



*expertmeter™*

High Performance Analyzer

PM180

IEC 61850 Communications Protocol

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Reference Guide

Every effort has been made to ensure that the material herein is complete and accurate. However, the manufacturer is not responsible for any mistakes in printing or faulty instructions contained in this book. Notification of any errors or misprints will be received with appreciation.

For further information regarding a particular installation, operation or maintenance of equipment, contact the manufacturer or your local representative or distributor.

#### REVISION HISTORY

|    |          |   |
|----|----------|---|
| A1 | Oct 2012 | Initial release   |
| A2 | Feb 2013 | Added configurable measurement units, datasets and RCBs, and generating IID/CID files.  |
| A3 | May 2019 | Added PMU logical device, LTIM and LTMS logical nodes, and IEC 61850-9-5 multicast sampled values control block.                                      |
| A4 | Nov 2019 | Added maxMMXU1 maximum/peak measurements node.  |
| A5 | Oct 2020 | The IEC 61850 conformance statement is moved to a separate document.<br>Updated IEC 61850 configuration instructions for the new Ed1/Ed2 PAS release. |

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# 1 General

This document provides information on setting up and operating an IEC 61850 server in PM180 devices with IEC 61850-8-1 and IEC 61850-9-2 interfaces compliant with the IEC 61850 set of standards.

See the PM180 IEC 61850 Conformance Statement (PICS, PIXIT, MICS, TICS) for information on the device data object model, protocol implementation, and communication capabilities of the PM180 IEC 61850 server.

Refer to the PM180 Operation Manual for basic information on configuring and operating the PM180.

See the PM180 Bay Control Unit application note for information on configuring and operating the bay controller.

## IMPORTANT

Control commands addressed to the CSWI switch controller nodes and to the boGGIO general binary output nodes will be rejected until the internal BOOLEAN variable REMOTE MODE is set to TRUE via a setpoint logic equation. See Controls in Section 2.2 for details.

This document applies to PM180 devices with firmware version 31.1Y.XX for IEC 61850 Ed1 and 31.2Y.XX for IEC 61850 Ed2 releases, where XX indicates the firmware build number and Y indicates the PQ standard implemented in the device.

The IEC 61850 configuration instructions apply to PAS V1.5.4.19 and higher.

## IMPORTANT

Since PAS V1.5.4.19, a new database format is used to store IEC 61850 settings, so older versions of PAS may not recognize your settings in databases created by newer PAS versions. However, you still have the option to import IEC 61850 settings from legacy databases or continue to use previously created databases, but in each case PAS will prompt you to re-save your settings in the new format.

## 2 Impact of the device settings

### 2.1 Logical device mode

Logical device mode given by LLN0.Mod is always ON.

### 2.2 Controls

The Loc attribute in logical nodes containing controls indicates the complementary status of the internal BOOLEAN variable REMOTE MODE defaulted to FALSE. It is controlled via a setpoint logic equation that should normally check the status of an external Local/Remote switch.

Control commands addressed to the CSWI switch controller nodes and to the boGGIO general binary output nodes will be rejected with AddCause=2 Blocked-by-switching-hierarchy until REMOTE MODE is set to TRUE via a logic equation.

The PM180 can provide additional protection for control nodes based on client IP addresses by enabling control commands for specific clients and disabling or conditional blocking via logic equations for others. Commands received from a blocked client port are rejected with AddCause=2 Blocked-by-switching-hierarchy.

### 2.3 Measurement units

Voltage, current and power units are selectable (see Section 3.2 for details).

| Measurement type | Units (precision)                                     |   |
|------------------|---|---|
|                  | PT = 1  | PT > 1  |
| Current          | A/kA (0.01 A)   | A/kA (0.01 A)                                     |
| Voltage AC       | V/kV (0.1 V)  | V/kV (1 V)  |
| Power            | kW, kVA, kvar or MW, Mvar, MVA<br>(0.001 kW/kVA/kvar) | kW, kVA, kvar or MW, Mvar, MVA<br>(1 kW/kVA/kvar) |
| Energy           | 0.001/0.01/0.1/1 kWh, kVAh, kvarh                     | 0.001/0.01/0.1/1 kWh, kVAh, kvarh                 |

### 2.4 Process Measurement Limits

| Measurement type                       | Measurement limits |                       |  |
|--|--------------------|-----------------------|--|
|  | Condition          | min                   | max  |
| Current (standard inputs)              |                    | 0                     | Current Scale × CT Ratio <sup>1, 2</sup><br>(Imax) |
| Auxiliary current I4 (standard input)  |                    | 0                     | Current Scale × I4 CT Ratio <sup>1, 2</sup>        |
| Current (extended inputs)              |                    | 0                     | 20 × CT Primary current                            |
| Auxiliary current I4x (extended input) |                    | 0                     | 20 × I4 CT Primary current                         |
| Voltage AC                             |                    | 0                     | Voltage Scale × PT Ratio <sup>3</sup><br>(Vmax)    |
| Auxiliary voltage V4                   |                    | 0                     | Voltage Scale × V4 PT Ratio <sup>3</sup>           |
| Power signed (kW, kvar)                |                    | -Vmax × Imax × 2/1000 | Vmax × Imax × 2/1000 <sup>4</sup>                  |

| Measurement type   | Measurement limits |                           |  |
|--|--------------------|---------------------------|--|
|  | Condition          | min                       | max                                      |
| Power unsigned (kVA, kW import/export, kvar import/export) and power demands |                    | 0                         | $V_{max} \times I_{max} \times 2/1000^4$ |
| Power factor signed  |                    | -1.000                    | 1.000                                    |
| Power factor unsigned (lag, lead)  |                    | 0                         | 1.000                                    |
| Unbalance  |                    | 0                         | 300.0                                    |
| THD  |                    | 0                         | 999.9                                    |
| TDD  |                    | 0                         | 999.9                                    |
| K-Factor   |                    | 1.0                       | 999.9                                    |
| Harmonics  |                    | 0                         | 100.00                                   |
| Analog inputs  | +/-1mA             | -AI full scale $\times$ 2 | AI full scale $\times$ 2                 |
|  | 0-20mA             | AI zero scale             | AI full scale                            |
|  | 4-20mA             | AI zero scale             | AI full scale                            |
|  | 0-1mA              | AI zero scale             | AI full scale                            |
|  | 0-50mA             | AI zero scale             | AI full scale $\times$ 2                 |
|  | +/-10V             | -AI full scale            | AI full scale                            |

**NOTES:**

1. CT Ratio = CT primary current/CT secondary current.
2. The default Current Scale is  $4 \times$  CT secondary current for devices with a 400% overload (ANSI) or  $2 \times$  CT secondary current for devices with a 200% overload (IEC). It can be changed via the Device Options setup in PAS.
3. The default Voltage Scale is 828V. It can be changed via the Device Options setup in PAS.
4. If PT Ratio = 1.0 and Pmax is greater than 9,999 kW, then it is truncated to 9,999 kW.

## 2.5 Deadbands

The db value represents the percentage of difference between max and min process measurement limits indicated in the table above. The default db (deadband) attribute values in functional constraint CF are defined in the ICD file. They can be changed to provide reasonable conditions for generating reportable events.

## 2.6 Textual descriptions

The default d (textual description of the data) attribute values in functional constraint DC are defined in the device. They can be changed for descriptions of measured/metered and status data.

## 2.7 Preconfigured Datasets

### Predefined Datasets

| Item                            | Value/Comments  |
|---------------------------------|---|
| Predefined datasets in ICD file | Measurand data:<br>MET1/LLN0\$DSet01Mx<br>MET1/LLN0\$DSet02Mx<br>MET1/LLN0\$DSet03Mx<br>MET1/LLN0\$DSet04St<br>MET1/LLN0\$DSet05Mx<br><br>Status data:<br>MET1/LLN0\$DSet01StInd<br>MET1/LLN0\$DSet02StInd<br>MET1/LLN0\$DSet03StInd<br>MET1/LLN0\$DSet04StInd<br>MET1/LLN0\$DSet04StSPCSO<br>MET1/LLN0\$DSet05StSPCSO<br>MET1/LLN0\$DSet06StSPCSO<br>MET1/LLN0\$DSet07StSPCSO<br>MET1/LLN0\$DSet08StInd<br>MET1/LLN0\$DSet09StInd<br>MET1/LLN0\$DSet09StFitNum<br><br>GOOSE publisher data set:<br>CTRL/LLN0\$DSetGOOSE1<br><br>MSV publisher data set:<br>PMU/LLN0\$DSetSV1 |

### Predefined Dataset Members

| Dataset name        | Members   |
|---------------------|---|
| MET1/LLN0\$DSet01Mx | MET1/osvMMXU1\$MX\$AvPhV<br>MET1/osvMMXU1\$MX\$AvPPV<br>MET1/osvMMXU1\$MX\$AvA<br>MET1/osvMMXU1\$MX\$TotW<br>MET1/osvMMXU1\$MX\$TotVAr<br>MET1/osvMMXU1\$MX\$TotVA<br>MET1/osvMMXU1\$MX\$TotPF<br>MET1/osvMMXU1\$MX\$Hz   |
| MET1/LLN0\$DSet02Mx | MET1/osvMMXU1\$MX\$PhV\$phsA<br>MET1/osvMMXU1\$MX\$PhV\$phsB<br>MET1/osvMMXU1\$MX\$PhV\$phsC<br>MET1/osvMMXU1\$MX\$PPV\$phsAB<br>MET1/osvMMXU1\$MX\$PPV\$phsBC<br>MET1/osvMMXU1\$MX\$PPV\$phsCA<br>MET1/osvMMXU1\$MX\$A\$phsA<br>MET1/osvMMXU1\$MX\$A\$phsB<br>MET1/osvMMXU1\$MX\$A\$phsC<br>MET1/osvMMXU1\$MX\$A\$neut |
| MET1/LLN0\$DSet03Mx | MET1/osvMMXU1\$MX\$W\$phsA<br>MET1/osvMMXU1\$MX\$W\$phsB<br>MET1/osvMMXU1\$MX\$W\$phsC  |

