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**TAB 7: TECHNICAL DISCIPLINES**

Electrical

**WAYSIDE POWER**

Wayside power requirements for trains and buses (bus layover bays). Refer GO STANDARD DRAWINGS.

**PROGRAMMABLE LOGIC CONTROLLER – RELAY PANEL (TBD)**

**POWER FACTOR CORRECTOR (TBD)**

**SELECTION OF BREAKERS (TBD)**

**PANEL REQUIREMENTS (TBD)**

**TRANSFORMERS (TBD)**

**MONITORING AND CONTROLS**

Installation of supervision monitoring and control systems at selected locations, will monitor status of equipment, power quality and demand, control and will provide capacity for automated reporting.

Metrolinx Main Computer Centre will monitor the selected sites via the Metrolinx Network.

Meter additions are considered in designated locations.

One (1) or a maximum of two (2) Internet Static (IP) addresses 10Mb will be required per selected Central Office. For each new installation, inform Metrolinx IT representative that a new IP address is required.

The Main Meter/Controller is set up with **BACnet network Card**.

Communication is established through Metrolinx Corporate Network utilizing TCP/IP.

Sub Meters are connected to the Main Meter/Controller through a local RS-485 communication bus.

The main meter/controller should ideally be placed in the control compartment of the main switchboard. If space is confined an auxiliary wall mounted box should be installed.

The cabling will be routed directly to the main meter/controller and the physical connection shall be isolated within the control compartment or the auxiliary Panel where the meter resides.

The compartment or the auxiliary Panel should be located in electrical room.



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Design and Installation should be done in AutoCAD. Send Cad design to Metrolinx Representative to confirm acceptance and allows comments.

#### Power Measurement Controller

At selected offices and sites install Power Measurement Controller, providing per-phase power monitoring, analysis and control capabilities, at each low voltage incoming main distribution point.

The following option shall be included depending on the applications:

Limit the required Digital Inputs and the Return Input in consideration of:

- 1) Connection with other Counters such as Gas Meter, Water Meter, etc. Counters taking in consideration that they can use the same return Input;
- 2) Synchronization with Hydro Meter.

#### Monitor Controller for MCC

At each motor control centre in selected central offices install a Power Measurement providing per-phase power monitoring and analysis.

#### Monitor Breaker Controller

At each supervised breaker in selected Central Offices, install Power Measurement meter providing per-phase power monitoring.

For local supervised breaker in remote Offices, install a breaker controller Power Measurement meter providing per-phase power monitoring.

#### Monitors for load sharing

When load sharing is required, install Power measurement meter providing per-phase power monitoring.

#### Monitor Panels or equivalent

Special monitoring panels are to be manufactured by an external supplier to house power meters.

The meters to be mounted at the factory into a metal box that needs to be attached on the wall as close as possible to the panel to monitor. The panels to include all the accessories to allow proper functioning of the unit (even the current transformers). All the current transformers not included in the power monitoring panels are split-core in order to allow installation without having to disconnect the power cables. A wide variety of monitoring panels are available depending on:

- a) The model on power meter model



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b) Amperage capacity

Panels to be available for the following Power Measurement meters:

- a) Main Power measurement controller,
- b) Monitor Controller for MCC,
- c) Monitor Controller for Breaker,
- d) Monitor Controller for load sharing.

Panels are available in different ampere capacities to accommodate the most common sizes of panels.

#### Electric Power Monitors – Installation

Coordination with Metrolinx Technical Support Representative:

The installation of power monitoring units in a Metrolinx Main Computer Centre office (number and models of units to install, location of units,) must be coordinated with a representative of the Metrolinx Technical Support group.

Install three (3) Current Transformers (CT's) even if a two (2) CT's arrangement is feasible, to ensure proper collection of the parameters and the waveform. Always provide CT's Shorting Device. When existing CT's are reused validate, their ratio in comparison with the load.

Even if not required by the manufacturer, install two (2) Potential Transformers (PT's) where there are no neutral conductors. Otherwise install three (3) PT's to prevent injuries and isolate the Meter from 600 V or 208 V Source. Ensure that primary and secondary PT's are protected with fuses (IC of 100 kA minimum). When existing PT's are reused validate, their accuracy (better than 1%) and their protection.

Connect all meter power supply from a UPS or inverter circuit.

Request commissioning by the manufacturer's representative for proper configuration.

Install the power meters in compartments of the switchboards, Power metering arrangement will vary among locations. The Metrolinx IT Representative will review each installation approach.

#### Physical location

#### Communication (i.e. BACnet network):

- > Supply a 6"x6" box on a wall as close as possible from the Main Power Measurement Controller master unit in electrical room.
- > Supply a 19mm conduit and a communication cable.



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- > Between the 6"x6" box and the Main Power Measurement Controller master unit, install a 19mm conduit and cable inside. The length of the cable must be 25' at the maximum.

