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**ENERGY CONTROL SYSTEM  
 - RETROFIT INSTALLATION -**

**PART 1 GENERAL**

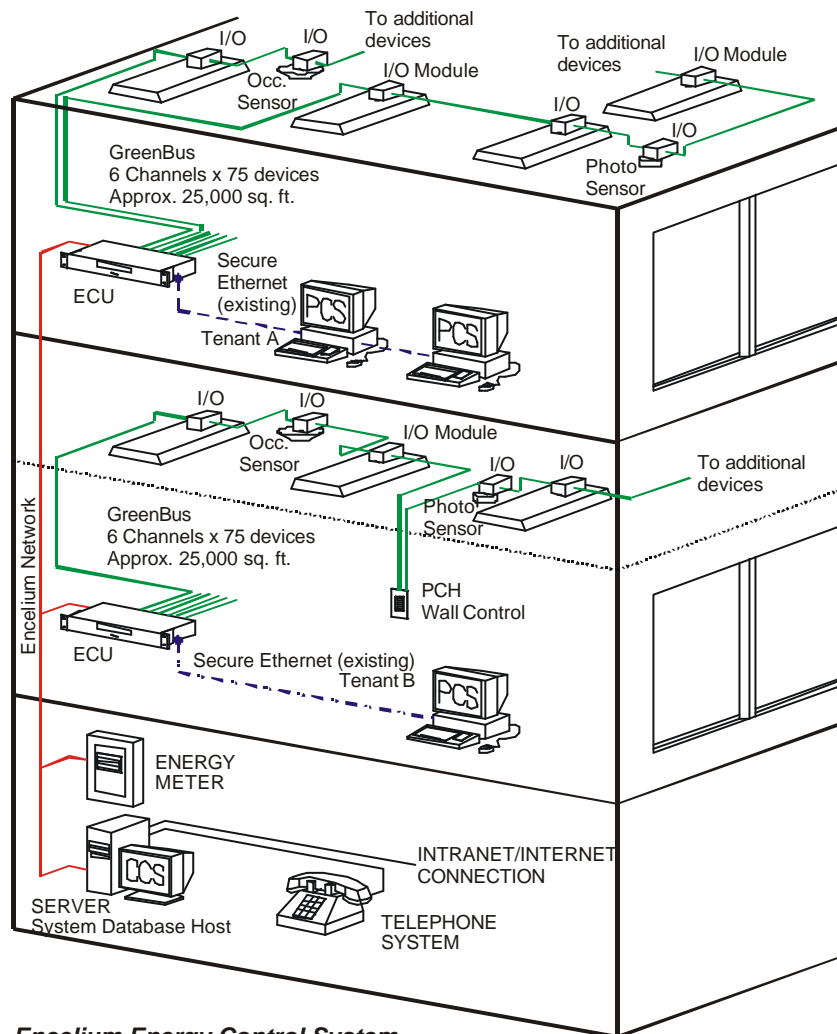
**1.01 SCOPE**

1.01.1 This document describes the general specifications for the installation of the Encelium Energy Control System. For project specific requirements, refer to Project Description document.

**1.02 SYSTEM DESCRIPTION**

1.02.1 The Encelium Energy Control System consists of six (6) main elements: An Energy Control Unit (“ECU”), I/O Module, Dimming Electronic Ballast, Sensors (Photo and Occupancy), Switches (“Personal Controllers” or “PCHs”), and prefabricated Category 3/5 Communication Wiring (“GreenBus”).

1.02.2 Additional components may include an electrical meter, voltage transformers and linear and/or compact fluorescent fixtures. The system architecture is depicted below:



**Encelium Energy Control System**

- 1.02.3 ECU: One ECU is typically installed per floor of a building (or per approx. 25,000 square feet), located in the electrical service room or similar area. Interconnections between ECU modules are accomplished using the building's existing ethernet (or similar installed network). Location to be determined by Encelium.
- 1.02.4 Ballast: One I/O Module is installed in each light fixture for each dimming electronic ballast. Electrical connections between the I/O module and the ballast consist separately of:
- Interrupting the line voltage, and
  - Class II, low voltage to the 0-10V terminals/wires.
- 1.02.5 Sensors: One I/O Module is mounted to an electrical junction box for each sensor. Electrical connections between the I/O module and the sensor consist of Class II, low voltage only.
- 1.02.6 GreenBus Wire: One GreenBus wire is used to interconnect each of the system components, in series (except ECUs, as noted above). GreenBus wiring utilizes quick-connect RJ45 connectors and receptacles and is prefabricated to standard lengths.
- 1.02.7 Personal Controllers: PCHs are connected by low voltage, GreenBus wiring only.

### 1.03 REQUIREMENTS

- 1.03.1 Install a complete energy control system, free of installation defects. The installation shall include line voltage wire manipulation, Class II low voltage connections and communications cable routing. Transforming voltages and rewiring lighting circuits may also be required.
- 1.03.2 The contractor shall coordinate with the Encelium project manager (and building owner/tenants where appropriate) to facilitate equipment installation, scheduling, protection of equipment, and access to the project site in order to provide a substantially complete project in a timely manner.
- 1.03.3 Work will generally be performed outside of regular business hours to avoid disruption to tenants.
- 1.03.4 The successful contractor will not be determined by price alone, but by a rating system to include a combination of price, qualifications, etc.