| Dataset name             | Members  |
|--------------------------|--|
|                          | MET1/osvMMXU1\$MX\$VAr\$phsA<br>MET1/osvMMXU1\$MX\$VAr\$phsB<br>MET1/osvMMXU1\$MX\$VAr\$phsC<br>MET1/osvMMXU1\$MX\$VA\$phsA<br>MET1/osvMMXU1\$MX\$VA\$phsB<br>MET1/osvMMXU1\$MX\$VA\$phsC<br>MET1/osvMMXU1\$MX\$PF\$phsA<br>MET1/osvMMXU1\$MX\$PF\$phsB<br>MET1/osvMMXU1\$MX\$PF\$phsC |
| MET1/LLN0\$DSet04St      | MET1/engMMTR1\$ST\$SupWh<br>MET1/engMMTR1\$ST\$DmdWh<br>MET1/engMMTR1\$ST\$SupVArh<br>MET1/engMMTR1\$ST\$DmdVArh   |
| MET1/LLN0\$DSet05Mx      | MET1/osvMMXU1\$MX\$AuxA<br>MET1/osvMMXU1\$MX\$AuxV<br>MET1/osvMMXU1\$MX\$ExtA\$phsA<br>MET1/osvMMXU1\$MX\$ExtA\$phsB<br>MET1/osvMMXU1\$MX\$ExtA\$phsC<br>MET1/osvMMXU1\$MX\$ExtAuxA<br>MET1/osvMMXU1\$MX\$AvExtA   |
| MET1/LLN0\$DSet01StInd   | MET1/biGGIO1\$ST\$Ind1<br>MET1/biGGIO1\$ST\$Ind2<br>...<br>MET1/biGGIO1\$ST\$Ind16<br>MET1/biGGIO2\$ST\$Ind1<br>MET1/biGGIO2\$ST\$Ind2<br>...<br>MET1/biGGIO2\$ST\$Ind16   |
| MET1/LLN0\$DSet02StInd   | MET1/biGGIO3\$ST\$Ind1<br>MET1/biGGIO3\$ST\$Ind2<br>...<br>MET1/biGGIO3\$ST\$Ind16<br>MET1/biGGIO4\$ST\$Ind1<br>MET1/biGGIO4\$ST\$Ind2<br>...<br>MET1/biGGIO4\$ST\$Ind16   |
| MET1/LLN0\$DSet03StInd   | MET1/biGGIO5\$ST\$Ind1<br>MET1/biGGIO5\$ST\$Ind2<br>...<br>MET1/biGGIO5\$ST\$Ind16<br>MET1/biGGIO6\$ST\$Ind1<br>MET1/biGGIO6\$ST\$Ind2<br>...<br>MET1/biGGIO6\$ST\$Ind16   |
| MET1/LLN0\$DSet04StInd   | MET1/biGGIO7\$ST\$Ind1<br>MET1/biGGIO7\$ST\$Ind2<br>...<br>MET1/biGGIO7\$ST\$Ind16<br>MET1/biGGIO8\$ST\$Ind1<br>MET1/biGGIO8\$ST\$Ind2<br>...<br>MET1/biGGIO8\$ST\$Ind16   |
| MET1/LLN0\$DSet04StSPCSO | MET1/boGGIO1\$ST\$SPCSO1   |

| Dataset name              | Members  |
|---------------------------|--|
|                           | MET1/boGGIO1\$ST\$SPCSO2<br>...<br>MET1/boGGIO1\$ST\$SPCSO8<br>MET1/boGGIO2\$ST\$SPCSO1<br>MET1/boGGIO2\$ST\$SPCSO2<br>...<br>MET1/boGGIO2\$ST\$SPCSO8   |
| MET1/LLN0\$DSet05StSPCSO  | MET1/boGGIO3\$ST\$SPCSO1<br>MET1/boGGIO3\$ST\$SPCSO2<br>...<br>MET1/boGGIO3\$ST\$SPCSO8<br>MET1/boGGIO4\$ST\$SPCSO1<br>MET1/boGGIO4\$ST\$SPCSO2<br>...<br>MET1/boGGIO4\$ST\$SPCSO8   |
| MET1/LLN0\$DSet06StSPCSO  | MET1/boGGIO5\$ST\$SPCSO1<br>MET1/boGGIO5\$ST\$SPCSO2<br>...<br>MET1/boGGIO5\$ST\$SPCSO8<br>MET1/boGGIO6\$ST\$SPCSO1<br>MET1/boGGIO6\$ST\$SPCSO2<br>...<br>MET1/boGGIO6\$ST\$SPCSO8   |
| MET1/LLN0\$DSet07StSPCSO  | MET1/boGGIO7\$ST\$SPCSO1<br>MET1/boGGIO7\$ST\$SPCSO2<br>...<br>MET1/boGGIO7\$ST\$SPCSO8<br>MET1/boGGIO8\$ST\$SPCSO1<br>MET1/boGGIO8\$ST\$SPCSO2<br>...<br>MET1/boGGIO8\$ST\$SPCSO8   |
| MET1/LLN0\$DSet08StInd    | MET1/spGGIO1\$ST\$Ind1<br>MET1/spGGIO1\$ST\$Ind2<br>...<br>MET1/spGGIO1\$ST\$Ind32   |
| MET1/LLN0\$DSet09StInd    | MET1/spGGIO2\$ST\$Ind1<br>MET1/spGGIO2\$ST\$Ind2<br>...<br>MET1/spGGIO2\$ST\$Ind32   |
| MET1/LLN0\$DSet09StFltNum | MET1/drRDRE1\$ST\$FltNum<br>MET1/drRDRE2\$ST\$FltNum<br>...<br>MET1/drRDRE8\$ST\$FltNum  |
| CTRL/LLN0\$DSetGOOSE1     | CTRL/QA1XCBR1\$ST\$Pos\$stVal<br>CTRL/QA1XCBR1\$ST\$Pos\$q<br>CTRL/QA2XCBR2\$ST\$Pos\$stVal<br>CTRL/QA2XCBR2\$ST\$Pos\$q<br>CTRL/QB1XSWI1\$ST\$Pos\$stVal<br>CTRL/QB1XSWI1\$ST\$Pos\$q<br>CTRL/QB2XSWI2\$ST\$Pos\$stVal<br>CTRL/QB2XSWI2\$ST\$Pos\$q<br>CTRL/QB3XSWI3\$ST\$Pos\$stVal<br>CTRL/QB3XSWI3\$ST\$Pos\$q |

| Dataset name      | Members  |
|-------------------|--|
|                   | CTRL/QB4XSWI4\$ST\$Pos\$stVal<br>CTRL/QB4XSWI4\$ST\$Pos\$q<br>CTRL/QB5XSWI5\$ST\$Pos\$stVal<br>CTRL/QB5XSWI5\$ST\$Pos\$q<br>CTRL/QB6XSWI6\$ST\$Pos\$stVal<br>CTRL/QB6XSWI6\$ST\$Pos\$q<br>CTRL/QE1XSWI7\$ST\$Pos\$stVal<br>CTRL/QE1XSWI7\$ST\$Pos\$q<br>CTRL/QE2XSWI8\$ST\$Pos\$stVal<br>CTRL/QE2XSWI8\$ST\$Pos\$q<br>CTRL/QE3XSWI9\$ST\$Pos\$stVal<br>CTRL/QE3XSWI9\$ST\$Pos\$q<br>CTRL/QE4XSWI10\$ST\$Pos\$stVal<br>CTRL/QE4XSWI10\$ST\$Pos\$q<br>CTRL/QE5XSWI11\$ST\$Pos\$stVal<br>CTRL/QE5XSWI11\$ST\$Pos\$q<br>CTRL/QE6XSWI12\$ST\$Pos\$stVal<br>CTRL/QE6XSWI12\$ST\$Pos\$q<br>CTRL/QE7XSWI13\$ST\$Pos\$stVal<br>CTRL/QE7XSWI13\$ST\$Pos\$q<br>CTRL/QE8XSWI14\$ST\$Pos\$stVal<br>CTRL/QE8XSWI14\$ST\$Pos\$q<br>MET1/osvMMXU1\$MX\$PhV\$phsA\$scVal<br>MET1/osvMMXU1\$MX\$PhV\$phsA\$q<br>MET1/osvMMXU1\$MX\$PhV\$phsB\$scVal<br>MET1/osvMMXU1\$MX\$PhV\$phsB\$q<br>MET1/osvMMXU1\$MX\$PhV\$phsC\$scVal<br>MET1/osvMMXU1\$MX\$PhV\$phsC\$q |
| PMU/LLN0\$DSetSV1 | PMU/MMXU1\$MX\$PhV\$phsA\$scVal\$mag<br>PMU/MMXU1\$MX\$PhV\$phsA\$scVal\$ang<br>PMU/MMXU1\$MX\$PhV\$phsA\$q<br>PMU/MMXU1\$MX\$PhV\$phsA\$t<br>PMU/MMXU1\$MX\$PhV\$phsB\$scVal\$mag<br>PMU/MMXU1\$MX\$PhV\$phsB\$scVal\$ang<br>PMU/MMXU1\$MX\$PhV\$phsB\$q<br>PMU/MMXU1\$MX\$PhV\$phsB\$t<br>PMU/MMXU1\$MX\$PhV\$phsC\$scVal\$mag<br>PMU/MMXU1\$MX\$PhV\$phsC\$scVal\$ang<br>PMU/MMXU1\$MX\$PhV\$phsC\$q<br>PMU/MMXU1\$MX\$PhV\$phsC\$t<br>PMU/MMXU1\$MX\$A\$phsA\$scVal\$mag<br>PMU/MMXU1\$MX\$A\$phsA\$scVal\$ang<br>PMU/MMXU1\$MX\$A\$phsA\$q<br>PMU/MMXU1\$MX\$A\$phsA\$t<br>PMU/MMXU1\$MX\$A\$phsB\$scVal\$mag<br>PMU/MMXU1\$MX\$A\$phsB\$scVal\$ang<br>PMU/MMXU1\$MX\$A\$phsB\$q<br>PMU/MMXU1\$MX\$A\$phsB\$t<br>PMU/MMXU1\$MX\$A\$phsC\$scVal\$mag<br>PMU/MMXU1\$MX\$A\$phsC\$scVal\$ang<br>PMU/MMXU1\$MX\$A\$phsC\$q<br>PMU/MMXU1\$MX\$A\$phsC\$t<br>PMU/MMXU1\$MX\$Hz\$mag<br>PMU/MMXU1\$MX\$Hz\$q                                     |

| Dataset name | Members   |
|--------------|---|
|              | PMU/MMXU1\$MX\$Hz\$t<br>PMU/MMXU1\$MX\$HzRte\$mag<br>PMU/MMXU1\$MX\$HzRte\$q<br>PMU/MMXU1\$MX\$HzRte\$t<br>PMU/MMXU1\$ST\$Health\$stVal<br>PMU/MMXU1\$ST\$Health\$q<br>PMU/MMXU1\$ST\$Health\$t<br>PMU/LPHD\$ST\$PhyHealth\$stVal<br>PMU/LPHD\$ST\$PhyHealth\$q<br>PMU/LPHD\$ST\$PhyHealth\$t |

## 2.8 Preconfigured Reports

### Predefined RCB

See Section 3.2 on configuring the number of RCB instances in the device.

