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**Multiple Customer Metering System
 for Existing Buildings
 Supply and Installation Requirements**

REVISION SHEET

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1. Introduction

This specification describes the requirements for unit smart meters, referred to as Multiple Customer Metering Systems (MCMS), to be supplied and installed within an existing building located in Hydro Ottawa Ltd's (HOL) service territory. An MCMS is a dedicated HOL owned and operated building central processing system servicing multiple metering points and storing/sending the data over a network to a central repository.

2. References

- Hydro Ottawa – DFS0009 – Civic and Mailing Address Format
- Hydro Ottawa – GDG0010 – Schedule E1 Certificate of Acceptance
- Hydro Ottawa – GCS0008 – Revenue Metering Specifications
- Hydro Ottawa – MCS0020 – Typical Secondary Metering for Multiple Unit Building – Single Line Diagram
- Hydro Ottawa – MCS0023 – Typical Secondary Metering for Multiple Unit Building with Conventional Metering and MCMS – Construction Detail
- Hydro Ottawa – MCS0059 – Single Multi-Customer Metering Unit without Communication Equipment
- Hydro Ottawa – MCS0060 – Multi-Customer Metering Units with Communications Equipment
- Hydro Ottawa – MCS0105 – Minimum Clearance in Front of Revenue Metering Equipment
- Hydro Ottawa – MCS0110 – Single Multi-Customer Metering Unit with Communication Equipment
- Hydro Ottawa – MCS0115 – General Secondary Service Electrical Closet Clearances for Meter Centre and MCMU Installations
- Measurement Canada LMG-EG-07 – Specifications for Approval Type of Electricity Meters, Instrument Transformers and Auxiliary Devices
- Measurement Canada P-E-04 – Generic Procedures for Conducting Installation Verifications of Multiple Customer Metering Systems
- Measurement Canada S-E-04 – Installation Requirements for Multiple Customer Metering Systems
- Ontario Building Code
- Ontario Electrical Safety Code
- Ontario Regulation 389/10 - General (*Energy Consumer Protect Act, 2010*)
- Ontario Regulation 425/06 - Criteria and Requirements for Meters and Metering Equipment, System and Technology (*Electricity Act, 1998*)

3. Scope

This document defines HOL's minimum technical requirements for the design, procurement, installation and commissioning of MCMSs to serve as Measurement Canada revenue grade systems within existing class of units (residential, common elements etc..) as defined in the O.Reg 389/10 s. 38(1) located in HOL's service territory. The application of the MSMS shall be limited to multi-residential unit buildings, multi-residential unit buildings with some commercial units, residential condominiums and cooperative housing. Common elements of a residential building complex are also included.

The proposed building MCMS including the Multiple Customer Metering Unit (MCMU) panel(s), related hardware, and network infrastructure shall integrate HOL's MCMS.

This document will not cover the supply and installation requirements for conventional revenue and/or check metering and the requirements of the meter data management infrastructure that is required to integrate HOL's MCMS.

All buildings retrofitted with an MCMS shall have a conventional check meter meeting the specifications under GCS0008 at the service entrance.

Definitions

Authorized Service Provider means an organization recognized by Measurement Canada to inspect and certify measuring devices.

Contractor means a Hydro Ottawa approved contractor that has been contracted to supply and install MCMS equipment within an existing building located in HOL's service territory.

Local Area Network or LAN indicates the network communication that occurs between a building's MCMS panel meters.

MAC address means Media Access Control address which is a permanently assigned, unique identifier for a network node.

Multiple Customer Metering System or MCMS refer to GCS0008

Multiple Customer Metering Unit or MCMU refer to GCS0008

Wide Area Network or Wan indicates the network communication that occurs between a building's MCMS panel meters and the host server operating the MCMS meter management software.

