

# Disturbance Monitoring Requirements in IEEE 2800-2022 and NERC Reliability Std PRC-028

i2X Forum for the Implementation of Reliability  
Standards for Transmission (i2X FIRST)



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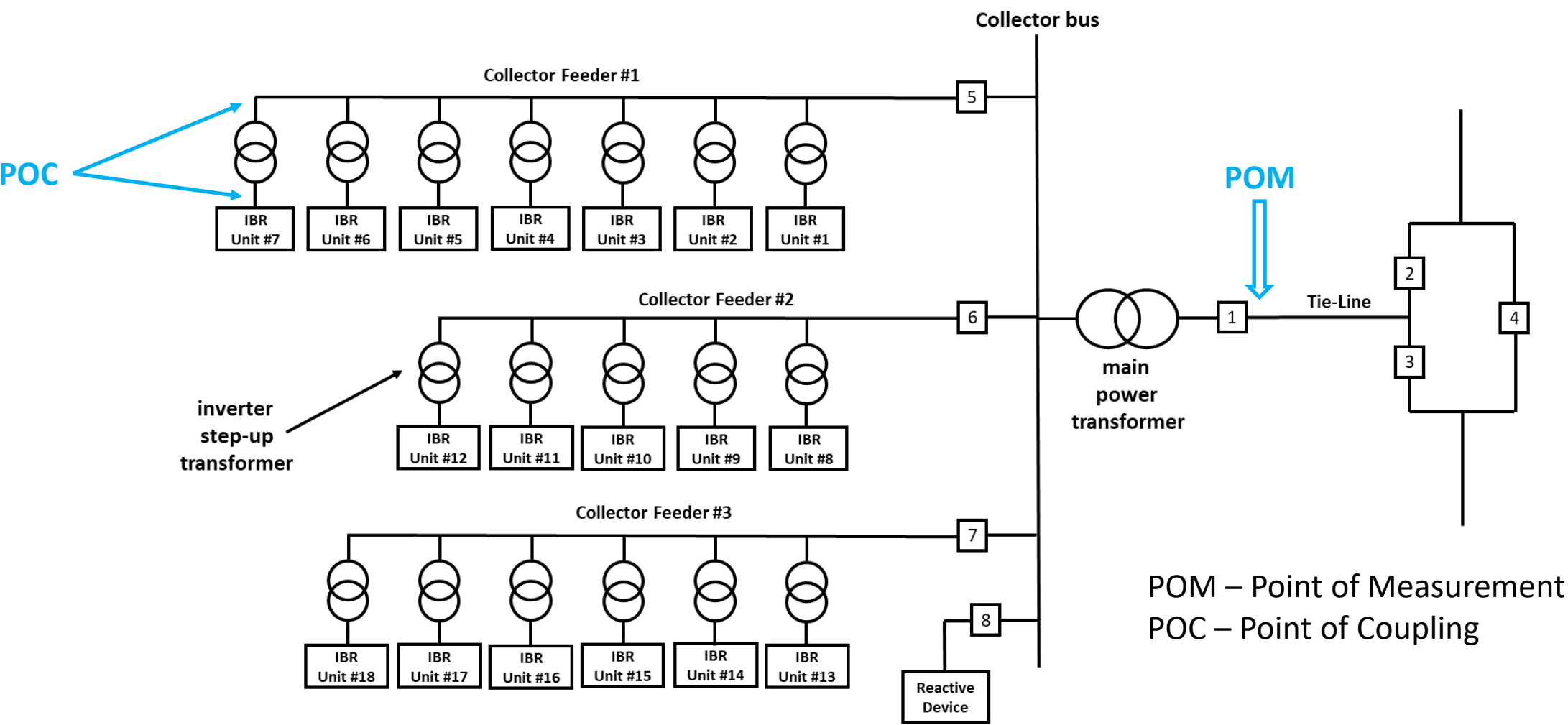
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Classification: **Public**

# IEEE 2800 versus PRC-028

	IEEE 2800-2022 Clause 11 (Measurement Data for Performance Monitoring and Validation)	PRC-028 Disturbance Monitoring and Reporting Requirements for IBRs	Comments
	Forward looking standard	Applicable to existing and new IBRs (BES and non-BES)	
SCADA Data	Yes	No	
Plant Level SER Data	Yes	Yes	Requirements in PRC-028 may be brief but serves purpose
Unit Level SER Data	Yes	Yes	
Plant Level DFR & DDR Data	Yes	Yes	
Unit Level DFR Data	Yes	No	In PRC-028, FR data from collector feeder breaker is required instead
Unit Level DDR Data	No	No	
Measurement Accuracy	Yes, except for unit level data	No	

# Unit Level Versus Plant Level



POC (unit level monitoring) Versus POM (plant level monitoring)