| Number of Instances                            | Report ID  |
|--|--|
| Number of RCB instances = 1 (non-indexed RCBs) | 16 URCBs:<br>CTRL/LLN0\$RP\$URep01<br>CTRL/LLN0\$RP\$URep02<br>CTRL/LLN0\$RP\$URep03<br>CTRL/LLN0\$RP\$URep04<br>CTRL/LLN0\$RP\$URep05<br>CTRL/LLN0\$RP\$URep06<br>CTRL/LLN0\$RP\$URep07<br>CTRL/LLN0\$RP\$URep08<br>MET1/LLN0\$RP\$URep01<br>MET1/LLN0\$RP\$URep02<br>MET1/LLN0\$RP\$URep03<br>MET1/LLN0\$RP\$URep04<br>MET1/LLN0\$RP\$URep05<br>MET1/LLN0\$RP\$URep06<br>MET1/LLN0\$RP\$URep07<br>MET1/LLN0\$RP\$URep08<br>16 BRCBs:<br>CTRL/LLN0\$BR\$BRep01<br>CTRL/LLN0\$BR\$BRep02<br>CTRL/LLN0\$BR\$BRep03<br>CTRL/LLN0\$BR\$BRep04<br>CTRL/LLN0\$BR\$BRep05<br>CTRL/LLN0\$BR\$BRep06<br>CTRL/LLN0\$BR\$BRep07<br>CTRL/LLN0\$BR\$BRep08<br>MET1/LLN0\$BR\$BRep01<br>MET1/LLN0\$BR\$BRep02<br>MET1/LLN0\$BR\$BRep03<br>MET1/LLN0\$BR\$BRep04<br>MET1/LLN0\$BR\$BRep05<br>MET1/LLN0\$BR\$BRep06<br>MET1/LLN0\$BR\$BRep07<br>MET1/LLN0\$BR\$BRep08 |

| Number of Instances  | Report ID  |
|--|--|
| Number of RCB instances = 1 (indexed RCBs, RptEnabled max=1) | 16 URCBs:<br>CTRL/LLNO\$RP\$URepA01<br>CTRL/LLNO\$RP\$URepB01<br>CTRL/LLNO\$RP\$URepC01<br>CTRL/LLNO\$RP\$URepD01<br>CTRL/LLNO\$RP\$URepE01<br>CTRL/LLNO\$RP\$URepF01<br>CTRL/LLNO\$RP\$URepG01<br>CTRL/LLNO\$RP\$URepH01<br>MET1/LLNO\$RP\$URepA01<br>MET1/LLNO\$RP\$URepB01<br>MET1/LLNO\$RP\$URepC01<br>MET1/LLNO\$RP\$URepD01<br>MET1/LLNO\$RP\$URepE01<br>MET1/LLNO\$RP\$URepF01<br>MET1/LLNO\$RP\$URepG01<br>MET1/LLNO\$RP\$URepH01<br>16 BRCBs:<br>CTRL/LLNO\$BR\$BRepA01<br>CTRL/LLNO\$BR\$BRepB01<br>CTRL/LLNO\$BR\$BRepC01<br>CTRL/LLNO\$BR\$BRepD01<br>CTRL/LLNO\$BR\$BRepE01<br>CTRL/LLNO\$BR\$BRepF01<br>CTRL/LLNO\$BR\$BRepG01<br>CTRL/LLNO\$BR\$BRepH01<br>MET1/LLNO\$BR\$BRepA01<br>MET1/LLNO\$BR\$BRepB01<br>MET1/LLNO\$BR\$BRepC01<br>MET1/LLNO\$BR\$BRepD01<br>MET1/LLNO\$BR\$BRepE01<br>MET1/LLNO\$BR\$BRepF01<br>MET1/LLNO\$BR\$BRepG01<br>MET1/LLNO\$BR\$BRepH01 |
| Number of RCB instances = 2 (indexed RCBs, RptEnabled max=2) | 8 URCBs x 2 clients:<br>CTRL/LLNO\$RP\$URepA01<br>CTRL/LLNO\$RP\$URepA02<br>CTRL/LLNO\$RP\$URepB01<br>CTRL/LLNO\$RP\$URepB02<br>CTRL/LLNO\$RP\$URepC01<br>CTRL/LLNO\$RP\$URepC02<br>CTRL/LLNO\$RP\$URepD01<br>CTRL/LLNO\$RP\$URepD02<br>MET1/LLNO\$RP\$URepA01<br>MET1/LLNO\$RP\$URepA02<br>MET1/LLNO\$RP\$URepB01<br>MET1/LLNO\$RP\$URepB02<br>MET1/LLNO\$RP\$URepC01<br>MET1/LLNO\$RP\$URepC02<br>MET1/LLNO\$RP\$URepD01<br>MET1/LLNO\$RP\$URepD02<br>8 BRCBs x 2 clients:<br>CTRL/LLNO\$BR\$BRepA01<br>CTRL/LLNO\$BR\$BRepA02   |

| Number of Instances  | Report ID  |
|--|--|
|  | CTRL/LLN0\$BR\$BRepB01<br>CTRL/LLN0\$BR\$BRepB02<br>CTRL/LLN0\$BR\$BRepC01<br>CTRL/LLN0\$BR\$BRepC02<br>CTRL/LLN0\$BR\$BRepD01<br>CTRL/LLN0\$BR\$BRepD02<br>MET1/LLN0\$BR\$BRepA01<br>MET1/LLN0\$BR\$BRepA02<br>MET1/LLN0\$BR\$BRepB01<br>MET1/LLN0\$BR\$BRepB02<br>MET1/LLN0\$BR\$BRepC01<br>MET1/LLN0\$BR\$BRepC02<br>MET1/LLN0\$BR\$BRepD01<br>MET1/LLN0\$BR\$BRepD02   |
| Number of RCB instances = 4 (indexed RCBs, RptEnabled max=4) | 4 URCBs x 4 clients:<br>CTRL/LLN0\$RP\$URepA01<br>CTRL/LLN0\$RP\$URepA02<br>CTRL/LLN0\$RP\$URepA03<br>CTRL/LLN0\$RP\$URepA04<br>CTRL/LLN0\$RP\$URepB01<br>CTRL/LLN0\$RP\$URepB02<br>CTRL/LLN0\$RP\$URepB03<br>CTRL/LLN0\$RP\$URepB04<br>MET1/LLN0\$RP\$URepA01<br>MET1/LLN0\$RP\$URepA02<br>MET1/LLN0\$RP\$URepA03<br>MET1/LLN0\$RP\$URepA04<br>MET1/LLN0\$RP\$URepB01<br>MET1/LLN0\$RP\$URepB02<br>MET1/LLN0\$RP\$URepB03<br>MET1/LLN0\$RP\$URepB04<br>4 BRCBs x 4 clients:<br>CTRL/LLN0\$BR\$BRepA01<br>CTRL/LLN0\$BR\$BRepA02<br>CTRL/LLN0\$BR\$BRepA03<br>CTRL/LLN0\$BR\$BRepA04<br>CTRL/LLN0\$BR\$BRepB01<br>CTRL/LLN0\$BR\$BRepB02<br>CTRL/LLN0\$BR\$BRepB03<br>CTRL/LLN0\$BR\$BRepB04<br>MET1/LLN0\$BR\$BRepA01<br>MET1/LLN0\$BR\$BRepA02<br>MET1/LLN0\$BR\$BRepA03<br>MET1/LLN0\$BR\$BRepA04<br>MET1/LLN0\$BR\$BRepB01<br>MET1/LLN0\$BR\$BRepB02<br>MET1/LLN0\$BR\$BRepB03<br>MET1/LLN0\$BR\$BRepB04 |

**Predefined RCB Attributes**

| Report ID             | Dataset     |
|-----------------------|-------------|
| CTRL/LLN0\$RP\$URep01 | Not defined |
| CTRL/LLN0\$RP\$URep02 | Not defined |

| Report ID             | Dataset                   |
|-----------------------|---------------------------|
| CTRL/LLN0\$RP\$URep03 | Not defined               |
| CTRL/LLN0\$RP\$URep04 | Not defined               |
| CTRL/LLN0\$RP\$URep05 | Not defined               |
| CTRL/LLN0\$RP\$URep06 | Not defined               |
| CTRL/LLN0\$RP\$URep07 | Not defined               |
| CTRL/LLN0\$RP\$URep08 | Not defined               |
| CTRL/LLN0\$BR\$BRep01 | Not defined               |
| CTRL/LLN0\$BR\$BRep02 | Not defined               |
| CTRL/LLN0\$BR\$BRep03 | Not defined               |
| CTRL/LLN0\$BR\$BRep04 | Not defined               |
| CTRL/LLN0\$BR\$BRep05 | Not defined               |
| CTRL/LLN0\$BR\$BRep06 | Not defined               |
| CTRL/LLN0\$BR\$BRep07 | Not defined               |
| CTRL/LLN0\$BR\$BRep08 | Not defined               |
| MET1/LLN0\$RP\$URep01 | MET1/LLN0\$DSet01Mx       |
| MET1/LLN0\$RP\$URep02 | MET1/LLN0\$DSet02Mx       |
| MET1/LLN0\$RP\$URep03 | MET1/LLN0\$DSet03Mx       |
| MET1/LLN0\$RP\$URep04 | MET1/LLN0\$DSet05Mx       |
| MET1/LLN0\$RP\$URep05 | Not defined               |
| MET1/LLN0\$RP\$URep06 | Not defined               |
| MET1/LLN0\$RP\$URep07 | Not defined               |
| MET1/LLN0\$RP\$URep08 | Not defined               |
| MET1/LLN0\$BR\$BRep01 | Not defined               |
| MET1/LLN0\$BR\$BRep02 | Not defined               |
| MET1/LLN0\$BR\$BRep03 | Not defined               |
| MET1/LLN0\$BR\$BRep04 | Not defined               |
| MET1/LLN0\$BR\$BRep05 | Not defined               |
| MET1/LLN0\$BR\$BRep06 | MET1/LLN0\$DSet08StInd    |
| MET1/LLN0\$BR\$BRep07 | MET1/LLN0\$DSet09StFltNum |
| MET1/LLN0\$BR\$BRep08 | Not defined               |

### Report service information

Any predefined RCB attribute value may be written when RptEna is FALSE. Only existing data sets (see Dataset model table) may be used for DatSet attribute changing. Internal events, caused by data-change and quality-change trigger options only, result in immediate sending of reports or buffering events for transmission (limited by a buffer size of 64 Kbytes per report).

### 3 Configuring IEC 61850

The PAS software supplied with the PM180 provides an IED configuration tool for customizing your device settings and exporting IED configuration description files (CID/IID/ICD) for use with IEC 61850 client applications. See the PM180 Operation Manual for general information on installing and operating PAS.

#### NOTE

**When you select an IEC 61850 configuration tab while the On-line checkbox on the PAS toolbar is checked, the currently displayed configuration settings show the online settings from the connected device. In case the On-line checkbox on the PAS toolbar is not checked, the currently displayed configuration settings show the offline settings from the IED database, or default IED settings if the setup is not present in the IED database.**

**Click the Open button on the configuration tab to display IED database settings.**

**Click the Receive button on the configuration tab to display online device settings.**

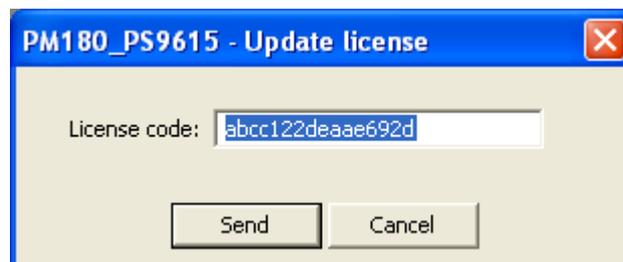
#### 3.1 Licensing IEC 61850

A valid license key must be provided in the PM180 for IEC 61850 communications. The device is normally shipped with a temporary license, which is valid for a 30-day operation and then can be extended for an additional month.