#### RS-485:

- > Starting from the Main Power Measurement Controller master unit, install a 19mm conduit between all powers monitoring unit in order to create a daisy chain. The sequence used to link all those units has no importance.
- > Use #12AWG, 2 conductors cable with metal shield, type FT-4 to link all the power monitoring units.
- > The metal shield in the daisy chain sequence must be continuous.
- > When connecting the cable to the RS-485 port, the shield of the incoming cable must be linked to the shield of the outgoing cable.
- > The metal shield in the daisy chain sequence must be connected to the terminal of only one (1) power monitoring unit. This is to avoid a ground loop.

#### 120V power feed:

- > The 120V power feed of the power monitoring devices must continuous, i.e. come from a UPS or an inverter.
- > Install a 19mm conduit between the UPS or inverter and the Main Power Measurement Controller master unit.
- > Starting from the Main Power Measurement Controller master unit, install a 19mm conduit between all powers monitoring unit in order to create a daisy chain. The sequence used to link all those units has no importance.
- > Connect the 120V power feed of all power monitoring units to one UPS or inverter circuit of 15A.
- > Use a #12AWG cable, type multi-strand, for the 120V power feed.

#### Current Transformers (CT's):

Follow CT polarity at the time of installation. The dot must be towards the source (not towards the load).

- > Special case: when replacing an old analog meter by a new unit from Power Measurement, if the re-usage of existing CT's is needed, do not assume that the polarity of the existing CT's is correct. Functioning of an analog meter is not affected by the incorrect polarity of one or more CT but the functioning of Power Measurement is affected.



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- > In the case of the Breaker controller and Power Measurement controller master units, the CT's must be installed at the output of the breaker (load side).
- > In the case of the Load sharing and MCC controller, if there is not enough space inside the Panel cabinet to install the CT's, install in the nearest structure located before the panel (example: pull-box, output of the transformer feeding the panel,...).
- > Use a #12AWG cable, type multi-strand; to link the CT's to the power monitoring unit. If the distance exceeds 25', use a #10AWG cable.
- > Cover the two connectors of each CT with black tape, 2000V.
- > CT's transformer will be split core type with a maximum of 3% of tolerance drift and ratio to five (5).
- > CT's transformer will be provided by contractor.

#### Voltage measurement points:

- > In the case of Breaker controller and Power Measurement controller master unit, the voltage measurement points must be installed at the input of the breaker (feeder side).
- > Use a #12AWG cable, type multi-strand, to link the voltage measurement points to the power monitoring unit. If the distance exceeds 25', use a #10AWG cable.
- > Special case: when the use of an external power measurement panel is not possible and the power monitoring unit must be installed directly on the front of an existing panel, the CSA specifications require is such a situation that we use Power Transformers (PT's) if the voltage of the point to monitor is more than 250V.

#### Status of breakers or/and automatic transfer switch:

- > When monitoring the status of breakers (or/and the automatic transfer switch), install a 19mm conduit between each breaker and the Power Measurement controller master unit.
- > The relay on the breaker (or the automatic transfer switch) must be Normally Open, form-A or form-C, dry type relay.
- > Connect the Main breaker or transfer switch relay contact on input I/O of Power Measurement controller master unit meter
- > Connect the Diesel Generator breaker relay where applicable
- > Use a #12AWG cable multi-strand, to link each breaker to the Power Measurement controller master unit.



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#### 20mA output signal:

When the 4-20mA output signals generated by the Controller for Breakers unit must be used, install a 19mm conduit between Controller for Breakers unit and the Energy Management System of the site.

Use a #12AWG, 2 conductors cable with metal shield, type FT-4 to link the Controller for Breakers unit to the Energy Management System of the site.

#### Commissioning:

When the installation activity performed by the electrician is done and that all monitoring units are functional, commissioning of these units must be performed.

An agreement with GO/ Metrolinx has to be signed for commissioning activities.

Commissioning agent to be present on site and verify the quality of installation, program and calibrate the monitoring units, verify the communication between the units and also between the Power Measurement controller master unit and the server.

#### Power Monitors – Monitoring Program

Install Monitoring Program to locally monitor all Power Meters at selected sites.

## PROVISION FOR INFRASTRUCTURE FOR FUTURE EV CHARGING STATIONS

- > If provisioning for future Electric Vehicle Charging Stations, provide empty conduit, complete with #12 AWG green insulated grounding conductor RWU90 for easy tracing terminated in a handwell, sized as per OESC (Ontario Electrical Safety Code) but, not smaller than 2" (50mm) for future use. Impact on existing power services and building infrastructure shall be investigated by the designer.
- > When considering the provision of Electric Vehicle Charging Station infrastructure, ensure the physical space required for an EV Charging Station panel is reserved in the Electrical Room for its future installation
- > EV Charging Station Design details as per Tab 2 CI-0203 Parking Infrastructure.

## SERVICE ROOMS

### GENERAL REQUIREMENTS