 00 – Power for Instrumentation for Smart Windows

Division 26 - Electrical

* + - 1. DEFINITIONS
				1. Refer to other divisions for industry standard glass and glazing definitions. The following apply to this section:

IGU: Insulated Glass Unit

IGU Smart Window Connector: Wire extruding from each Insulated Glass Unit.

Quad Network Window Controller: Control module for Smart Window System that

Sends and receives electrical and data signals for up to four windows

Is connected directly to trunk line and responsible for facilitating power delivery to connected IGU(s)

Delivers power over ethernet (PoE) to connected devices

IGU Cable: Wire that connects one IGU Smart Window Connector to one of the ports on a Quad Network Window Controller.

Sky Sensor: Photo and infrared sensor that detects light levels and cloud cover.

Controls Integrated in Shop: For shop glazed units.

Cables that are integrated into the framing system by the glazier.

Controls Integrated in Field: For field glazed units.

Cables that are integrated into the framing system or building envelope by the Electrical Contractor.

REST API: REST (Representational State Transfer) APIs (Application Programming Interfaces) are commonly used communication protocols between different software systems on the internet

Power over Ethernet (PoE): Cable or ports that pass electric power over twisted-pair Ethernet cable to powered devices, in addition to data.

* + - 1. SYSTEM DESCRIPTION
				1. Basic instrumentation and controls system: Smart Window insulated glass units shall be operated by the manufacturer’s Smart Window control system.

Smart Window control system must be based on a computer model that represents the entirety of the building, its surroundings, and its location in 3D as a digital twin, to optimize user comfort while accounting for solar position and occupant locations.

System glare control shall primarily be done via calculations of sun angle, time of the day and year, window location, occupant seating, and penetration depth using prediction methodologies

The system shall use a single Sky Sensor per building, located on the roof. The Sky Sensor shall be used for exception-based control only, modifying the base schedule in response to real-time weather and lighting conditions. The Sky Sensor shall be capable of 360-degree ambient light sensing (on a 30-degree interval) and infrared measurement of cloud cover, including speed and direction of clouds

The system shall utilize a single exterior Sky Sensor per building to minimize installation and wiring costs but provide the capability to monitor light levels every 30 degrees to optimize user comfort

System must be capable of a remote connection to the manufacturer’s 24/7 remote monitoring facility and allow for tracking of individual IGUs, remote schedule changes, system parameter modification and over-the-air (OTA) software upgrades

Smart Window wiring must be linear trunk line-based ethernet communication system with a coaxial trunk line carrying power and data back to a Smart Window control panel.

Smart Window wiring must allow individual IGUs to be disconnected from the system, for service purposes, without affecting the connectivity or operation of any other IGU in the system.

Smart Window system shall be capable of creating functional blocks of IGUs called "Zones". Zones can range in size from a single IGU to the entire system, and individual IGUs shall be assignable to more than one zone. Zone configurations shall be entirely based on software, and shall not require any field wiring changes to be modified

Smart Window wiring featuring pre-terminated and field-terminated connections to minimize wiring errors, labor cost and give design flexibility

Central Network Hub must have enterprise grade server on rack

Smart Window System must have vertical fiber optic backbone that connects all Smart Window control panels and is fault-tolerant with built-in redundancy

Smart Window system shall be capable of communicating to 3rd party systems via REST API's.

* + - 1. SUBMITTALS
				1. Comply with Division 01 General Requirements and submit for approval:

Product Data: Manufacturer’s Smart Window literature including data sheets, installation instructions, use restrictions and limitations.

Interconnect drawing: Electrical subcontractor shall review View Interconnect drawings and note any revisions to View related to trunk line lengths and Quad Network Window Controller locations.

Interconnect wiring diagrams: Show framing system and integrated cables, cable routing, components, location of connectors, and exit from framing.

Include identification, lengths, quantities and locations of cabling and components.

Large-scale drawings for fabrication, installation, and erections including plans, elevations, details, anchorages, connections, and accessories along with head, jamb, sill and joining details. Provide templates for work installed by others.

Take accurate field measurements before fabrication and indicate same on shop drawings.

* + - * 1. Ensure electrical schematics and shop drawings for control system have been reviewed and approved by manufacturer before being submitted.
			1. QUALITY ASSURANCE
				1. Installer qualifications:

Experienced with comparable installations and having successful performance on not less than 3 such installations.