A permanent license can be obtained from your local distributor for an additional fee. A device serial number must be provided in the license request. The device may also be shipped with the permanent license in the event of a pre-paid fee.

To program a license key in you device:

1. Select Administration->Update License from the Monitor menu.



2. Type in the license code and click Send.

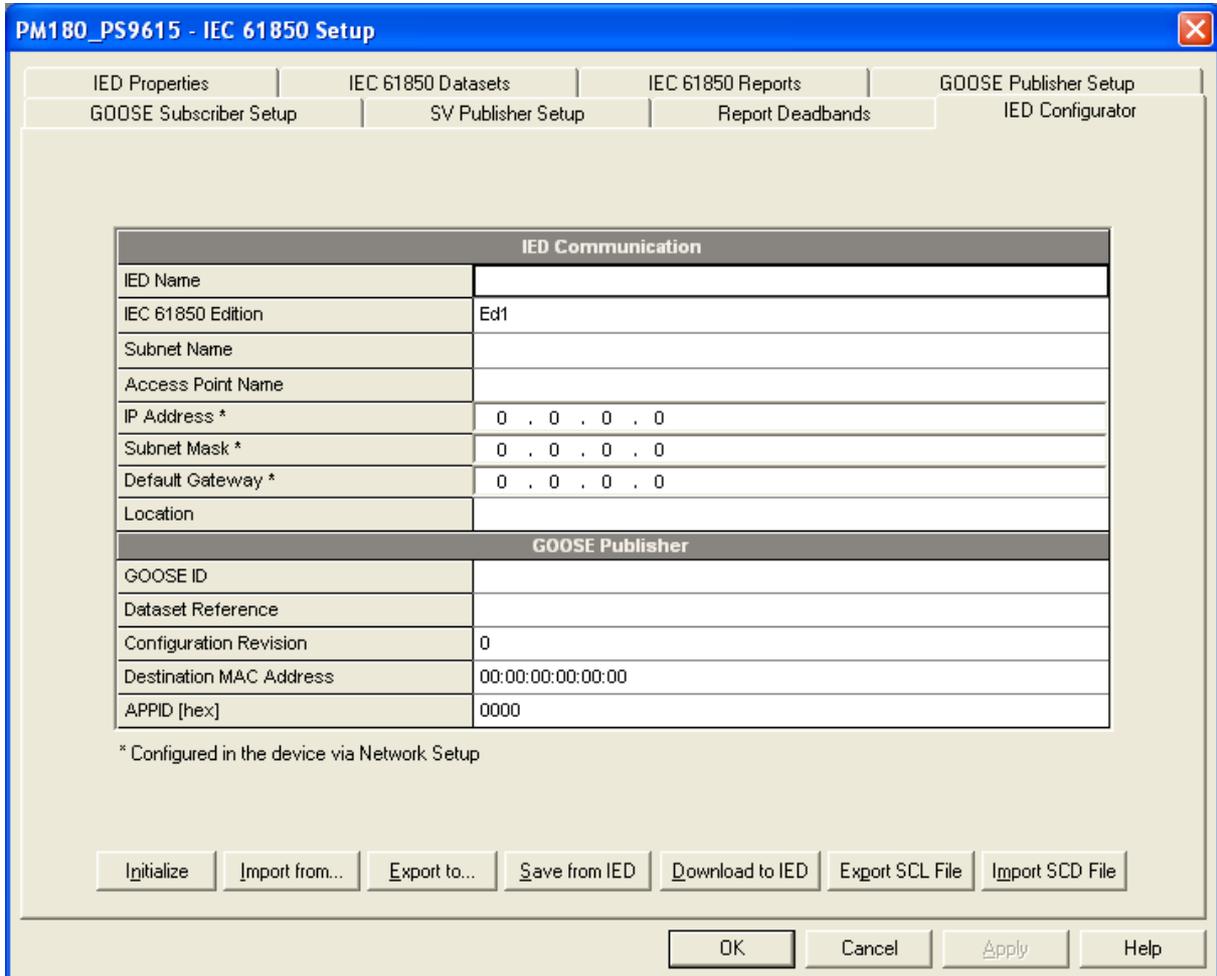
#### 3.2 Initializing the IED Site Database

IEC 61850 configuration settings for an IED are stored in the IED site database, from where they can be downloaded to your device online or exported to an IED configuration file. See the PM180 Operation Manual for information on how to create a site database for your device.

The IED database can be initialized with default settings applicable to your device, or settings imported from another IED's database, or settings uploaded directly from the IED online.

To initialize the IED site database for your device:

1. Select IEC 61850 Setup from the Meter Setup menu and click on the IED Configurator tab. The settings shown on the tab indicate the communication parameters of the IED stored in the IED database.



2. Select one of the following options to initialize the IED database:
  - To initialize the database with default settings, click the “Initialize” button.
  - To import IEC 61850 settings from another IED’s database, click the “Import from...” button, and then select the source IED database file.
  - To import the settings from the connected device, make sure the On-line checkbox on the PAS toolbar is checked, and then click the “Save from IED” button.

In case the IED database is initialized with default settings, the IED site name is used as a temporary name for the IED. The figure below shows what the IED database settings might look like after initialization with default values.

See the following sections in this manual for information on how to configure IEC 61850 parameters for your specific application.

PM180\_PS9615 - IEC 61850 Setup

|                        |                    |                   |                       |
|------------------------|--------------------|-------------------|-----------------------|
| IED Properties         | IEC 61850 Datasets | IEC 61850 Reports | GOOSE Publisher Setup |
| GOOSE Subscriber Setup | SV Publisher Setup | Report Deadbands  | IED Configurator      |

| IED Communication |                     |
|-------------------|---------------------|
| IED Name          | PM180_PS9615        |
| IEC 61850 Edition | Ed1                 |
| Subnet Name       | vW01                |
| Access Point Name | S1                  |
| IP Address *      | 192 . 168 . 0 . 203 |
| Subnet Mask *     | 255 . 255 . 255 . 0 |
| Default Gateway * | 192 . 168 . 0 . 1   |
| Location          |                     |

| GOOSE Publisher         |                         |
|-------------------------|-------------------------|
| GOOSE ID                | CTRLALLN0\$GO\$GoCBPub1 |
| Dataset Reference       | CTRLALLN0\$DSetGOOSE1   |
| Configuration Revision  | 1                       |
| Destination MAC Address | 01:0C:CD:01:01:FF       |
| APPID [hex]             | 3001                    |

\* Configured in the device via Network Setup

Initialize Import from... Export to... Save from IED Download to IED Export SCL File Import SCD File

OK Cancel Apply Help

### 3.3 Configuring IED Properties

To configure the IED identification parameters and general IEC 61850 protocol options for your IED:

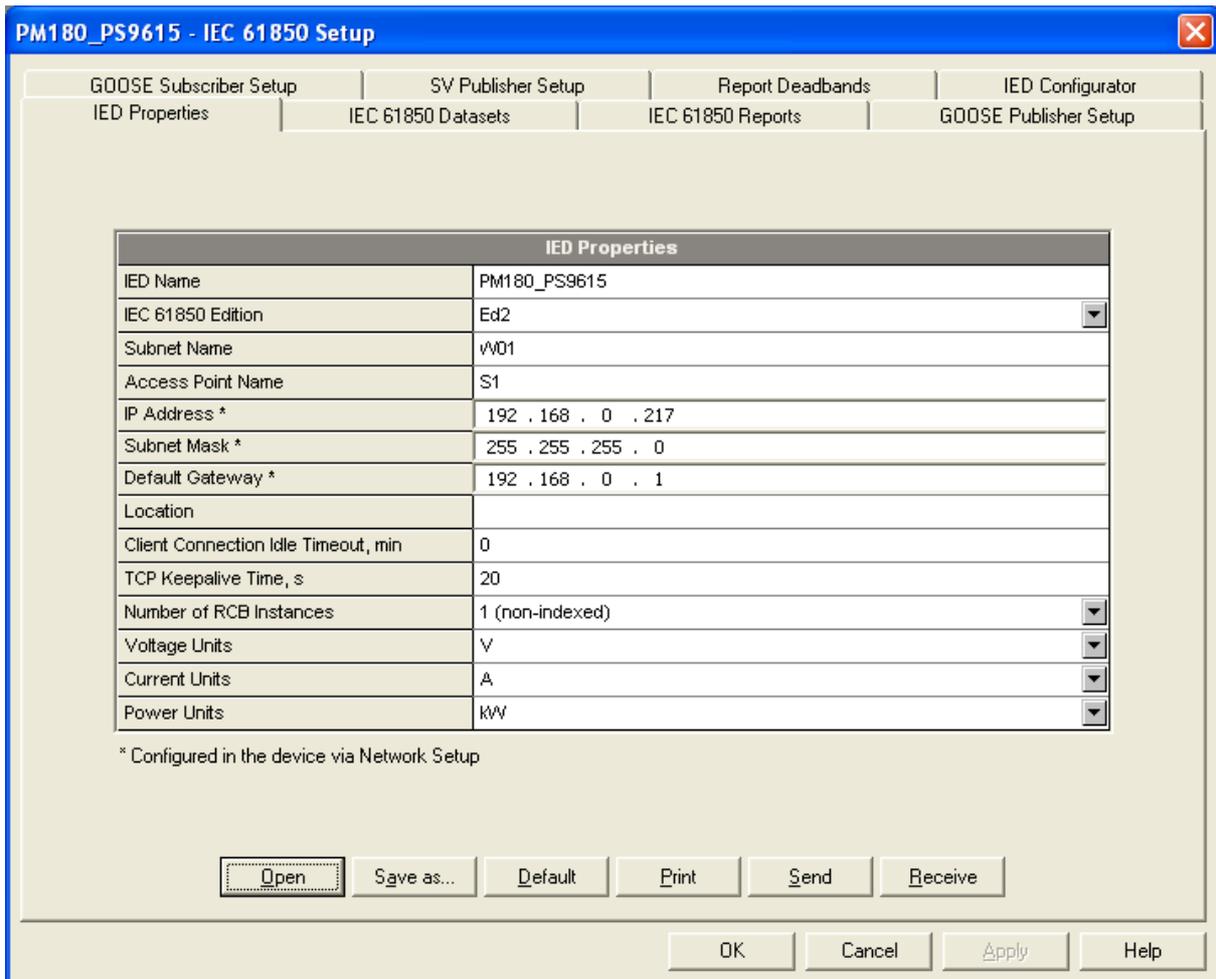
1. Select IEC 61850 Setup from the Meter Setup menu and click on the IED Properties tab.
2. Select the IEC 61850 edition implemented in your device and configure other IED parameters to suit your application. Note that the actual IEC 61850 edition supported by the device is always indicated when receiving the IED settings online.

