

CARMA Standards for Validating, Editing, and Estimating Monthly and Interval Data

1. Introduction

This document defines the data validation, editing, and estimation techniques used by CARMA to verify meter reads. Meter reads include consumption and Time-of-Use (TOU) consumption.

2. Required data validation checks

Data validation checks are designed to identify things that can go wrong at the meter/recorder and cause the data collected not to reflect actual usage.

The following checks are required for monthly data validation for kWh.

Time Base

Check for the following:

- Time drift of meter reading device / system shown in coincident demand display within MMServ
- If coincident demand is not employed then ensure Master/PC Clock setting within mmsys.dat

High/low Usage

Check for the following:

- Confirm multipliers within config.dat
- Loss of PT's (voltage reference)
- Broken meter (unexplained voltage or current values)

Zero Consumption For Active Meters

Check for the following:

- loss of communication
- loss of log files (interval data)
- loss of PT's (voltage reference)
- meter doesn't register (zero reads)

Meter identification

Check for the following:

- that the meter ID within the config.dat matches Wiring Diagram
- the meter has not been changed out or moved
- the data is being reported for the correct meter (cross posting)

3. Rules for Monthly Data Validation Check

For monthly data, Carma performs validation of the collected data on a daily basis. There will be situations where checks could be done beyond this daily validation if problems are encountered triggered by the daily evaluation.

All of the Carma checks and estimation algorithms are based on historical data for the same customer and the same site.

3.1. Time Check Of Meter Reading Device/System

Time check of meter reading device/system ensures that the collection device is synchronized to a national time standard before data collection begins.

3.2. Time Tolerance Check Of Meter (Coincident Demand setting)

The time tolerance check is only required if the meter is collecting data using Demand billing. It verifies that the meter's time is correct, and that the demand interval represents the appropriate time periods. Note that depending on the communication technology used, network latency must be taken into account.

3.2.1. If time in meter is within ± 9 seconds of the time standard, the data has passed Time Tolerance check. Note that if the meter is within ± 9 seconds of the standard, the time in the meter can optionally be corrected.

3.2.2. If time in meter is off > 9 seconds but ≤ 1 minute, the data passes the Time Tolerance check.

3.2.3. If time in meter is off > 1 minutes, the data fails the time tolerance check and must be estimated. The time in the meter must be reset. If the meter fails the time tolerance check after being reset for three consecutive months, the meter must be physically inspected/tested.

3.3. High/Low Usage

High low usage is calculated during the meter read load into the CIS system. High Low parameters are set within the CIS to identify reads that are outside of these parameters.

The High/Low Usage check validates cumulative consumption (kWh). Two methods are provided - one based on historical data, and one based on previous day data from similar customers.

3.5. TOU Usage

Carma performs the following checks and adjustment for the TOU meters.

If we have the following TOU periods:

| <u>Time</u> | <u>Period</u> |
|---------------|---------------|
| 7 am to 11 am | Mid-Peak |
| 11 am to 5 pm | On-Peak |
| 5 pm to 7 pm | Mid-Peak |
| 7 pm to 7 am | Off-Peak |

And if we had log records up until 10:00 AM (consumption of 5,000) and then starting again at 1:00 PM (consumption of 6,200) then we would calculate the 11:00 END reading to be:

| | | |
|-------|-------|-----|
| 10 | 5,000 | |
| 10.25 | 5,100 | 100 |
| 10.5 | 5,200 | |
| 10.75 | 5,300 | |
| 11 | 5,400 | |
| 11.25 | 5,500 | |
| 11.5 | 5,600 | |
| 11.75 | 5,700 | |
| 12 | 5,800 | |
| 12.25 | 5,900 | |
| 12.5 | 6,000 | |
| 12.75 | 6,100 | |
| 1 | 6,200 | |

The TOU usage check takes the last two readings that we have, finds the difference between them and divides that by the number of 15 minute intervals in between them (as this is how much we would then add on for each 15 minute period). i.e. using the example above the 11:00 reading would be 5,400.

When we are calculating the TOU periods we are always taking the CONSUMPTION for the 15 minute intervals and doing a subtraction (i.e. to calculate the first 'bucket' we would take the reading at 11:00 AM and subtract from it the reading at 7:15).

3.6. Zero Consumption for Active Meters

The Zero Consumption checks for zero usage during the billing month.

3.6.1. If the meter is an active meter (i.e., is associated with a customer who has financial responsibility), calculate the usage for the present billing month. Within the Carma system this check is performed daily.

3.6.2. If the usage is greater than 0, the data passes the zero consumption check.

3.6.3. If the usage is 0, the data failed the zero consumption check. Optionally verify the meter reading by re-reading the meter and/or testing the meter. If the reread is the same and the usage is still 0, the data failed the Zero Consumption check but is verified. If a new, different meter reading is obtained, run all the checks again using the new data

3.6.4. Data that fails the zero consumption check may be manually investigated and verified if justification is found (for example, a building or equipment that is only used seasonally). If the data is not validated or verified, it must be estimated. This is normally done within our database software on a daily basis.

3.10. Meter Identification

While Carma only performs remote reads of their meters, an external verification of the register can be done on-site with our local displays.

Meter Reading Method Perform Internal ID Check

If the meter is read remotely the Internal Meter Identification check is performed. This compares the meter's internal identification (Emp # Meter #) with the identification expected by the meter reading system (programmed in the config.dat). If they match, the data passes this check. If they don't match, Carma will investigate why the meter is different than indicated by their records and resolve the inconsistency

4. Monthly Data Estimation Rules

CARMA maintains a record of the estimation algorithm used for each data element that is estimated. Monthly data estimation algorithms include:

- Estimation based on preceding billing period's data (≥ 27 days)
- Estimated demand based on average load

4.1. Estimating Usage

Carma will estimate usage based on historical usage for the same customer and site.

4.1.1. Method 1 - Based on Historical Usage

4.1.1.1. Calculate ADU to be applied

4.1.1.1.1. If billing data is available from the same customer and same site for the same billing period last year and it is not estimated, calculate the ADU for the same billing period last year and use this value as the ADU. In this case, the estimation algorithm is estimation based on previous year's data.

4.1.1.1.2. If there is no data from the previous year but there is a full preceding billing month (at least 27 days) calculate the ADU for the preceding billing month and use this value for the ADU. In this case, the estimation algorithm is estimation based on preceding billing period's data.

4.1.1.1.3. If neither of the previous two options are available, data must be estimated based on any available data, which would be previous months beyond the last 27 days (see 4.1.1.2 and 4.1.1.3).

4.1.1.2. Calculate the number of days since the last good meter reading within the current billing cycle to the end of this billing period. If the meter is read monthly, this would typically be last month's billing meter reading. If the meter is read more frequently, this could be more recent than last month's billing reading.

4.1.1.3. Multiply the ADU (including any constants or factors) by the number of days since the last good reading. If necessary, divide this value by a meter constant or other factor to convert it to the same units reported in the meter reading. Truncate the value to an integer, and add the truncated value to the last good reading to obtain an estimated reading. This is the estimated meter reading. Mark the reading as being estimated using the appropriate algorithm.

4.2 Estimating TOU Usage

For missing TOU usage data, each period must be estimated using the methods outlined above under Section 4.1 within the separate TOU time periods.