

Loss Equations Administration of Losses

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Document Change History

Issue	Reason for Issue	Date
1.0	Initial Release	June 1, 2016
1.1	Updates to Loss Calculation Formulae done by 'Metering' group.	March 31, 2017
2.0	Corrections made to loss calculation formulae and a few other paragraph updates	March 31, 2017
3.0	Issued for Baseline 44.1	December 2, 2020

Table of Changes

Reference (Section and Paragraph)	Description of Change
Throughout document	Updated to meet accessibility requirements pursuant to the <i>Accessibility for Ontarians with Disabilities Act</i> .

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1. Introduction

The Market Rules require revenue meters to be located at the defined meter point. If the revenue meter is not located at the defined meter point, the Market Rules require loss adjustments to be applied to the meter readings. The compensated readings represent metered values at the defined meter point.

1.1 Purpose

The purpose of the document is to describe how loss equations (fixed loss factors and loss coefficients) are applied to specific service points within the IESO's Meter Data Management (MDM) system.

1.2 Scope

This guide applies to all meter installations in the IESO-administered markets that are not located at the defined meter point.

1.3 Who Should Use this Document

This document is intended for the market participants and IT support staff in Revenue Metering.

– End of Section –

2. Accountability for Loss Equations

The metered market participant is accountable for providing the loss coefficients and loss factors for the site-specific loss equation models.

The IESO is accountable for the following:

- Defining standard loss-equation models;
- Defining the format for submission of parameters by the metered market participant;
- Adjusting metering data for site-specific losses.

– End of Section –

3. Loss Equations

This section describes the loss application rules and the loss equations used in the MDM system when applying losses to service points (including meter points and summary points).

3.1 Loss Application Rules

Losses adhere to the following rules:

- Losses are associated with loss codes.
- Losses have precedence and date effectivity within a loss code.
- Loss codes are associated with a service point.
- Loss calculations are based on precedence and time effectivity within a loss code.
- The rules for loss precedence are as follows:
 - For service points that are meter points, fixed factor losses and equation losses are cumulative; meaning within a loss code the loss from the first-order loss factor is applied to the load and used as the basis for the second-order loss factor, and so forth.
 - For service points that are summary points:
 - Fixed factor losses are cumulative; meaning that the loss is based on load plus losses obtained from subordinate meter points and summary points
 - Equation losses are not cumulative when the loss precedence flag attribute is NO for that trade date. The loss is based only on load from subordinate meter points and summary points
 - Equation losses are cumulative when the loss precedence flag attribute is YES for that trade date. The loss is based on load plus losses obtained from subordinate meter points and summary points

Note: The loss precedence flag attribute is configured in the MDM system as follows:

- Loss precedence flag = NO, before May 31, 2016, at 23:59:59
- Loss precedence flag = YES, after June 1, 2016, at 00:00:00.

3.2 Types of Losses

Loss Equations use up to two variables per equation when determining losses. Depending on the application of the losses, the MDM system uses the following methods:

Table 3-1: Types of Losses

Loss Type	Description
Fixed Factor	Calculation is kWh delivered and/or kWh received times the applicable delivered and/or received factor.
Method 1 SSLA – V ² h+I ² h Equation	Transformer Equation – loss type defined as per V ² h and I ² h
Method 2 SSLA – Volt-Ampere Equation	Volt-Ampere Equation – loss type defined as per VA

Note: SSLA is defined in Market Manual 3: Metering, Part 3.5: Site-Specific Loss Adjustments Procedure.

3.2.1 Fixed Factor Losses

Fixed Factor Losses have a delivered and received component:

- *Load and Losses for Active Energy Delivered = kWh_{Del} * (1 + FF_{Del})*
- *Load and Losses for Active Energy Received = kWh_{Rec} * (1 + FF_{Rec})*

The calculation multiplies the delivered and received active energy (kWh) values by their appropriate fixed factors for each interval. Precedence is adhered to as described in Section 3.1 above.