#### NOTES

- The configured IED name will be concatenated with logical device instances' names in IEC 61850 object references.
- The device location will also identify the substation location in COMTRADE configuration files as the station\_name attribute.
- Attributes marked with the asterisk cannot be changed in the device via this setup but you can define and store them to the device database when working offline for later updating a device CID/IID/ICD configuration file.
- The number of RCB instances defines how pre-defined RCBs are arranged in the device for use in multi-client applications. The RCBs are automatically pre-configured in the device in the way indicated in Section "Reporting model". The RCB names and report

IDs are set to defaults as the number of RCB instances changes. If you intend to change the default setting, setup the number of RCB instances first before configuring report control blocks.

- The TCP\_KEEPALIVE interval can be configured in the device from 1 to 60 seconds (default 20 s) or can be set to 0 to inactivate keepalive probes.
- Client connection idle timeout can be used with keepalive probes or separately to terminate a TCP connection if the connection is idle for too long. The idle timeout can be set between 1 and 10 minutes or set to 0 to inactivate the idle timer. The timer is disabled in the device by default.



3. Click on “Save as ...” to save your setup to the IED database.
4. To update the device's online settings right now, send your new setting to the device.

**NOTE**

**The network IP address and subnet settings received online from the device always indicate the actual device’s network settings and may not match your settings in the IDE database, unless they are imported from the device or you have changed them via the device network setup (see note in Section 3.12).**

### 3.4 Configuring Datasets

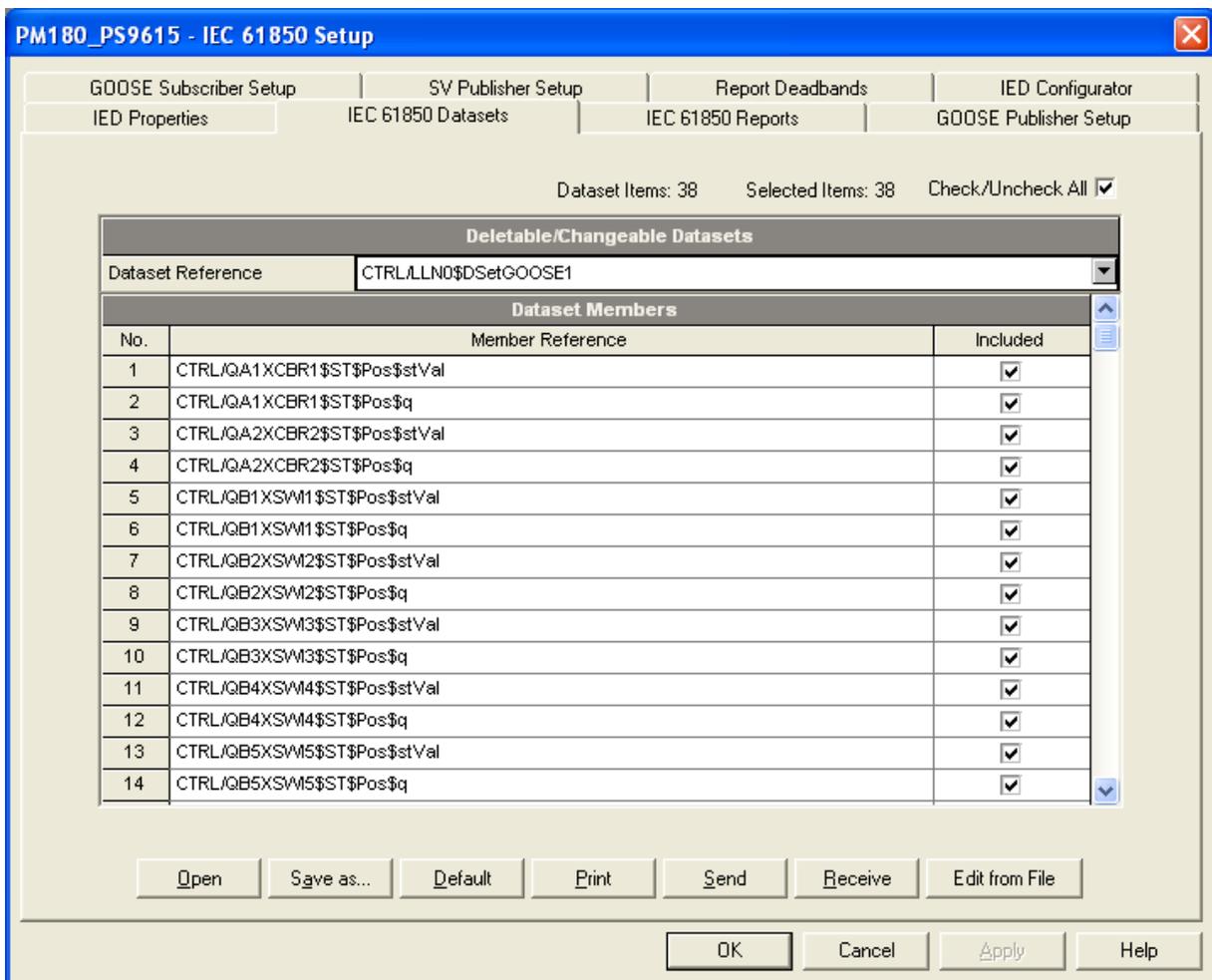
This setup dialog allows you to create, reconfigure, or delete any deletable dataset. Pre-defined datasets are non-deletable and are not listed in this dialog.

#### NOTES

1. A dataset cannot be deleted or its attributes changed if it is referenced by any currently enabled report, GOOSE, or sampled values control block.
2. Create your new datasets **before configuring your reports**; otherwise you may see an incomplete dataset list in your reports setup dialog.

To review or configure deletable IEC 61850 datasets:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the IEC 61850 Datasets tab.



2. Select a dataset you wish to view or configure in the “Dataset Reference” box. Select “New Dataset” to create a new dataset.
3. To delete dataset members, uncheck the appropriate “Included” boxes. Uncheck all dataset members to delete the entire dataset.
4. To add or change dataset members, you need to use a preconfigured CID or IID configuration description file for your IED. See Section 3.10 “Exporting IEC 61850 IED

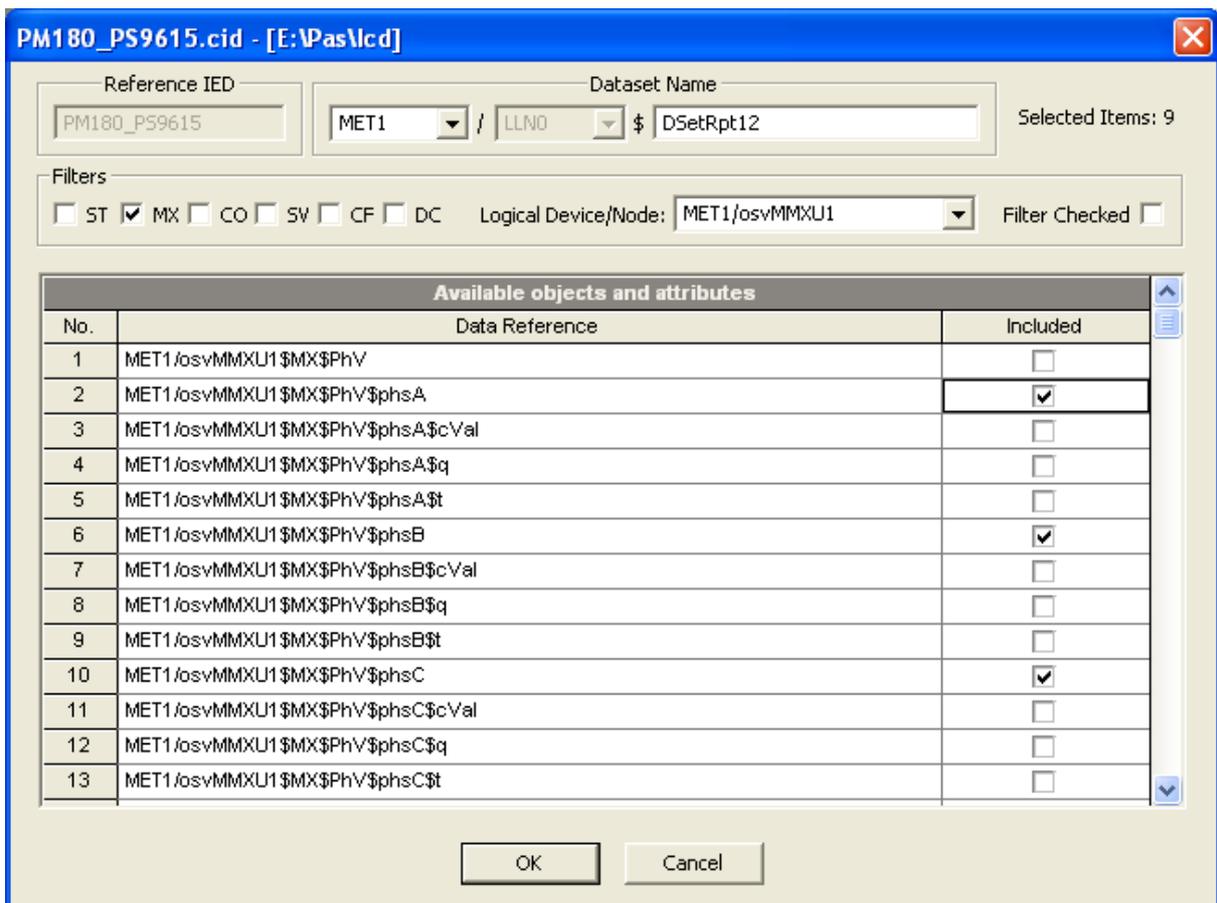
Configuration Files” for instructions on creating a CID/IID file for your device. Click “Edit from file”, select the type of the IED configuration file, locate the file, and then click Open.

A full list of the available data objects and data attributed is displayed, where included dataset members are checked.

To create a new dataset, select a logical device where the dataset to be located and type a dataset name in the “Dataset Name” box.

Check the “Included” boxes for items you wish to be members of the dataset and click OK.

To make easy selection of items across the list, use filters for functional constraints or/and a selected logical device/logical node. Click “Filter checked” to see and revise a list of the selected items.



5. Click on “Save as ...” to save your setup to the IED database.
6. To update the device's online settings right now, send the new setting to the device.

### 3.5 Configuring Reports

#### NOTES:

1. No change of attribute values of the report control block is allowed while the report is enabled by a client.
2. If you have created new datasets previously, make sure they have been saved in the IED database if you are working offline, or updated in the device if you are connected to the device online; otherwise, the list of dataset references may be incomplete.

To configure Report Control Blocks (RCB) for your IED:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the IEC 61850 Reports tab.
2. Select an RCB you wish to view or configure in the “RCB Reference” box.