4. Procurement MCMS Main Components

4.1 Multiple Customer Metering Unit (MCMU) Panel(s)

The MCMU meter panel(s) shall be Measurement Canada approved and shall meet the functional specifications as defined in O.Reg. 425/06. The panels shall be revenue-grade solid state MCMU capable of metering services approved under their respective Measurement Canada Notice of Approval.

The use of different models shall be acceptable but the number of variations shall be kept to a minimum. All proposed panels shall be supplied by the HOL's approved manufacturer and must be recognizable as part of the same "family" of products.

The MCMU(s) shall be programmable to allow for kWh delivered and received for both cumulative and interval metering. Time of Use billing must be supported by the MCMU panels and software responsible for data management. All MCMU(s) shall be verified or reverified and sealed by an Authorized Service Provider.

The MCMU panel electronics shall be enclosed in a metallic enclosure that has provision for the application of a utility seal to prevent unauthorized access to the internal components.

The MCMU panel enclosure shall have an RJ-45 Ethernet port or RS-232 port available for panel diagnosis and troubleshooting without the need to break the panel seal. The diagnostic software available through these port(s) shall be password protected by a password determined by Hydro Ottawa.

The MCMU panel enclosure shall be wall-mountable with a minimal installation footprint.

The use of marettes as a connective device shall not be accepted; if multiple connections are required, the use of permanently mounted terminal blocks shall be the only acceptable means of connection.

The MCMU(s) shall have non-volatile memory with sufficient memory allocation to store a minimum of 90 days' worth of meter data recorded in 15-minute intervals for all metered points.

The MCMU(s) shall have a local onboard alpha-numeric display that will be capable of displaying panel configuration, programming details, diagnostic notices, alarm status and cumulative energy consumption

and/or energy consumption for all individually metered units. Each metered unit shall be referenced by their respective utility badge numbers.

Each MCMU must be easily exchangeable with a standard, readily available panel that requires limited hardware and/or software reconfiguration.

The MCMU panel shall be capable of operating from the same power feed that is used to reference the phase voltages. For applications greater than 120 VAC, potential transformers may be used in the metering circuit.

The MCMU and ancillaries shall be UL/ULC listed and CSA approved for mechanical and electrical safety.

The MCMU shall operate in the following environmental conditions:

- Operating temperature: 0°C - 50°C
- Humidity: 10 - 90% RH non-condensing
- Dust: Uncontrolled

4.2 Instrument Transformers

4.2.1 Potential Transformers

Potential Transformers (PTs) shall be used when monitoring loads greater than 120 VAC.

The metering PTs shall be Measurement Canada approved potential transformers and installed with manufacturer approved fusing for protection; protective overcurrent devices other than conventional fuses shall not be accepted.

The potential sensing elements shall be mounted within a sealable metal enclosure to establish the reference voltage and be able to power the MCMU.. Only one MCMU will be permitted per potential sensing module.

4.2.2 Current Transformers

Current Transformers (CTs) part of the building MCMS shall be Measurement Canada approved current transformers. One CT per phase shall be required for each metered point; the sharing of CTs between different physical metering panels shall not be accepted.

All CT leads shall be equipped with CSA approved shorting blocks to allow for the transformers to be safely disconnected from the MCMU. The shorting blocks may be part of the terminal block or a separate device if necessary. The terminal block and shorting blocks shall be installed within a sealable metal enclosure.

CT converters may be required due to load size and MCMU limitations. In these cases; one converter shall be provided for each current transformer to decrease the amperage to appropriate current ratings accepted by the MCMU. CT converters shall be Measurement Canada approved and installed within a sealable metal enclosure.

4.3 MCMS Connectivity

4.3.1 MCMS LAN Connectivity

MCMS metering LAN connection shall be hard-wired category 5e or category 6 Ethernet cable with a FT6 fire rating.

4.3.2 MCMS WAN Connectivity

The WAN connection type for a building's MCMS shall be via a cellular modem interface. The cellular modem shall be supplied by HOL but installed by the Contractor. Where practicable, MCMU(s) shall be connected to a single wireless modem through the use of Ethernet hubs or routers. Multiple network hubs may be used if the building topography warrants.