* + - 1. Installer shall be trained in:
* BICSI Cabling Installation/Design Certifications or equivalent
* BICSI Manual: ITSIMM Seventh Edition or higher
* BICSI Installer 1 (INST, Course IN101)
* BICSI Installer 2, Copper (INSTC, Course IN225)
* BICSI Installer 2 Optical Fiber (INSTF, Course IN250)
* BICSI Technician (TECH, Course TE350)
* BICSI Registered Communication Distribution Designer (RCDD, DD102)

Acceptable to manufacturer.

* + - * 1. Controls, Software, and Services installers will attend a minimum of (1) pre-installation training sessions conducted by View Project Manager either in person or via web hosted by View Project Manager prior to Controls, Software, and Services installation. Attendance at training session to be confirmed by View Project Manager.
				2. Pre-Installation Meetings: Conduct meetings to review procedures, schedules, safety, and coordination with other project elements.

Recommended Attendance: Architect, Contractor, glazing contractor, framing manufacturer, electrical contractor, automation engineer, Smart Window manufacturer.

* + - 1. DELIVERY, STORAGE AND HANDLING
				1. Comply with product requirements, delivery storage and handling provisions of Division 01 and the following:

Do not deliver components until the job is ready for installation.

Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

Store materials in original packaging, protected from exposure to harmful environmental conditions including static electricity, and at temperature and humidity conditions recommended by manufacturer.

All cables supplied by the manufacturer shall have an installation temperature rating of -20°C to 80°C. All cables must be stored at a room temperature of 23°C (74°F) 24 hours prior to installation. Install cables within 8-hours after removing from room temperature.

* + - 1. PROJECT CONDITIONS
				1. Verify conditions including:

That frame channel dimensions are adequate for wire runs as designed.

That penetrations for frame/sensor cables are in place and correctly located.

* + - * 1. Environmental Requirements: Install assemblies only in indoor, clean, climate-controlled spaces using the final building mechanical system.
			1. WARRANTY
				1. For Controls, Software, and Services Components necessary for operation and control of insulating glass units, the manufacturer shall warrant the system free of defects in material and workmanship as follow:

The warranty period shall commence on the date of delivery of components by the system manufacturer.

Warranty period: 5 years.

1. PRODUCTS
	* + 1. MANUFACTURER
				1. Basis-of-Design: ‘View Net’ or View’s Smart Window Smart Window Instrumentation and Control assemblies as manufactured or supplied by:

VIEW Inc.

195 S. Milpitas Blvd, Milpitas, CA 95035

Telephone: 408-263-9200

E-mail: salesops@view.com

Internet: http://www.view.com.

* + - * 1. Manufacturer Experience: Instrumentation and Control assembly manufacturer should have manufactured and shipped 100,000 or more units of dynamic glass and should have been in operation for 10 years or more. Manufacturers should have experience in at least 10 or more large scale projects, with smart glass installation of 50,000 square feet or greater.
				2. Substitutions: Not permitted
				3. Proposed substitutions: Will be reviewed only if submitted in writing for approval by the design professional of record a minimum of 10 working days prior to the bid date and made available to all bidders. Proposed substitutes shall be accompanied by review of specification noting compliance on a line-by-line basis.
			1. MATERIALS
				1. Smart Window Control Panel:

#### Wall mounted enclosure housing power supplies and controllers, containing only class 2 power outlets.

#### Power specification:

##### Input Power:

###### Commercial: 208 VAC (3-phase 3-wire), 50-60 Hz, 20 Amps

###### Residential: 240 VAC (single-phase 3-wire), 50-60 Hz, 20 Amps

###### Input power should be on a dedicated circuit with breaker

##### Output Power (at each power output): 48VDC, 2.0A.

#### Components include:

##### Control Panel Head End with 32 BNC ports

##### Class 2 Power supplies.

#### Capacity: Each control panel should support at least 512 IGUs to optimize space utilization in electrical and telecom rooms or closets.

* + - * 1. Cabling: Provide cabling by system manufacturer using only approved parts and including:

Trunk line coaxial cable capable of carrying data at speeds greater than 1 Gbps and power

IGU cable with FEP material or robust equivalent

* + - * 1. Quad Network Window controller: Controllers shall be connected to up to four insulating glass units and must be capable of powering one additional PoE powered device. Refer to definitions for functional description.
				2. IGU Smart Window Connector: Manufacturer’s custom cable as follows:

Length: 15.5 inches

Termination: IP67 rated, environmentally sealed, 13/32 inch (10mm) circular connector.