The screenshot shows a software window titled "PM180\_PS9615 - IEC 61850 Setup" with a standard Windows-style title bar (minimize, maximize, close buttons). The window contains a tabbed interface with the following tabs: "GOOSE Subscriber Setup", "SV Publisher Setup", "Report Deadbands", "IED Configurator", "IED Properties", "IEC 61850 Datasets", "IEC 61850 Reports", and "GOOSE Publisher Setup". The "IEC 61850 Reports" tab is active. In the center of the window is a table titled "RCB #1 - Unbuffered Report Control Block". The table has the following data:

| RCB #1 - Unbuffered Report Control Block |                       |
|--|-----------------------|
| RCB Reference                            | MET1.LLN0\$RP\$URep01 |
| Report ID                                | MET1.LLN0\$RP\$URep01 |
| Enabled                                  | NO                    |
| Reserved                                 | NO                    |
| Dataset Reference                        | MET1.LLN0\$DSetRpt12  |
| Configuration Revision                   | 1                     |
| Optional Fields                          | 0111110000            |
| Buffer Time                              | 0                     |
| Sequence Number                          | 0                     |
| Trigger Options                          | 011001                |
| Integrity Period, ms                     | 0                     |

Below the table are several buttons: "Open", "Save as...", "Default", "Print", "Send", and "Receive". At the bottom of the window are "OK", "Cancel", "Apply", and "Help" buttons. To the right of the "Optional Fields" and "Trigger Options" rows, there are right-pointing arrow buttons (->).

3. Configure the RCB attributes as required for your application. The following items can be configured:

- Report ID
- Dataset reference (can be selected from the available datasets list)
- Configuration revision
- Optional fields
- Trigger options
- Buffer time
- Integrity period for periodic reports with the integrity trigger option selected

To change the Optional fields or Trigger options, click the arrow button to the right of the item, check the appropriate options and click OK.

**NOTES:**

- The dataset list shows only datasets located in the same logical node as the selected report control block.
  - In case you change the dataset reference while the configuration revision is still unchanged, the device will automatically increment the configuration revision when you download your new settings to the device. Keep this in mind when validating your device settings.
4. Click on “Save as ...” to save your setup to the IED database.
  5. To update the device's online settings right now, send your new setting to the device.

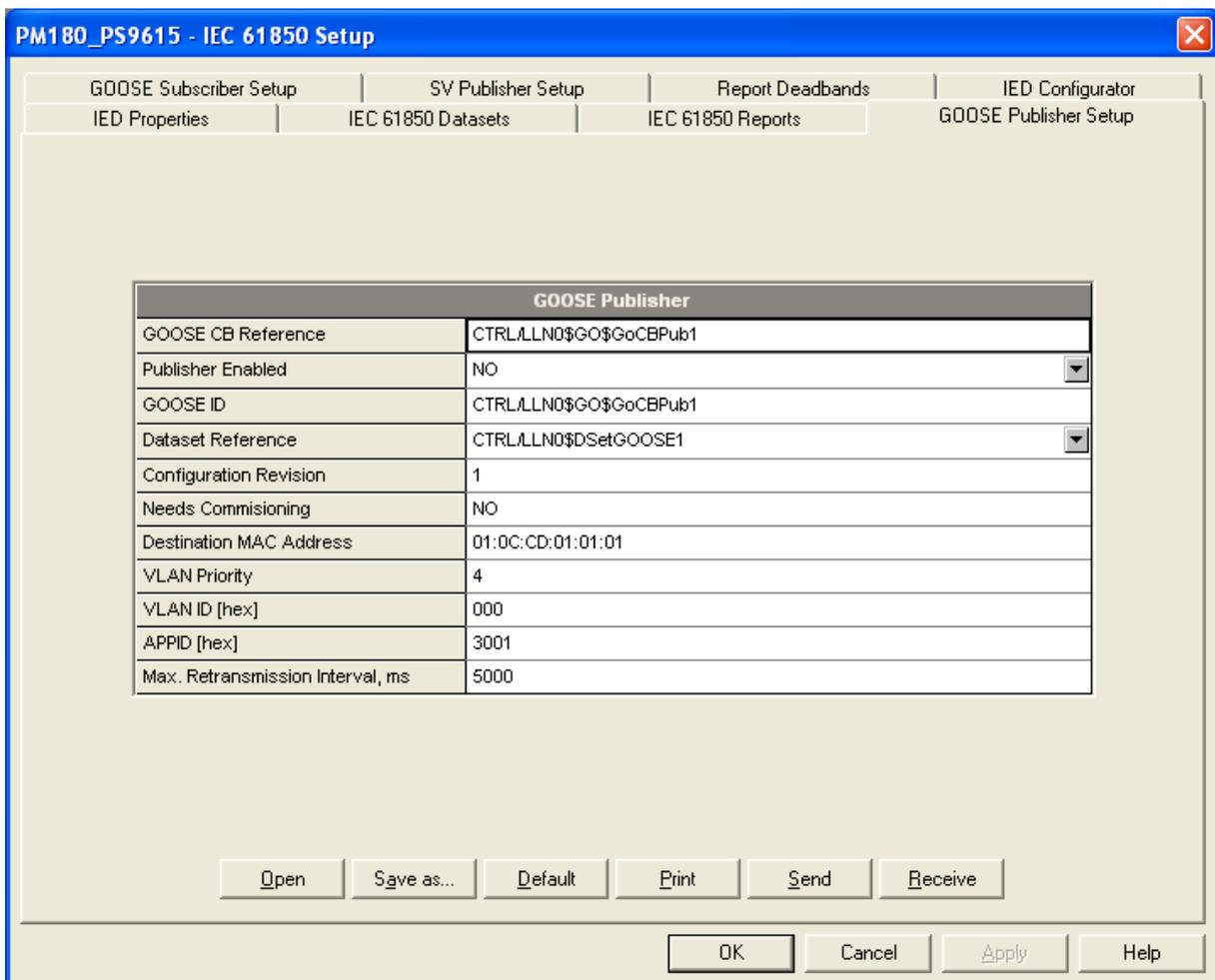
### 3.6 Configuring the GOOSE Publisher

**NOTE**

No change of attribute values of the GOOSE publisher control block is allowed while the GOOSE publisher is enabled.

To configure the GOOSE publisher:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the GOOSE Publisher Setup tab.



2. You can configure the destination MAC address, GOOSE ID, application ID and the maximum message retransmission interval for your application. You can also preset the configuration revision if needed. Other attributes are indicated for information only.

The default GOOSE dataset reference is preconfigured in your device for GOOSE communications. The dataset variables list can be modified via the IEC 61850 Datasets setup (see Section 3.4).

In Ed2 versions, a GOOSE dataset can also be selected from the supplied list. Note that only datasets located in the same logical device as the GOOSE publisher are displayed. **In case you change the GOOSE dataset reference while the configuration revision is still unchanged, the device will automatically increment the configuration revision when you download your new settings to the device.**

3. Select Yes in the Publisher Enabled box to enable publisher operation.
4. Click on “Save as ...” to save your setup to the IED database.
5. To update the device's online settings right now, send the new setting to the device.

### 3.7 Configuring the GOOSE Subscriber

The PM180 can subscribe to messages sent by any GOOSE network device including both PM180 and non-SATEC devices.

The GOOSE subscriber supports up to 20 subscriptions with up to 16 data elements in each subscription. The location of the subscribed elements in GOOSE data sets and mapping to the PM180 internal variables are configurable. The subscribed elements can be selected from a publishing device’s CID/IID IED configuration description file or a SCD substation configuration description. See Section 3.10 “Exporting IEC 61850 IED Configuration File” for instructions on creating a CID/IID file for your device.

The PM180 provides a set of internal variables for mapping external GOOSE data:

- a 128-bit binary string composed of 128 binary variables ExtInd1...ExtInd128 of type BOOLEAN called external indication and intended for mapping single-point BOOLEAN and integer elements and double-point Dbpos data;
- 32 variables ExtiVal1...ExtiVal32 of type INT32 for mapping signed and unsigned integer numbers of any size;
- 32 variables ExtfVal1...ExtfVal32 of type FLOAT32 for mapping single-precision floating point numbers.

When the subscriber receives GOOSE message updates, the subscribed data is copied to the internal variables that can be monitored and recorded in the device like any other measured value. When the subscriber does not receive updates, or the declared message live time has expired, or the data set differs from the subscriber setup, the internal variables are zeroed and the non-active status is indicated in the subscription status.

The subscription status can be monitored from an IEC 61850 client via the GOOSE subscriber logical nodes CTRL/sbsLGOS1-CTRL/sbsLGOS20, or from a Modbus client application via the GOOSE subscriber status register (see the PM180 Modbus Reference Guide for the register location).

## NOTE

**No change of attribute values of the GOOSE subscriber control block is allowed while the GOOSE subscriber is enabled.**

To configure the GOOSE subscriber:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the GOOSE Subscriber Setup tab.
2. In the Subscription Number box, select the subscription you wish to configure.
3. Click the “Open SCL File” button and open a CID, IID or SCD file of the publishing device you wish to subscribe to. PAS shows you a list of all datasets linked to GOOSE publisher control blocks that are found in the IED or SCD configuration file.

The screenshot shows the 'PM180\_PS9615 - IEC 61850 Setup' dialog box. It has a blue title bar and a close button in the top right. The main area is divided into several tabs: 'IED Properties', 'IEC 61850 Datasets', 'IEC 61850 Reports', 'GOOSE Publisher Setup', 'GOOSE Subscriber Setup', 'SV Publisher Setup', 'Report Deadbands', and 'IED Configurator'. The 'GOOSE Subscriber Setup' tab is active, showing a 'GOOSE Subscriber Settings' section with the following fields:

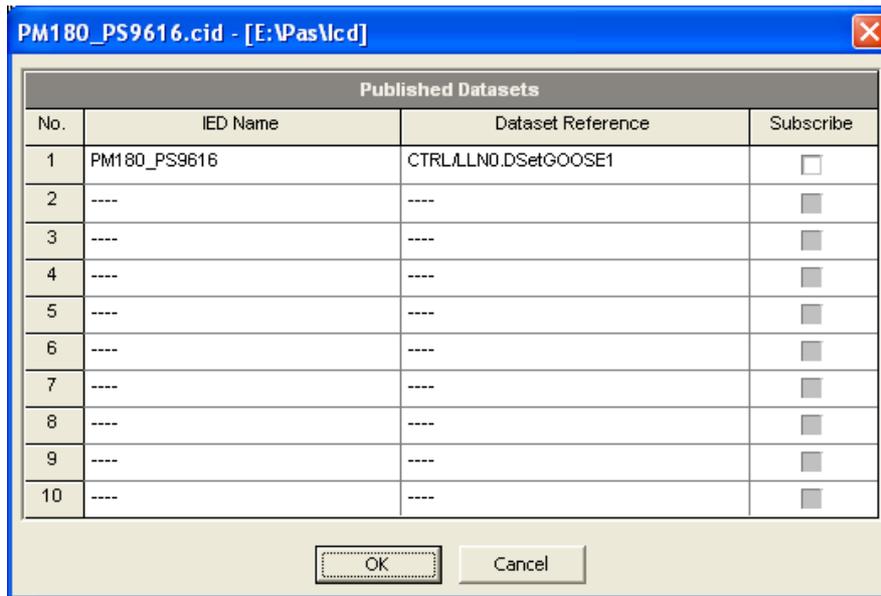
|                         |                   |
|-------------------------|-------------------|
| Subscription Number     | 1                 |
| Subscription Enabled    | NO                |
| GOOSE ID                |                   |
| GOOSE CB Reference      |                   |
| Dataset Reference       |                   |
| Configuration Revision  | 1                 |
| Destination MAC Address | 01:0C:CD:01:01:01 |
| APPID [hex]             | 0000              |