5. Design & Document Submittals

5.1 Pre-Contract Approval

The Contractor shall prepare a building electrical single line diagram to show the existing multi-level building distribution system complete with all main power and distribution panels, all residential units, public loads, fire pump circuit(s), commercial unit(s) and embedded generation as applicable. The Contractor shall also supply proposed construction and installation drawings for HOL's review, showing where the MCMU enclosures and components will be installed prior to installation.

The building electrical single line shall include all proposed conventional revenue and check metering point(s). Refer to HOL's revenue metering specification GCS0008 and applicable HOL engineering standards for installation requirements of conventional meters where necessary. The proposed MCMS shall be an overlay to the multi-level building single line diagram to identify and locate the check meter, residential units, commercial units, fire pumps, and/or embedded generation with their distribution panel(s) and to identify and locate the proposed MCMU panel(s), electrical connections, and all MCMS necessary enclosures within the building.

The proposed MCMU panel(s) shall be Measurement Canada approved for the service configuration and voltage to be metered. Compliance with Measurement Canada Notice of Approvals and Specifications will be applied. .

The electrical single line diagram shall also indicate any proposed changes to the building distribution system to suit the proposed metering. The drawings should be provided electronically and comply with the requirements listed in Appendix A.

HOL prefers that common building and/or public loads be consolidated and be independently metered using conventional meters where possible. In the event that the consolidation of the common and/or public loads or the installation of conventional meters demand major changes/upgrades to the building electrical distribution system or creates a large financial burden to the project, the Contractor shall include a proposal to meter the common service loads using the building MCMS.

Refer to MCS0020 and MCS0023 for typical secondary metering with conventional and/or MCMS metering. The Contractor's proposal shall include all preliminary works (normally done "By Others") to facilitate the installation of the building MCMS.

5.2 Post-Contract Approval

The building electrical single line diagram with the MCMS equipment list shall be revised and resubmitted for final acceptance to HOL Design and Metering groups prior to material procurement and/or the start of the field work.

Based upon the LAN and WAN network topography agreed upon, the Contractor shall create network equipment lists and the installation processes for the specific jobsite. The documentation shall also include the test process that will be used to evaluate and commission the building MCMS communication network.

6. Installation Technical Requirements

All installations shall conform to Measurement Canada's document S-E-04 '*Specifications for the Installation Requirements for Multiple Customer Metering Systems*' and all requirements of the *Electricity and Gas Inspection Act*. The MCMS shall be installed in a manner that allows for on-site testing of all metering components. All equipment associated with the building MCMS shall be installed in manner conforming to the Ontario Electrical Safety Code and the Ontario Building Code.

MCMU panels and all associated equipment, switches and disconnects shall be sealed with utility seals provided by HOL and marked with the HOL logo.

All potential and current sensing circuit terminations shall be identified through the use of tamper-proof labels. The Contractor is to follow installation and wiring guidelines provided by the MCMU manufacturer.

Once the MCMS is sealed and ready for installation, the Contractor shall make arrangements for unit notification of the impending installation work and inform affected customers of any service interruptions that may result. The HOL assigned designer shall be consulted and notified of such communication. Once it is confirmed that affected unit-owners have been notified, the Contractor shall proceed with the installation.

The Contractor shall have detailed installation document to indicate the relationship between:

- The MCMU panel including serial number, MAC address and HOL badge number
- Metering points
- Serialized instrument transformer
- Supply electrical panel
- Individual unit/circuit breaker within electrical distribution panel

All building MCMS installations must have an ESA inspection and approval. Attempts should be made to have the inspection occur on the day of installation to minimize potential customer inconvenience and power disruption.

All building MCMS installations must be inspected by HOL's Metering Department prior to the energization of the service to confirm compliance to the installation standards and to ensure HOL's requirements are met for Ontario Regulation 22/04. HOL reserves the right to inspect, test and audit an installation.