Minimum diameter hole through framing: 7/16 inch (11mm).

* + - * 1. Control Sensor:

Outdoor Photo sensor: up to 100,000 Lux

IR sensors for cloud detection

PoE powered with CAT5 ethernet cables

* + - * 1. Optional Accessories:

Operable solutions for doors and windows

* + - * 1. AC Wiring: Supplied under other sections by Electrical contractor.
				2. Ethernet Wiring: Supplied under other sections by Electrical contractors or IT facilities installers.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine site conditions and ensure that:

Controls network is comprised of linear ethernet coaxial lines from control panel to end of façade and each window controller branches off trunk line.

Equipment, conduit, gang boxes, and other related materials are installed and ready to receive Work of this Section.

Pathways are clear of obstructions

Conduit and boxes are concealed.

* + - * 1. If correct conditions are deemed unsatisfactory, do not proceed until the required corrections are complete.
			1. CONTROLS INSTALLATION
				1. Using approved submittals, install products in accordance with manufacturer’s instructions, recommendations, restrictions, and limitations and in environment meeting specified conditions.
				2. Options for Control Integration:

In-Shop: Install Quad Network Window Controller, Network Adapters, cables, and other control components per framing manufacturer’s wiring diagram.

In-Field: Install Quad Network Window Controller, Network Adapters, cables, and other control components per interconnect wiring diagrams.

* + - * 1. Install Trunk Line cables according to the instructions to form a linear network. Utilize Trunk-out and Trunk-in ports as required to connect Network Window Controllers.
				2. Ensure Trunk line wire run lengths comply with Manufacturer’s Smart Window Control System Design Rules.

Refer to approved interconnect drawings for details.

* + - * 1. Install Quad Network Window Controllers using provided mounting holes in locations specified on View Interconnect drawings.

Ensure Controllers are accessible for service after installation.

* + - * 1. Make final connection between IGU cables (installed by glazier and labeled to match window controller) and Quad Network Window Controllers
				2. All cables shall be installed through appropriately sized sleeves wherever said cables penetrate fire resistance rated barriers. A sleeve application shall include steel escutcheon plates and intumescent firestop gaskets sized to fit the outside diameter of the sleeve and sandwich the barrier to lock sleeve in place. The sleeve shall be provided with a sufficient thickness of intumescent firestop putty to seal the ends of the sleeve to restrict the passage of fire, smoke, and superheated gases. The firestop sleeve shall be UL Certified and tested to the requirements of ASTM E814 (UL1479) and CAN/ ULC-S115.
				3. Do not modify IGU smart window connectors, especially the pre-terminated connector. Contact manufacturer’s product support if connector is damaged.
				4. Complete View Smart Window Site Installation and Verification Checklist requirements for low voltage subcontractor to verify Controls, Software, and Services integrity. Controls, Software, and Services testing procedures are to be conducted after IGU installation and testing is completed.
				5. Evaluate any performance irregularities and recommend corrective action for any Controls, Software, and Services component or IGU test failure to general contractor and View project manager.
				6. Provide signed and dated Site Installation and Verification Checklist to general contractor verifying that all installed Controls, Software, and Services components are functional based on View test procedures.
				7. Provide Site Installation and Verification Checklist verifying that all installed Controls, Software, and Services components are functional based on View test procedures signed and dated by General Contractor.
			1. PROGRAMMING OF SMART GLASS SYSTEM
				1. Initial Programming Confirmation: Confirm and define specific programming requirements for Manufacturer’s Smart Window system controls.
				2. Pre-programming of Controls: Pre-program controls at factory to match initial programming requirements.
				3. Final programming: Using manufacturer’s personnel, modify and complete programming at end of commissioning period.
			2. COMMISSIONING OF SMART GLASS SYSTEM
				1. Commissioning must be accomplished using vendor provided mobile apps and web interfaces
				2. Quad Network Window Controllers and other end points must be auto discovered by the Control Panel
				3. Quad Network Window Controllers must be auto located in the building using a position algorithm so that no specific position is required, and no manual location matching is required
				4. Installer will submit digital verification of commissioning to View and have approval from View before commissioning is considered complete

END OF SECTION 27 10 00

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