Below this is a 'Mapped GOOSE Message' section with a table:

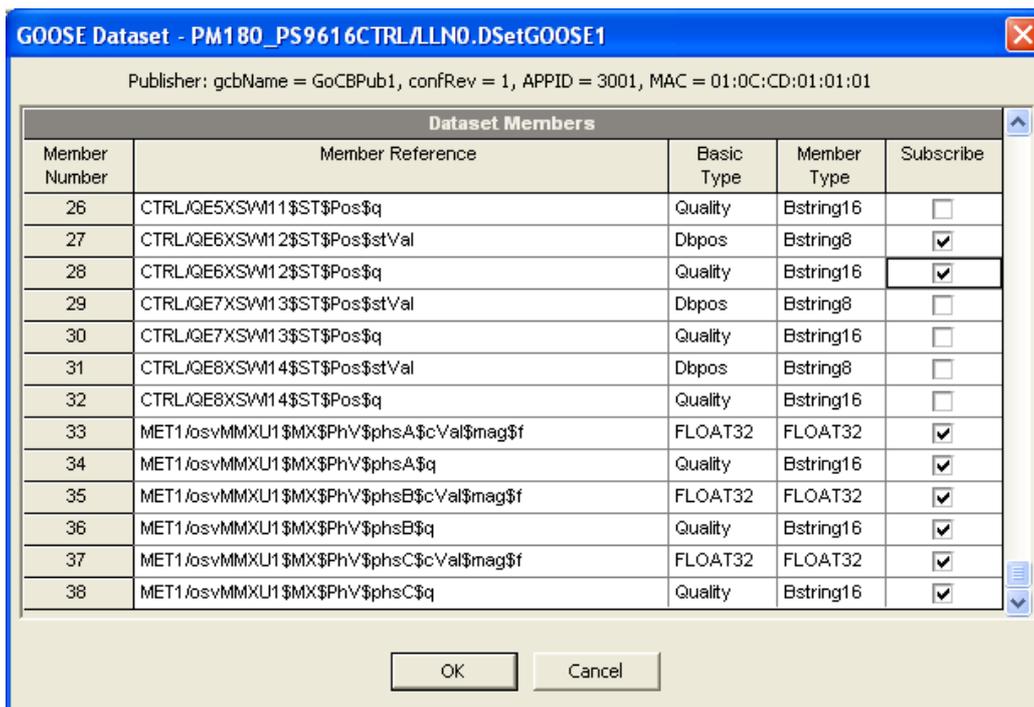
| No. | Element No. | Member Reference | Type | Input Variable |
|-----|-------------|------------------|------|----------------|
| 1   | ---         |                  | ---  | ---            |
| 2   | ---         |                  | ---  | ---            |
| 3   | ---         |                  | ---  | ---            |
| 4   | ---         |                  | ---  | ---            |
| 5   | ---         |                  | ---  | ---            |
| 6   | ---         |                  | ---  | ---            |
| 7   | ---         |                  | ---  | ---            |
| 8   | ---         |                  | ---  | ---            |
| 9   | ---         |                  | ---  | ---            |
| 10  | ---         |                  | ---  | ---            |

At the bottom of the dialog are several buttons: 'Open', 'Save as...', 'Default', 'Print', 'Send', 'Receive', 'Open SCL File', 'OK', 'Cancel', 'Apply', and 'Help'.

4. Check the Subscribe box for the dataset you wish to subscribe to.



- The publisher attributes and a list of dataset members for the selected dataset are displayed as shown in the picture below. PAS also indicates a basic IEC 61850 data element type and a physical MMS type for dataset members. Check the Subscribe boxes for elements you want to subscribe to, and then click OK.



You are allowed to select no more than 16 elements. Elements with incompatible data types cannot be selected.

The publisher attributes of the selected dataset and the selected data elements are copied to the current subscription.

For your convenience, PAS automatically maps the selected elements to the compatible input variables. If desired, you can change the mapping of the selected elements using the compatible types listed in the table below.

| Basic Data Type | MMS Data Type | Compatible Input Variables |
|-----------------|---------------|----------------------------|
| BitString32     | Bstring32     | ExtInd, ExtiVal            |
| Dbpos           | Bstring8      | ExtInd, ExtiVal            |
| Enum            | INT8          | ExtInd, ExtiVal            |
| INT32           | INT32         | ExtInd, ExtiVal            |
| INT32U          | INT32U        | ExtInd, ExtiVal            |
| INT16           | INT16         | ExtInd, ExtiVal            |
| INT16U          | INT16U        | ExtInd, ExtiVal            |
| INT8            | INT8          | ExtInd, ExtiVal            |
| INT8U           | INT8U         | ExtInd, ExtiVal            |
| BOOLEAN         | BOOLEAN       | ExtInd, ExtiVal            |
| FLOAT32         | FLOAT32       | ExtfVal                    |

**PM180\_PS9615 - IEC 61850 Setup**

IED Properties | IEC 61850 Datasets | IEC 61850 Reports | GOOSE Publisher Setup  
 GOOSE Subscriber Setup | SV Publisher Setup | Report Deadbands | IED Configurator

**GOOSE Subscriber Settings**

|                         |                                     |
|-------------------------|-------------------------------------|
| Subscription Number     | 1                                   |
| Subscription Enabled    | NO                                  |
| GOOSE ID                | PM180_PS9616CTRLALLN0\$GO\$GoCBPub1 |
| GOOSE CB Reference      | PM180_PS9616CTRLALLN0\$GoCBPub1     |
| Dataset Reference       | PM180_PS9616CTRLALLN0\$DSetGOOSE1   |
| Configuration Revision  | 1                                   |
| Destination MAC Address | 01:0C:CD:01:01:01                   |
| APPID [hex]             | 3001                                |

**Mapped GOOSE Message**

| No. | Element No. | Member Reference                           | Type    | Input Variable |
|-----|-------------|--|---------|----------------|
| 1   | 1           | CTRL/QA1XCBR1\$ST\$Pos\$stVal              | Dbpos   | ExtInd1        |
| 2   | 2           | CTRL/QA1XCBR1\$ST\$Pos\$q                  | Quality | ExtiVal1       |
| 3   | 3           | CTRL/QA2XCBR2\$ST\$Pos\$stVal              | Dbpos   | ExtInd3        |
| 4   | 4           | CTRL/QA2XCBR2\$ST\$Pos\$q                  | Quality | ExtiVal2       |
| 5   | 27          | CTRL/QE6XSWM12\$ST\$Pos\$stVal             | Dbpos   | ExtInd5        |
| 6   | 28          | CTRL/QE6XSWM12\$ST\$Pos\$q                 | Quality | ExtiVal3       |
| 7   | 33          | MET1/osvMMXU1\$MX\$PhV\$phsA\$cVal\$mag\$f | FLOAT32 | ExtfVal1       |
| 8   | 34          | MET1/osvMMXU1\$MX\$PhV\$phsA\$q            | Quality | ExtiVal4       |
| 9   | 35          | MET1/osvMMXU1\$MX\$PhV\$phsB\$cVal\$mag\$f | FLOAT32 | ExtfVal2       |
| 10  | 36          | MET1/osvMMXU1\$MX\$PhV\$phsB\$q            | Quality | ExtiVal5       |

Open Save as... Default Print Send Receive Open SCL File

OK Cancel Apply Help

**NOTES:**

- Mapping integer data to a BOOLEAN ExtInd variable results in copying a least-significant bit of the dataset member only.
- Mapping double-point data of type Dbpos to a BOOLEAN ExtInd variable causes a high-order bit of the dataset member to be copied to the following BOOLEAN ExtInd variable.

6. Check the application ID, configuration revision and destination MAC address imported from the IED configuration file to meet the requirements of your application.
7. Select Yes in the Subscription Enabled box to activate the subscription.
8. Repeat the setup for other subscriptions you wish to configure.
9. Click on "Save as ..." to save your setup to the IED database.

**The dataset member references are only stored in the IED database and are not sent to the device, so they may not be displayed when reading the device settings online if you have not saved the settings in the IED database.**

10. To update the device's online settings right now, send your new setting to the device.

### 3.8 Configuring the Sampled Values Publisher

The multicast sampled values (SV) publisher is responsible for publishing of the synchrophasor data over Ethernet at configured reporting rates.

Synchrophasor data transfer uses IEEE C37.118 to IEC 61850 mapping mechanism defined in IEC 61850-90-5 to map IEEE C37.118.2 synchrophasor data stream to IEC 61850-9-2 sampled values APDU.

The APDU contains a single ASDU, which is encoded using ISO/IEC 8825-1 ASN.1 basic encoding rules (BER) with context-specific field tag octets listed in IEC 61850-9-2, Table 14. Unlike other PDU attributes, a sequence of sampled phasor data is encoded as a compact block without ASN.1 tag triplets. The dataset members are encoded in their basic forms using fixed-length basic data type encoding rules listed in IEC 61850-9-2 Table 15.

#### NOTE

**No change of attribute values of the SV control block is allowed while the SV publisher is enabled.**

To configure the SV publisher:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the SV Publisher Setup tab.
2. Configure the destination multicast MAC address, application ID, sampled values ID and VLAN attributes (if used). You can also preset the configuration revision if needed.

The referenced SV publisher dataset is pre-configured in your device for streaming synchrophasor data and can be modified via the IEC 61850 Datasets setup (see Section 3.3). In Ed2 versions, the dataset reference can also be selected from the supplied list. Note that only datasets located in the same logical device as the SV publisher are displayed.