Measurement Canada, under P-E-04, has provided MCMS wiring diagram examples for installations with current transducers and for installations using external current transformers. When available, refer to the manufacturer specific wiring diagrams.

6.1 Equipment Access and Working Space

The MCMU panels and associated equipment shall be installed within the same electrical room as the distribution panel associated with the point being metered where possible. Each point to be metered shall have distinct and separate wiring at the metered panel.

Where MCMU panels are metering various distribution panels on multiple floors each distribution panel shall clearly indicate the location of its MCMU. A copy of the building electrical single line diagram (with metering and communication diagrams/overlay) shall be available in the main electrical room which shall indicate the location of MCMU panels and the distribution panels being metered to ensure HOL technicians are aware for location and isolation purposes.

The electrical room(s) or enclosure(s) housing metering equipment shall meet all the requirements outlined in GCS0008 Section 5, MCS0105 & MCS0115. The Contractor's proposal shall include all preliminary works (normally done "By Others") to facilitate the installation of the building MCMS. Deviation to the above standards shall be documented and reviewed for acceptance by HOL before proceeding with the installation work.

6.2 MCMU Panel Installation

The MCMU panel(s) shall be powered from the distribution panel that are being metered by the MCMU(s). The supply circuit shall be dedicated/hard wired to the MCMU(s) and the protection shall be sized as per the manufacturer's recommendation. The supply circuit shall be clearly marked and provided with lockable means to suit the distribution panel.

A separate lockable disconnect switch shall be installed as reasonably close as possible to the MCMU(s) for isolation purposes if any of the following exists:

- the distribution panel does not allow for lockable means,
- the supply circuit provides power to more than one MCMU, or
- the distribution panel and the MCMU are not in a straight line of sight.

The MCMU supply circuit and/or supply disconnecting switch(es) shall have provisions to be padlock lockable both in the open (OFF) position and in the closed (ON) position while still allowing for trip-free operation.

The Contractor shall ensure that the number of installed MCMU panels is minimized by programming the MCMU accordingly and by populating each installed panel with as many metered units as is reasonable.

All building MCMS components shall be installed in a safe and secure fashion. A plywood mounting board coated, on all sides, with a fire retardant paint shall be installed as the preferred MCMS panel mounting surface as per HOL engineering standards. The fire retardant coating shall provide a maximum Flame Spread Rating of 25 (Class A) in accordance with the standard CAN/ULC 4-S102.

All metering circuits (current transformer conductors and potential transformer conductors) shall be within an enclosure or continuous conduit or armoured cable to minimize the possibility of tampering and protecting individuals from intentionally opening of the power or current sensing circuit.

Refer to MCS0059, MCS0060 and MCS0110 for MCMU installation and proposed equipment layout. The Contractor's proposal shall include all preliminary works (normally done "By Others") to facilitate the installation of the building MCMS. Deviation to the above standards shall be documented and reviewed by HOL before proceeding with the installation work.

6.3 Instrument Transformer Installation

The preferred location of the instrument transformers is within the distribution panel or switchboard of the metered points. An oversized distribution panel preferred, however, an adjacent panel housing the current transformers is acceptable.

Distribution panels or switchboards shall have a lockable cover or installed in a controlled access room and lockable means to lock each individual circuit in the OFF position. Existing distribution panel or switchboard without circuit lockable means shall be fitted with circuit lockable means to be approved by HOL Metering department before proceeding with the distribution panel retrofit work.

Where the installation of transformers within the distribution panel would contravene with ESA's panel space requirements, transformers shall be installed in a separate lockable and sealable enclosure if approved by ESA.

All wiring to the transformer shall be continuous and unbroken, with any terminations ending at a terminal block with each wire secured by two set screws. In situations where a break in the transformer wiring is necessary and a terminal block cannot be installed in the vicinity, window butt splice connectors shall be used. Butt splice connectors or terminal blocks shall be housed in a junction box and/or enclosure to be located with HOL metering equipment on the equipment mounting board to suit. Twist-on wire connectors ("Marrettes") will not be permitted.