3.2.2 Equation Losses

There are two types of Equation Losses:

- Method 1 SSLA – V²h+I²h Equation and
- Method 2 SSLA – Volt-Ampere Equation

3.2.2.1 Method 1 SSLA – V²h+I²h Equation

This loss calculation formula is applied on a per interval basis and calculated per delivered and received active energy channels:

$$\begin{aligned} & \text{Load and Losses for Active Energy Delivered} \\ & = kWh_{Del} + r_{del} * \left(a * \sum \text{voltage channels} + b * \sum \text{current channels} \right) \end{aligned}$$

$$\begin{aligned} & \text{Load and Losses for Active Energy Received} \\ & = kWh_{Rec} - r_{rec} * \left(a * \sum \text{voltage channels} + b * \sum \text{current channels} \right) \end{aligned}$$

Where

- a = A coef (V²h value in loss code parameter record for loss code)
- b = B coef (I²h value in loss code parameter for loss code)
- rdel || rrec = compare kWh Delivered to kWh Received at every interval
 - If both zero, rdel = 1, rrec = 0
 - If both non-zero and Distribution Flag = NO, rdel = 1, rrec = 1
 - Otherwise If Distribution Flag = YES, OR If kWh Delivered > 0 and kWh Received = 0, OR If kWh Delivered = 0 and kWh Received > 0
 - rdel = kWh Delivered / (kWh Delivered + kWh Received)
 - rrec = kWh Received / (kWh Delivered + kWh Received)

Note: The loss distribution flag attribute is configured in the LPS system as follows:

- Loss distribution flag = NO, before May 31, 2016, at 23:59:59
- Loss distribution flag = YES, after June 1, 2016, at 00:00:00

The following additional logic applies:

If $\sum V^2h = 0$ and $\sum I^2h = 0$,

$$V^2h = \frac{\text{assumed } V^2}{IPH}$$

$$I^2h = \left(\frac{1000}{N} \right)^2 * \frac{(kVAH \text{ Delivered} + kVAH \text{ Received})^2}{\text{average } V^2h (CT * VT)^2}$$

If $\sum V^2h = 0$ and $\sum I^2h > 0$,

$$V^2h = \left(\frac{1000}{N} \right)^2 * \frac{(kVAH \text{ Delivered} + kVAH \text{ Received})^2}{\text{average } I^2h (CT * VT)^2}$$

If $\sum V^2h > 0$ and $\sum I^2h = 0$,

$$I^2h = \left(\frac{1000}{N}\right)^2 * \frac{(kVAH\ Delivered + kVAH\ Received)^2}{averageV^2h(CT * VT)^2}$$

If $\sum V^2h > 0$ and $\sum I^2h > 0$,

Use V^2h and I^2h

Where

$$kVAH\ Delivered = \sqrt{(kWh\ Delivered^2 + kVARh\ Delivered^2)}$$

$$kVAH\ Received = \sqrt{(kWh\ Received^2 + kVARh\ Received^2)}$$

If $kVARh$ Delivered and/or $kVARh$ Received is MISSING:

$$kVAH\ Delivered = \frac{kWh\ Delivered}{assumed\ PF}$$

$$kVAH\ Received = \frac{kWh\ Received}{assumed\ PF}$$

Assumed V^2h , assumed PF, CT ratio, VT ratio, N (Service Type) are parameters required for method 1 loss calculation.

If Service Type = D:

- $N = \sqrt{3}$

If Service Type = W:

- $N = 3$

Notes:

1. Service points that have a SSLA1 type loss code assigned to them will need to have the corresponding data elements of assumed voltage, assumed power factor, CT ratio, VT ratio, and service type assigned.
2. If at any interval kWh Delivered exists, but kVARh Delivered is missing, kVAh Delivered is computed by dividing kWh Delivered by the Assumed PF.
3. If at any interval kWh Received exists, but kVARh Received is missing, kVAh Received is computed by dividing kWh Received by the Assumed PF.
4. If at any interval kWh Delivered is missing, but kVARh Delivered exists, kVAh Delivered is 0.
5. If at any interval kWh Received is missing, but kVARh Received exists, kVAh Received is 0.
6. In the event that the values at any interval are 0 for all channels, a loss is still calculated, but it is based only on the number of channels multiplied by (assumed V^2h^2/IPH) the A coefficient.

3.2.2.2 Method 2 SSLA – Volt-Ampere Equation

This loss calculation formula is applied on a per interval basis:

$$\begin{aligned} & \textit{Load and Losses for Active Energy Delivered} \\ & = kWh_{Del} + \left(k1 * IPH * \frac{kVAh_{del}^2}{1000000} + k2 * \frac{kVAh_{del}}{1000} + k3 * \frac{r_{del}}{IPH} \right) \end{aligned}$$

$$\begin{aligned} & \textit{Load and Losses for Active Energy Received} \\ & = kWh_{Rec} - \left(k1 * IPH * \frac{kVAh_{rec}^2}{1000000} + k2 * \frac{kVAh_{rec}}{1000} + k3 * \frac{r_{rec}}{IPH} \right) \end{aligned}$$