# IEEE 2800 versus PRC-028

## SCADA Data

Provision data type	Measurement/data points (as applicable)	Recording rate	Retention	Duration	Measurement (as applicable)
Plant SCADA data (CSV file)	<p>The plant SCADA system is often a lower resolution repository of information that, at minimum, shall include the following data points:</p> <p>Measurements</p> <ul style="list-style-type: none"><li>— <i>Point of measurement</i> voltage and medium-voltage collector system voltages</li><li>— <i>Point of measurement</i> frequency</li><li>— <i>IBR plant</i> active and reactive power output</li><li>— <i>IBR units</i> active and reactive power output of individual<sup>147</sup></li><li>— Shunt dynamic device reactive power output</li></ul> <p>Signals</p> <ul style="list-style-type: none"><li>— External control signals from the <i>TS operator</i> (BA, RTO, RC, etc.)</li><li>— External automatic generation control signals</li><li>— Active and reactive power commands sent to <i>IBR units</i></li></ul>	One record per s	1 year	One year	Subclause 4.4, Table 1

Not included in PRC-028

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# IEEE 2800 versus PRC-028

## Plant Equipment Status - Sequence of Event Recording Data

Provision data type	Measurement/data points (as applicable)	Recording rate	Retention	Duration	Measurement (as applicable)
Plant equipment status (tabular log file)	<ul style="list-style-type: none"><li>— All breaker statuses, including change of status log</li><li>— Shunt (dynamic or static) reactive compensation device statuses</li><li>— Substation transformer status (main step-up and collector system)</li><li>— Status of on load tap changer</li><li>— Medium-voltage collector system statuses</li><li>— Status of individual IBR units</li><li>— Time stamp</li><li>— Time synchronization (e.g., GPS status word) or status of the GPS clock signal</li></ul>	Static, as changed	1 year  20 calendar days	NA	Not applicable

PRC-028: Status of breakers associated with MPT, collector bus, reactive device(s), AC-DC & DC-AC converters in case of VSC-HVDC system with a dedicated connection to IBR, are included.

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# IEEE 2800 versus PRC-028

## Digital Fault Recording Data

Provision data type	Measurement/data points (as applicable)	Recording rate	Retention	Duration	Measurement (as applicable)
Digital fault recording (DFR) data (COMTRADE format and tabular log file)	<p>This data shall be captured for at least the plant-level (e.g., at the <i>point of measurement</i>) response to BPS events. It is typically high resolution (kHz) point-on-wave data (transient) and triggered based on configured settings. Data points shall include:</p> <ul style="list-style-type: none"><li>— Time stamp</li><li>— Phase-to-ground voltage for each phase</li><li>— Bus frequency (as measured/calculated by the recording device)</li><li>— Each phase current and residual or neutral current</li><li>— Calculated active and reactive power output</li><li>— If applicable, dynamic reactive device voltage, frequency, current, and power output</li><li>— Applicable binary status</li></ul>	<p><math>\geq 128</math> samples per cycle, triggered</p> <p><math>\geq 64</math> samples per cycle, triggered</p>	<p>90 days</p> <p>20 calendar days</p>	<p>5 s</p> <p>COMTRADE data, (split between pre-fault and post-fault data needs to be mutually agreed upon with the <i>TS owner/TS operator</i>)</p> <p>2 second</p>	<p>Subclause 4.4, Table 2</p>

PRC-028 includes measurement/data points with noted differences

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# IEEE 2800 versus PRC-028

## Dynamic Disturbance Recording Data

Provision data type	Measurement/data points (as applicable)	Recording rate	Retention	Duration	Measurement (as applicable)
Dynamic disturbance recorder (DDR) data (COMTRADE format and tabular log file)	<p>A DDR shall capture the specified plant-level data continuously at the <i>point of measurement</i>. This data can be used for multiple purposes including event analysis and disturbance-based model verification. Data points shall include:</p> <ul style="list-style-type: none"><li>— Time stamp</li><li>— Bus voltage phasor (phase quantities and positive-sequence)</li><li>— Bus frequency</li><li>— Current phasor (phase quantities and positive-sequence)</li><li>— Calculated active and reactive power output</li></ul>	<p>Input: <math>\geq 960</math> samples per s output: <math>\geq 60</math> times (records) per s, continuous<sup>149</sup> <b>Same in PRC-028</b></p>	<p>1 year  <b>20 calendar days</b></p>	<p>NA<sup>149</sup></p>	<p>Subclause 4.4, Table 2</p>