Cable run lengths shall conform to Measurement Canada specification S-E-10 and shall conform to the Notice of Approval for the MCMU.

Transformers shall be installed secured to the unit service wires, within the distribution panel or switchboard, using cable ties to make relocation and/or removal difficult. The installation shall be organized in a neat manner and clearly marked as required as per Section 8 of this document.

Potential transformers shall be equipped with fuses between the PT and the MCMU and sized as per manufacturer's specifications.

6.4 MCMS Connectivity Equipment

All building MCMS communication and meter data management infrastructure shall be compatible and integrate HOL's MCMS.

All MCMS WAN equipment shall be installed adjacent to the check meter where possible or on the first metering floor.

Power to communication equipment shall be provided by the Contractor supplied outlet and metered as a public load.

Ethernet hubs and routers shall be installed by the Contractor, housed within a sealed lockable enclosure to prevent unauthorized access. The modem shall be installed by the Contractor, housed within a sealed lockable enclosure with dedicated plug to provide power to the modem. If a wireless modem is used, the Contractor shall ensure the modem or antenna is installed in a location such that it can reliably communicate (i.e. ensure there is sufficient signal available).

Refer to MCS0060 and MCS0110 for communication equipment and proposed layout. The Contractor's proposal shall include all preliminary works (normally done "By Others") to facilitate the installation of the building MCMS. Deviation to the above standards shall be documented and accepted by HOL before proceeding with the installation work.

6.5 Potential Removal of MCMS Equipment

During the installation process consideration should be given to facilitate an easy removal process of the building MCMS. Design points to be considered are:

- Each installation shall have low-impact to the building structure where the removal of the MCMS components will not require repairs to the building structure or for relocation of panels or enclosures.
- Installation of the MCMS equipment shall require minimal or no re-routing of the building's existing wiring.
- All MCMS equipment shall be labelled to ensure easy identification of panels and of metered circuits and their association to the building wiring. Labelling shall be fixed to the panels and not to removal panel doors.
- Detailed equipment mapping shall be used to aid in the identification of equipment that may need to be removed.
- All installation records shall be submitted to HOL for record keeping.

7. Commissioning Requirements

All installations shall conform to Measurement Canada's document P-E-04 '*Generic Procedures for Conducting Installation Verifications of Multiple Customer Metering Systems.*'

Based upon the LAN and WAN network topography agreed upon, the Contractor shall commission the MCMS communication network and ensure successful communication between the MCMU and the headend system.

Building MCMS shall be field commissioned, tested and verified by the Contractor in presence of HOL metering staff.

During the commissioning process the accuracy of the following shall be verified:

- 1) All potential and current transformers are correctly associated with their specific metered point.
- 2) Potential and current transformer polarity and phasing is correct.
- 3) Labels, diagrams and breaker labels are correct.
- 4) Meter badge numbers, as provided by HOL, are correctly associated with their respective loads.
- 5) Customer contact and unit address information is recorded as per HOL's Civic and Mailing Address Standard, DFS0009.
- 6) All MCMS panel parameters, circuit associations and programming requirements have been entered correctly and properly represented in the MCMS data files and onboard displays.
- 7) Panel usernames and password have been set and accurately recorded for submission to HOL.

8. Metering Equipment Identification

All labels shall be provided by the Contractor unless otherwise indicated below. All labels shall be Lamacoids or Lamacoid like labels, with Arial font style lettering in legible font sizes.

MCMU panel(s), ancillaries and communication enclosure(s) shall be sealed with utility seals provided by HOL and marked with the HOL logo.

8.1 MCMU Panel

The MCMU supply breaker shall have a brightly-coloured, non-removable label indicating the MCMU panel identifier and that the breaker is for a HOL metering device. If the breaker supplies multiple MCMU panels, each panel identifier (ex. MU001) shall be indicated on the disconnect label.