Where

- k1, k2, k3 are coefficients of the Method 2 loss code
- kVAH is as above
- rdel is 1 if DISTRIBUTION=NO else kWhdel/(kWhdel + kWhrec)
- rrec is 1 if DISTRIBUTION=NO else kWhrec/(kWhdel + kWhrec)

Note: The loss distribution flag attribute is configured in the LPS system as follows:

- Loss distribution flag = NO, before May 31, 2016, at 23:59:59
- Loss distribution flag = YES, after June 1, 2016, at 00:00:00

At any interval,

- If kWhdel = 0 and kWhrec = 0, use the formula for Losses Delivered but set rdel to one.
- If kWhdel > 0 and kWhrec > 0, use both formulae above
- If kWhdel > 0 and kWhrec = 0, use formula for Losses Delivered
- If kWhdel = 0 and kWhrec > 0, use formula for Losses Received

– End of Section –

Appendix A: Loss Calculations – Method 1 SSLA

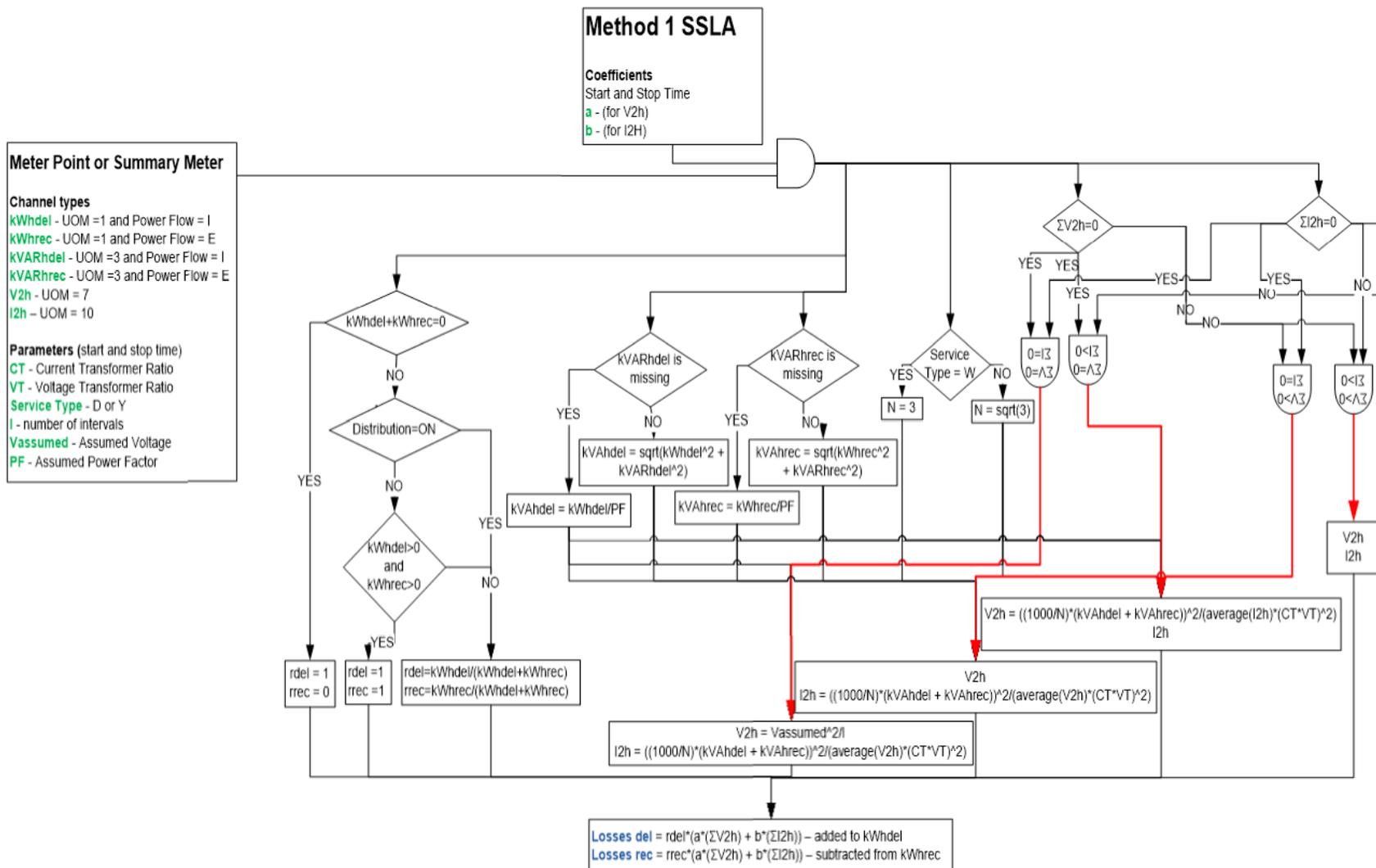


Figure A-1: Loss Calculations Method 1 SSLA

Appendix B: Loss Calculations – Method 2 SSLA

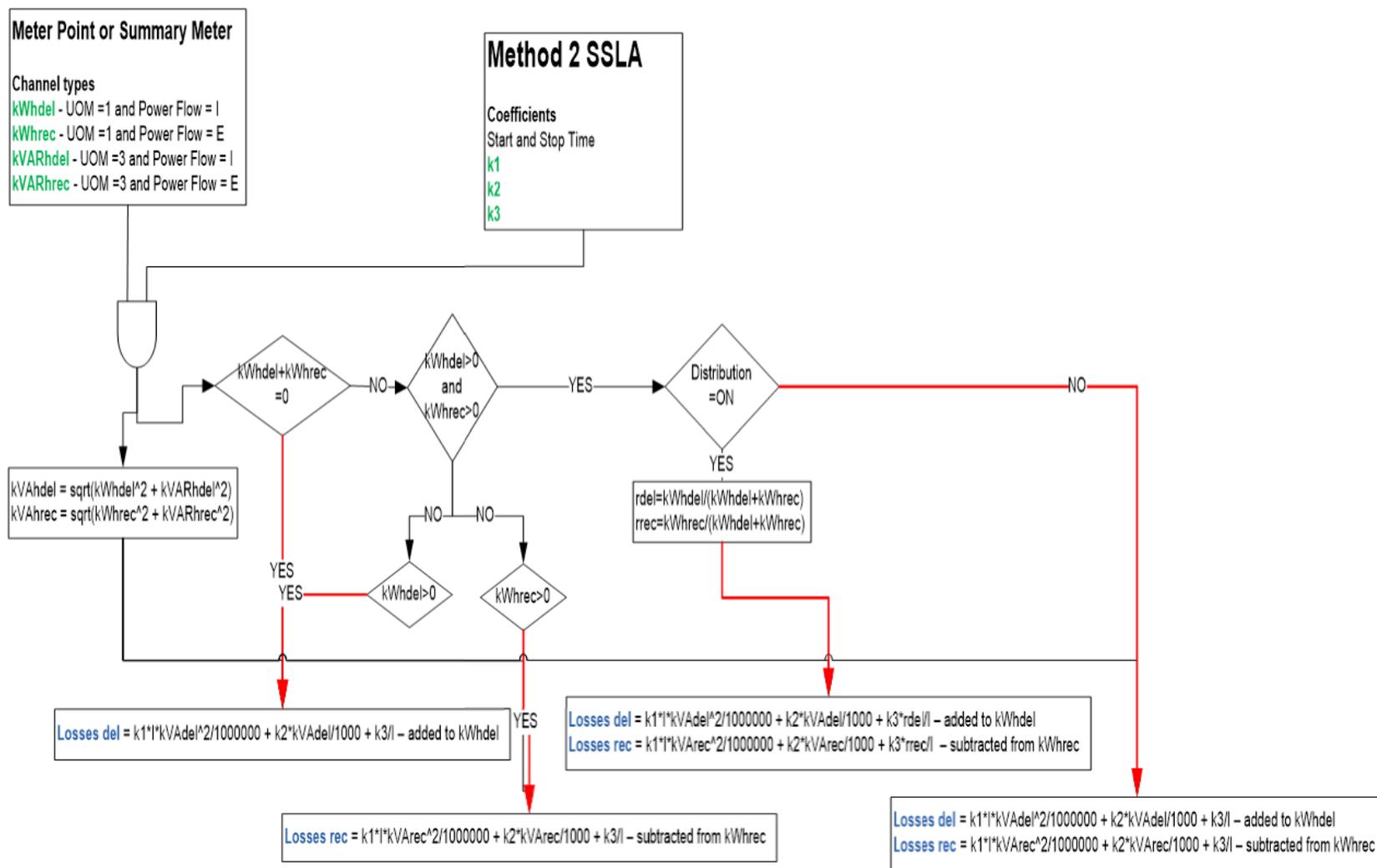


Figure B-1: Loss Calculations Method 2 SSLA

References

Document Title	Document ID
Market Manual 3: Metering, Part 3.5: Site-Specific Loss Adjustments Procedure	MDP_PRO_0011

Related Documents

Document Title	Document ID

– End of Document –