PRC-028 includes measurement/data points with noted differences

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# IEEE 2800 versus PRC-028

## Inverter Fault Codes & Dynamic Recordings

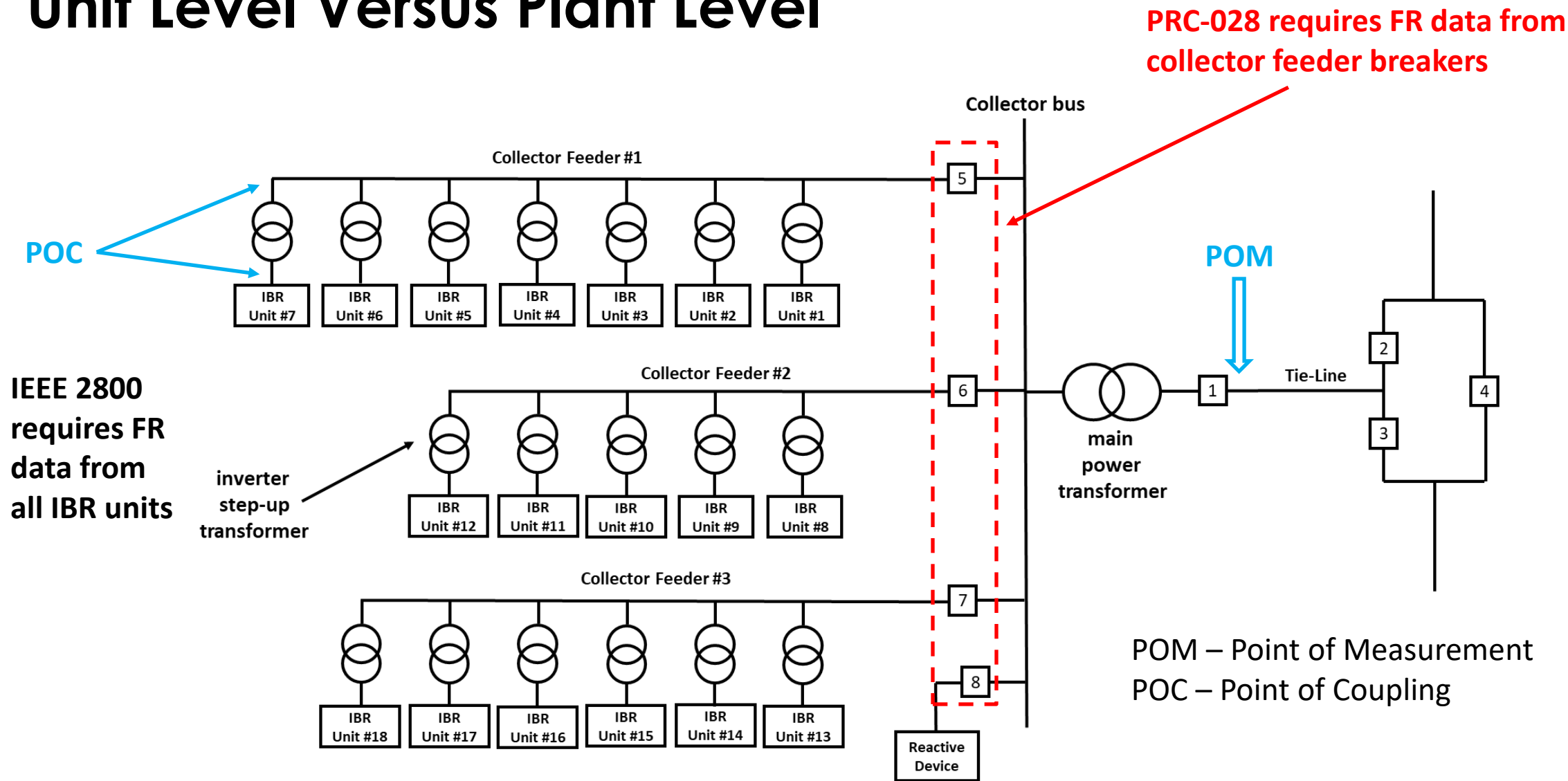
Provision data type	Measurement/data points (as applicable)	Recording rate	Retention	Duration	Measurement (as applicable)
Inverter fault codes and dynamic recordings (CSV file and tabular log file)	<p>For grid BPS faults/events which trigger ride-through operation of an <i>IBR unit</i> or cause it to trip, the following information shall be recorded at <i>IBR units</i> for analysis:</p> <ul style="list-style-type: none"> <li>— All major and minor fault codes</li> <li>— All fault and alarm status words</li> <li>— Change of operating mode</li> <li>— High- and low-voltage ride-through</li> <li>— High- and low-frequency ride-through</li> <li>— PLL loss of synchronism</li> <li>— DC current and voltage</li> <li>— AC phase currents and voltage</li> <li>— Pulse width modulation index (if applicable)</li> <li>— Control system command values, reference values, and feedback signals</li> </ul>	Many kHz, triggered	90 days <b>20 calendar days</b>	<p>5-s data, (split between pre-fault and post-fault data needs to be mutually agreed upon with the <i>TS owner/TS operator</i>)</p> <p><b>Not Applicable</b></p>	Stated by <i>IBR owner</i>

- Inverter Fault Codes: Required by PRC-028. Standard provides flexibility for IBR units in-service before the effective date of this standard.
- Dynamic Recordings: Not required by PRC-028.

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# Unit Level Versus Plant Level



**POC (unit level monitoring) Versus POM (plant level monitoring)**

# IEEE 2800 versus PRC-028

## Time Synchronization

	IEEE 2800-2022	PRC-028
	shall be synchronized to UTC with	shall be synchronized to UTC with
IBR Plant Level Monitoring	$\pm 1 \mu\text{s}$ time accuracy	$\pm 1 \text{ ms}$ time accuracy
IBR Unit Level Monitoring	$\pm 100 \mu\text{s}$ time accuracy	$\pm 100 \text{ ms}$ time accuracy

PRC-028 recognizes challenges of transmitting clock signal within the plant

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