Each MCMU panel shall be marked with a HOL logo and indicate that it is an electricity meter. The panel shall also be marked with a label indicating that it is an offence to tamper with a meter.

The MCMU meter panels shall be individually identified using alphanumeric identifiers with the form Tier 1 HOL identifier (vault or pad-mounted transformer) - MU#### where #### represents the panel number. The panel number must be unique within a building and range from 001-999. The panel numbering sequence shall start at the first floor where an MCMU is required, incrementing from ground level upwards to the top floor.

The panel identifier label will include the meter badge range that is associated with that panel. The meter badge range shall be in the format OTT##### - #### where ##### indicates the starting badge number and -### indicates the last three numbers of the final badge number.

All disconnect switches shall have a brightly-coloured, non-removable label indicating the location of its supply and that the disconnect switch is for a HOL metering device.

Each service breaker shall clearly identify the unit it supplies with a label that is water resistant.

8.2 Instrument Transformers

The transformer power distribution block positions and wiring shall be labelled with the corresponding breaker number and unit identification.

All transformer leads shall be either labelled with non-removable labels or colour coded as per Measurement Canada's requirements.

Transformer circuits shall be marked with the HOL logo and indicate that they are part of a metering circuit.

9. As-Built Drawings

The Contractor shall be responsible for the completion of As-Built drawings for each worksite and be responsible for their submission and to HOL for approval. The As-Built drawings will be required after the installation has been commissioned. The Contractor shall use form GDG0010 – Schedule E1 for partial/final acceptance.

The As-Built drawings should be provided electronically in AutoCAD and PDF format and comply with the requirements listed in Appendix A.

Appendix A. Minimum Drawing Requirements

A.1. Basic Drawing Requirements (applies to all drawings)

- a. Title block (name building owner, date, drawing/project number, drawing revision number, civic address of building)
- b. Name & phone number of the Project Manager for the specific application
- c. Language: English
- d. Scale or Dimensions (where applicable): Metric
- e. Scale Size (where applicable): Riser drawing is a single line schematic and is normally not to scale
- f. Legend of symbols, line style & weights, colour, and nomenclature
- g. Two-dimensional format that minimizes the number of crossovers of lines representing the electrical circuits.
- h. Text size and style: when printed/plotted to designed paper size, the font is a minimum of 10 points and is a common legible font style
- i. Line style and thickness appropriate to clearly illustrate different objects and area of interest
- j. Line and text colour: colours should not be confusing and clearly illustrate different objects and areas of interest. Note that colour scheme shall be clearly legible when the drawing is printed/plotted out on white paper in black ink.
- k. White space management: the drawing objects and text shall have sufficient space between the different objects and area of interest as not to compress or clutter the drawing
- l. Produced in CAD software with a final non-secure PDF format output.
- m. Certified standards that have been applied
- n. The identification of the Professional Engineer Ontario who signed and approved the plan/design

A.2. Project Specific Drawing Orientation Requirements

- a. Building elevation separation from bottom to top of the drawing with each floor clearly labelled.
- b. Separate buildings by providing separate drawings.
- c. Common electrical wiring raceways/risers kept together on the drawing and uniquely identified.
- d. Each electrical panel clearly identified.
- e. Each room clearly identified.
- f. Electrical schematic captures all the electrical branches and their unique nomenclature with their main control points (switches, circuit breakers, fuses, transformers, existing meters) for the building electrical service entrance to each end load/generator to be metered
- g. Correct electrical connectivity and topology with source, loads, and generators
- h. Electrical control points (switches, circuit breakers, fuses, transformers, existing meters) ampacity rating, operating voltage, phasing, and circuit wiring configuration (eg. 100A, 347/600V, three phase, four wire, grounded wye)
- i. Generators and large motors (>3HP)
- j. Location of known hazardous materials within the building clearly identified

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