**RIASSUNTO MANUALE PDC**

**Aggregation function**: this function is used to aggregate time-synchronized data with identical time stamps from multiple phasor measurement units (PMUs) or PDCs. Since data from different PMUs may not arrive at the same time, the function waits for data from all PMUs (and/or PDCs) to arrive before **aggregating and transmitting output data**. However, to prevent occasional loss of data from a PMU holding up the output indefinitely, this **wait time is limited**. Data arriving within a specified wait time is included in the output data stream, and data arriving beyond is excluded. They can use relative (local internal timer) or absolute (UTC) wait times.

Different applications may have different latency and data requirements, creating the need for the function to furnish multiple data streams with independent, settable wait times.

The PDC shall collect PMU data from all its inputs and place data **with valid and matching time stamps** in a data frame and transmit it to the designated destination. The **destination can be an output stream or a local function/application**.

The sort-by-arrival function allows inclusion of data in a transmission even if its time stamp does not match the time stamp for that transmission.

Absent data is the expected data that fails to arrive at the PDC by the end of the wait time in use. If some of the **input data is absent** when the output frame is assembled, the PDC shall provide an **absent data tag in its output** in accordance with the protocol used. See figure below for examples.

**If no data arrives** when a PDC is using relative wait time, the wait timer cannot initiate, and no output data transmission is possible. The receiver of output data receives nothing and has no indication of the cause of the problem. To address this situation, the PDC shall implement a **data loss timer**. The timer begins when the output stream is enabled, and when any data frame is transmitted. It times out after a user-selected time setting. If any valid data arrives and any data is transmitted during this interval, the timer shall restart. If it times out, the PDC shall transmit output data consisting entirely of **absent data tags**. The data loss timer interval shall be user configurable. The minimum allowed interval shall be greater than the user-configured wait time.

It shall be possible to include an input signal in multiple output streams.

Generally, the PDC function requires incoming data to be either copied straight into the output data stream or **converted to a different format** (e.g., rectangular/polar, floating/fixed point). The data are expected to be essentially unchanged. However, at times, a PDC may be required to perform phase adjustments on the incoming signal before it is sent to the destination. This need may arise when phase identification or sequence are different between the measuring system and the application system.

The PDC shall **create event logs available** in human-readable form, and available for export. The manufacturer shall specify the size, format, and access method for each of the following logs. The PDC shall gather a **count of data frame failures**. These shall be stored internally by the PDC, available to the user in human-readable format, and available for export. The manufacturer shall specify the access method. It shall be possible for the user to reset the counts. Data **frame failures** shall be counted separately as follows for each input stream:

1. **Frame not arrived**: The PDC shall record, for each output that employs time alignment, the number of expected frames that did not arrive before the cessation of the respective wait time.
2. **CRC errors**: The PDC shall record the number of frames that were rejected for PMU protocol CRC errors.
3. **Time stamp errors**: The PDC shall record the number of frames that were rejected for time stamp errors, including rejections due to leap second non-compliance by incoming data.
4. **Data sorted by arrival**: The PDC shall record the number of data frames included in any data output stream marked with the “sort by arrival” tag (see C.1).
5. **Stream ID errors**: The PDC shall record the number of frames that were rejected for stream ID errors.

**Latency statistics** are useful for setting up wait times for the PDC. The following quantities shall be recorded, when the feature is enabled by the user:

1. **Arrival latency**: This is the difference between the time the PDC has received the arriving data and the time stamp of that data. It shall be calculated for each input stream, for each time stamp, for the duration set by the user. The usage of these measurements for determining wait times is described in Annex F.
2. **Maximum arrival latency**: The PDC shall also record the maximum arrival latency for each input stream. This shall be available to the user in human-readable format. The manufacturer shall specify the extraction method. It shall be possible for the user to reset this quantity.
3. **Departure latency**: This is the difference between the time the PDC has transmitted an output data frame and the time stamp of that data. It shall be calculated for each output stream, for each time stamp, for the duration set by the user.

**Adverse Data Conditions**: PDC may misoperate during an adverse data condition but shall **resume its functions** after the cessation of the disturbance without requiring physical access. It is necessary to define ranges for adverse conditions a PDC is expected to withstand and the recovery mode corresponding to each:

* **Data Arrival Related Conditions**
  + Duplicate data: An identical data frame arrives at the PDC within the wait time. The PDC shall accept one and reject the duplicate.
  + Data bursts (absolute wait time): All incoming data arrive after 90% of wait time is over but before the wait time has elapsed. The PDC shall accept all such data.
  + Data bursts (relative wait time): One PMU's data arrives and starts the wait timer. Data from remaining PMUs arrive after 90% of wait time is over. The PDC shall accept all such data.
  + Out-of-order data: Data frames may arrive out of sequence due to network delays. The PDC shall accept any data arriving within the wait time, regardless of sequence. In case of data forwarding, the data shall be forwarded regardless of order. Any data arriving after the wait time is over will be rejected unless the “sort by arrival” feature is in use.
* **Configuration Errors**: conditions where incoming data do not match the expected configuration.
* **Invalid Data**: conditions where incoming data do not conform to the protocol in use.
* **Time Sync Related**: issues due to clock/time synchronization problems.
* **Communication Network Related**
  + Released bottleneck: Multiple frames blocked in the network are released all at once. The PDC shall accept all arriving within wait time.
  + Pulled communications cable: The PDC shall recover from a disconnected cable. Disconnection durations shall be specified.
  + Router/switch restart: The PDC shall recover from input network device power cycles.
  + Spurious connection requests: The PDC receives excessive connection requests (e.g., equal to existing outputs every second). These shall be rejected without performance degradation.
  + Non-synchrophasor data: Valid but non-synchrophasor data formats (e.g., files) misrouted to the synchrophasor layer shall be rejected.

Table below resumes all the adverse data condition and relative PDC behavior. Three different resumption possibilities are defined as follows and

considered acceptable:

1. Recovery mode 1: No disruption

* No loss of data.
* A delay is acceptable.

1. Recovery mode 2: Resumption without a restart of the PDC function. Data loss during the adverse condition and for a short duration after the adverse condition has ceased. The duration to be no longer than 5 data frames from the slowest input stream.
2. Recovery mode 3: Resumption after a restart of the PDC function

* Data loss during the adverse condition.
* A restart triggered within the PDC or remotely by the user.
* A remote access before function resumption. If the PDC resumes function automatically after a restart, without manual access, data loss duration would be significantly reduced. However, this is not a requirement.
* Requiring physical access to the PDC is not acceptable.

Immagine che contiene testo, diagramma, Parallelo, schermata

Il contenuto generato dall'IA potrebbe non essere corretto.

Immagine che contiene testo, diagramma, Parallelo, Piano

Il contenuto generato dall'IA potrebbe non essere corretto.