### 1.04 SUBMITTALS

- 1.04.1 Project initiation: Contractor shall furnish the following in a single consolidated submittal:
- The name of the person who will act as the contractor's official contact with the Encelium project manager and building owner/property manager.
  - A proposed project schedule, indicating general project deadlines. At a minimum, this schedule shall include the following milestones:
    - Start and timing of lighting circuit modifications (if applicable)
    - Start and timing of fixture retrofit and all other device installations, including communications interconnections.
    - Final inspection
  - Provide details (where necessary, furnish floor plans) for Encelium and owner review showing any required conduit or electrical modifications, indicating existing and proposed wiring.
- 1.04.2 Project completion: As a condition for project acceptance, the contractor shall submit the following for review and approval:
- An exception list of deviations (in materials, construction, and workmanship) from that specified in this document and shown on the project drawings. Encelium will review this list and declare each item as either an approved exception or as one the contractor must correct.
  - Inspection and test reports: During the course of the project the contractor shall maintain an adequate inspection system and shall perform such inspections to ensure that the materials supplied and the work performed conform to contract requirements.

### 1.05 RESPONSIBILITIES

- 1.05.1 Encelium reserves the right to exercise its discretion to require the contractor to remove from the project any such employee of the contractor deemed by Encelium to be incompetent, careless, insubordinate, or otherwise objectionable.
- 1.05.2 Quality and workmanship evaluation shall be solely by Encelium.
- 1.05.3 The contractor must be licensed in the province of Ontario.
- 1.05.4 All cleanup activity related to work performed will be the responsibility of the contractor and must be completed daily before leaving the facility.

**1.06 QUOTATIONS**

- 1.06.1 Price quotations shall detail:
  - a) Price for lighting circuit modifications including panels and transformers (if applicable), indicating labour and material costs separately.
  - b) Price per retrofitted fixture, including lamp, ballast and I/O Module installation.
  - c) Price per sensor-I/O Module assembly and switch installation.
  - d) Price per other installed component, including fixtures, ECUs and energy meters (if applicable).

**1.07 RELATED DOCUMENTS**

- 1.07.1 For project specific requirements, refer to Encelium Project Description document.
- 1.07.2 GreenBus cabling layout.
- 1.07.3 For individual sensors, refer to manufacturer’s specifications.
- 1.07.4 For information on I/O Module, refer to Encelium Technologies Inc. Universal I/O Module Installation and Service Manual.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- 2.01.1 Encelium supplied products shall bear the CSA label or equivalent.
- 2.01.2 All contractor supplied products shall be new and brought to the job site in original manufacturer’s packaging.
- 2.01.3 Electrical components, where not supplied by Encelium, shall bear the CSA label or equivalent. All wire and communications cable shall bear flammability testing ratings, and shall be used in appropriate circumstances (eg. CMP -- Plenum-rated communications cable; CMR -- Riser-rated communications cable).

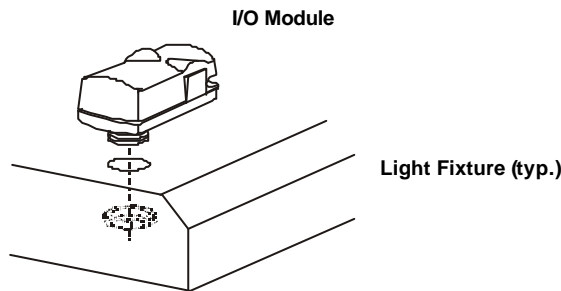
**PART 3 EXECUTION**

**3.01 GENERAL**

- 3.01.1 All work shall be performed in compliance with national and local electrical and building codes and per building owner requirements.
- 3.01.2 All installation and inspection of lighting fixtures should be performed with the power to the fixture turned off.
- 3.01.3 The contractor should avoid penetration of fire-rated walls. Where necessary, proposed modifications shall be reviewed and approved by Encelium.
- 3.01.4 Do not exceed cable bend radius and pull tension limits, refer to the communications cable manufacturer for the maximum allowable limits.
- 3.01.5 The contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- 3.01.6 The contractor shall replace cables showing evidence of improper handling including stretches, kinks, short radius bends, etc. and return defective units to Encelium.

**3.02 LIGHT FIXTURES**

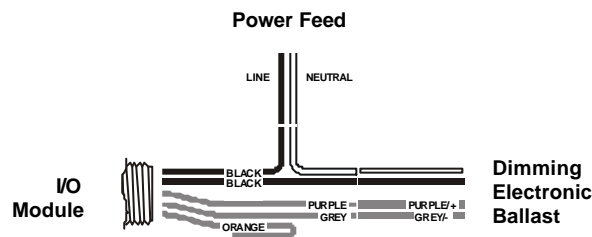
- 3.02.1 One (1) I/O Module to be installed in each light fixture included in system. Installation is facilitated via spare ½ inch knockout in the fixture. Module is inserted from the outside (top). Secure retainer nut before wiring unit. Where a knockout does not exist, a similar hole shall be made in accordance with appropriate safety requirements.



- 3.02.2 Ballasts to be installed in compliance with manufacturers’ requirements by qualified personnel.
- 3.02.3 One (1) I/O Module shall be installed in each light fixture included in system. Parallel wiring of fixtures is not permitted.
- 3.02.4 Do not connect more than two (2) ballasts in parallel to one (1) I/O Module. Note: 347 V, 300 VA maximum capacity.

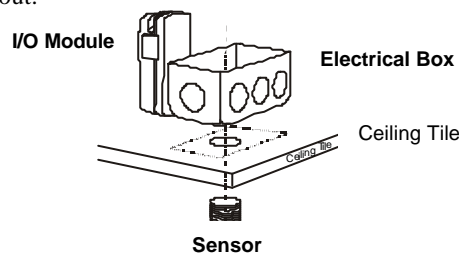
**3.03 BALLASTS**

- 3.03.1 Ballast/lamp wiring configuration shall be installed according to product specifications, all applicable codes and regulations and performed by qualified personnel. Unconnected leads should be capped individually and insulated to at least 600 volts. Ballasts with push-in/poke-in/wire trap connectors require use of 18 AWG solid copper wire only. Consult ballast manufacturer for specific requirements. Remote wiring of ballasts is not permitted.
- 3.03.2 Grounding: The ballast case and fixture must always be grounded to ensure safety, proper lamp starting, and acceptable EMI/RFI performance.
- 3.03.3 I/O Module wiring to ballasts:
  - a) I/O Module purple and grey wires (Class II, low voltage) to be connected to ballast purple (+) and grey (-) terminals, respectively.
  - b) I/O Module orange wire is not used and must be properly isolated.
  - c) Connect power supply line voltage to one I/O Module black wire lead and ballast line feed wire lead to the other I/O Module black wire lead. Note: 347 V, 300 VA maximum capacity.



**3.04 OCCUPANCY AND PHOTO SENSORS**

- 3.04.1 Mount I/O Module to electrical box via ½ inch knockout. Module is inserted from the outside. Secure retainer nut before wiring unit.
- 3.04.2 Sensor should be mounted through ceiling tile to electrical junction box through appropriately sized knockout.



- 3.04.3 One (1) I/O Module shall be installed per each sensor included in the system. Parallel wiring of sensors is not permitted.
- 3.04.4 Auxiliary power packs are not required for sensors specified by Encelium.
- 3.04.5 I/O Module wiring to sensors:
  - a) I/O Module black wire leads are not used in this application and should be properly isolated.
  - b) I/O Module purple, grey and orange wires (Class II, low voltage) to be connected to sensor “+”, “common/-”, and “signal” wires, respectively. Verify with sensor manufacturer specification prior to connection.



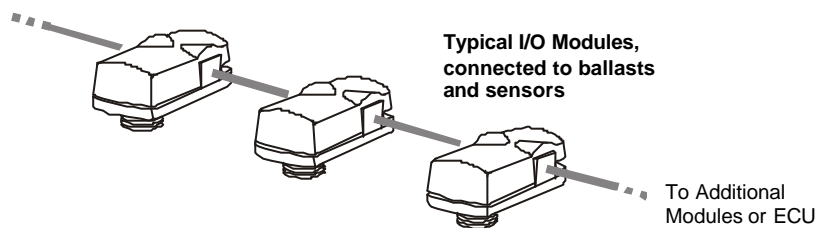
3.04.6 Refer to sensor manufacturer’s specification for product specific information.

**3.05 PERSONAL CONTROLLERS (PCHs)**

- 3.05.1 PCHs shall be mounted in a standard electrical box, where required by code/regulations.
- 3.05.2 Where existing line voltage wall switch is removed, bridge and isolate line voltage wiring per methods required by applicable codes/regulations.
- 3.05.3 PCHs do not require connection to an I/O Module. GreenBus wiring via RJ45 connectors should be made to the switch in the same manner as with I/O module.

**3.06 GREENBUS COMMUNICATION CABLE**

- 3.06.1 Connect to Encelium energy management system only. Do not connect to other circuits (eg. Ethernet/LAN, VoIP equipment, ISDN, etc.).
- 3.06.2 Installation of GreenBus cable is facilitated by prefabricated cable with RJ45 connectors, finished in standard lengths. Occasionally, custom lengths will be required and will be cut and finished on site. If necessary, Encelium shall specify and provide the required equipment.
- 3.06.3 All cabling shall be routed so as to avoid interference with any other service or system, operation or maintenance purposes, and conform to building specific requirements (eg. conduit rules).
- 3.06.4 Lay cables via the most labour efficient route between I/O modules, switches and to the ECU. Encelium to provide layout as necessary.
- 3.06.5 Start cable layout at one of ECUs six (6) channels and propagate in series to all I/O modules. Do not exceed 75 modules per channel unless specified by Encelium. Termination to each channel is not required. Follow Encelium layout if provided.



3.06.6 Do not exceed cable bend radius and pull tension limits, refer to the communications cable manufacturer for the maximum allowable limits.

**END OF SPECIFICATION**