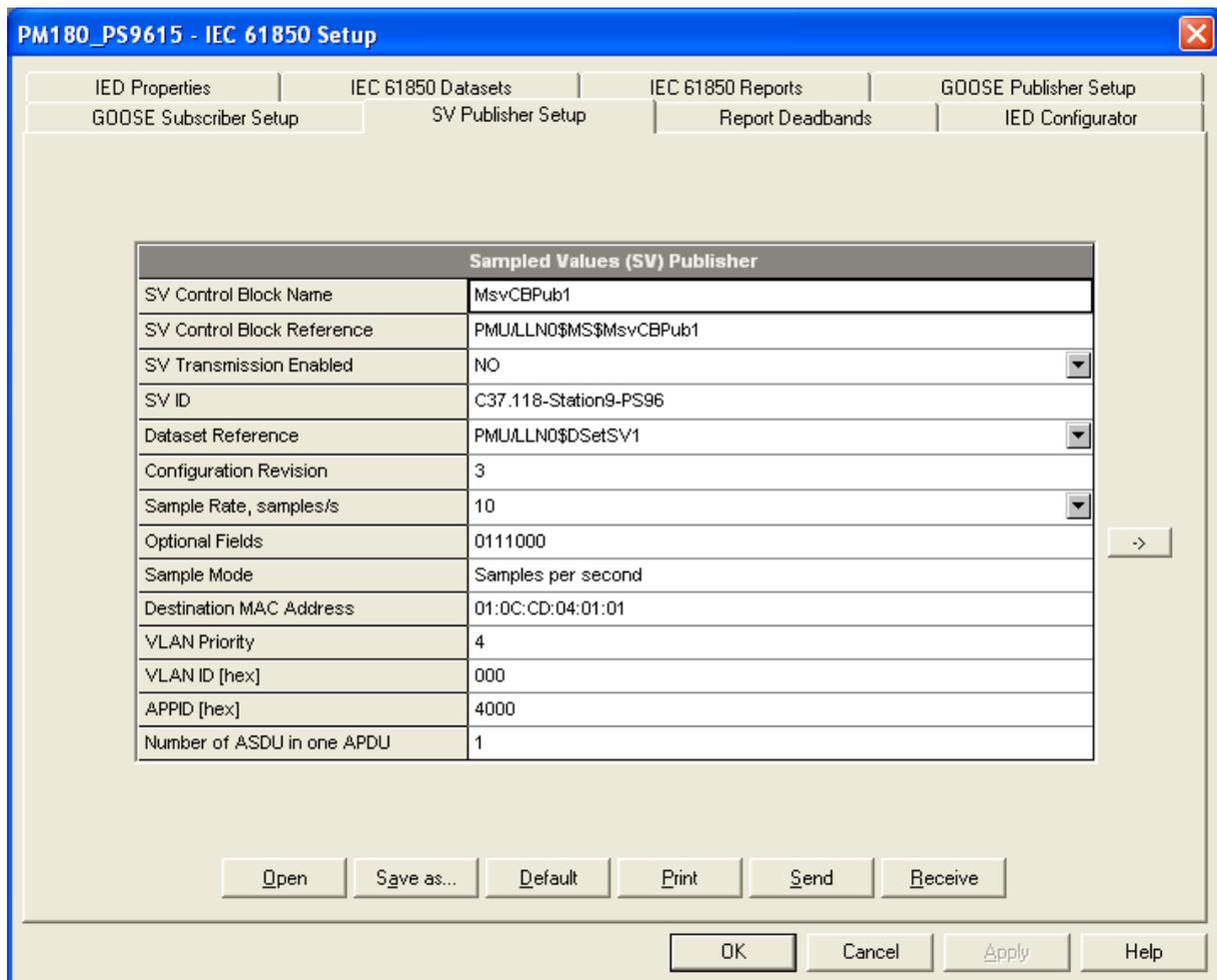
The multicast MAC address can be selected from the range 01:0C:CD:04:00:00 to 01:0C:CD:04:01:FF.

The IEC 61850-90-5 recommended format for the multicast sampled values ID is as follows:

C37.118-<Station Name>-<IDCode>

where the IDCode is the C37.118-2 data stream ID number in the range of 1 to 65534.

**In case you change the dataset reference or any other attribute value while the configuration revision is still unchanged, the device will automatically increment the configuration revision when you download your new settings to the device.**



3. To configure the optional fields to be sent in the sampled values messages, click on the right arrow and then check the required boxes.
4. Select the required sample rate in frames per second at which messages will be sent. The PM180 will automatically adjust it to the closest available reporting rate if the selected rate does not match the nominal network frequency setting.
5. Select YES in the SV Transmission Enabled box to enable publisher operation.
6. Click on "Save as ..." to save your setup to the device database.
7. To update the device's online settings right now, send your new setting to the device.

### 3.9 Configuring Report Deadbands

Generic deadbands for reporting measured analog values can be configured via PAS without the need to setup individual deadbands for every data element via IEC 61850 services. If required, you can then change deadbands for individual variables via your IEC 61850 application.

Downloading new report deadbands to the device changes deadbands for all analog data of the same type in all logical nodes, so it is recommended to do that before you make your individual deadband adjustments.

## NOTE

The process measurement scales for most analog values depend on your external PT and CT settings and on the voltage and current scales defined in the device. Configure them in your device and save to the device site database before changing report deadbands. See Basic Setup and Device Options Setup in the PM180 Operation Manual on how to configure these parameters in the device. See Programming Analog Inputs in the PM180 Operation Manual on how to setup the measurement scales for analog inputs.

To configure the deadbands for measured analog values:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the Report Deadbands tab.

For your convenience, PAS shows the deadbands both in percent and in engineering units, and indicates the minimum and maximum process measurements from which the percent deadband is taken.

**PM180\_PS9615 - IEC 61850 Setup**

IED Properties | IEC 61850 Datasets | IEC 61850 Reports | GOOSE Publisher Setup  
 GOOSE Subscriber Setup | SV Publisher Setup | Report Deadbands | IED Configurator

| Measured Value                            | Deadband, % | Deadband, units | Minimum Measurement | Maximum Measurement |
|---|-------------|-----------------|---------------------|---------------------|
| Phase voltage, V                          | 1.000       | 144             | 0                   | 14400               |
| Auxiliary voltage V4, V                   | 1.000       | 1.4             | 0.0                 | 144.0               |
| DC voltage, V                             | ----        | ----            | ----                | ----                |
| Phase currents, A                         | 1.000       | 200.00          | 0.00                | 20000.00            |
| Neutral current, A                        | 1.000       | 200.00          | 0.00                | 20000.00            |
| Auxiliary current I4, A                   | 1.000       | 200.00          | 0.00                | 20000.00            |
| Phase currents (extended inputs), A       | 0.133       | 133.00          | 0.00                | 100000.00           |
| Neutral current (extended inputs), A      | 0.133       | 133.00          | 0.00                | 100000.00           |
| Auxiliary current I4 (extended inputs), A | 0.133       | 133.00          | 0.00                | 100000.00           |
| Voltage sequence, V                       | 1.000       | 144             | 0                   | 14400               |
| Current sequence, A                       | 1.000       | 200.00          | 0.00                | 20000.00            |
| Current sequence (extended inputs), A     | 0.133       | 133.00          | 0.00                | 100000.00           |
| Voltage unbalance, %                      | 0.333       | 1.0             | 0.0                 | 300.0               |
| Current unbalance, %                      | 0.333       | 1.0             | 0.0                 | 300.0               |
| Active power, kW                          | 0.500       | 5760            | -576000             | 576000              |
| Reactive power, kvar                      | 0.500       | 5760            | -576000             | 576000              |
| Active power import/export, kW            | 1.000       | 5760            | 0                   | 576000              |
| Reactive power import/export, kvar        | 1.000       | 5760            | 0                   | 576000              |

Open Save as... Default Print Send Receive

OK Cancel Apply Help

2. Adjust the default percent deadbands to the desired values as required for your application. The allowable range is 0.001% to 50.000%. Press Enter or click elsewhere on the dialog window with the left mouse button to update the engineering deadbands.
3. Click on "Save as ..." to save your setup to the IED database.
4. To update the device's online settings right now, send your new setting to the device.

The following table shows the default factory-set deadbands for measured analog values.

| <b>Measured Value</b>                  | <b>Default Deadband, %</b> |
|--|----------------------------|
| Phase voltage                          | 1.000                      |
| Auxiliary voltage V4                   | 1.000                      |
| Phase currents                         | 1.000                      |
| Neutral current                        | 1.000                      |
| Auxiliary current I4                   | 1.000                      |
| Phase currents (extended inputs)       | 0.133                      |
| Neutral current (extended inputs)      | 0.133                      |
| Auxiliary current I4 (extended inputs) | 0.133                      |
| Voltage sequence                       | 1.000                      |
| Current sequence                       | 1.000                      |
| Current sequence (extended inputs)     | 0.133                      |
| Voltage unbalance                      | 0.333                      |
| Current unbalance                      | 0.333                      |
| Active power                           | 0.500                      |
| Reactive power                         | 0.500                      |
| Active power import/export             | 1.000                      |
| Reactive power import/export           | 1.000                      |
| Apparent power                         | 1.000                      |
| Active power demand                    | 1.000                      |
| Reactive power demand                  | 1.000                      |
| Apparent power demand                  | 1.000                      |
| Power factor                           | 5.000                      |
| Power factor lag/lead                  | 10.000                     |
| Frequency                              | 0.100                      |
| Voltage THD                            | 0.100                      |
| Current THD                            | 0.500                      |
| Voltage interharmonic THD              | 0.100                      |
| Current interharmonic THD              | 0.500                      |
| Current TDD                            | 1.000                      |
| Current K-factor                       | 0.100                      |
| Analog input #1                        | 1.000                      |
| Analog input #2                        | 1.000                      |
| Analog input #3                        | 1.000                      |
| Analog input #4                        | 1.000                      |
| Analog input #5                        | 1.000                      |
| Analog input #6                        | 1.000                      |
| Analog input #7                        | 1.000                      |
| Analog input #8                        | 1.000                      |
| Analog input #9                        | 1.000                      |
| Analog input #10                       | 1.000                      |
| Analog input #11                       | 1.000                      |
| Analog input #12                       | 1.000                      |
| Analog input #13                       | 1.000                      |
| Analog input #14                       | 1.000                      |
| Analog input #15                       | 1.000                      |
| Analog input #16                       | 1.000                      |

### 3.10 Exporting IEC 61850 IED Configuration Files (CID/IID/ICD)

Generating a new or updating a preconfigured CID/IID/ICD file for your device is done from the IED Configurator tab. A template ICD file or a preconfigured CID/IID is used as a source for creating a new SCL file.

**Make sure the IED database is up to date and all configuration settings are consistent with the device before exporting the IED configuration.**

To create or update a device CID/IID/ICD file:

1. Click on the IED Configurator tab.

The screenshot shows the 'PM180\_PS9615 - IEC 61850 Setup' dialog box with the 'IED Configurator' tab selected. The dialog has a tabbed interface with the following tabs: IED Properties, IEC 61850 Datasets, IEC 61850 Reports, GOOSE Publisher Setup, GOOSE Subscriber Setup, SV Publisher Setup, Report Deadbands, and IED Configurator. The 'IED Configurator' tab is active and contains two tables: 'IED Communication' and 'GOOSE Publisher'. Below the tables is a note: '\* Configured in the device via Network Setup'. At the bottom of the dialog are buttons for 'Initialize', 'Import from...', 'Export to...', 'Save from IED', 'Download to IED', 'Export SCL File', 'Import SCD File', 'OK', 'Cancel', 'Apply', and 'Help'.

| IED Communication |                     |
|-------------------|---------------------|
| IED Name          | PM180_PS9615        |
| IEC 61850 Edition | Ed2                 |
| Subnet Name       | v01                 |
| Access Point Name | S1                  |
| IP Address *      | 192 . 168 . 0 . 217 |
| Subnet Mask *     | 255 . 255 . 255 . 0 |
| Default Gateway * | 192 . 168 . 0 . 1   |
| Location          |                     |

| GOOSE Publisher         |                         |
|-------------------------|-------------------------|
| GOOSE ID                | CTRLALLN0\$GO\$GoCBPub1 |
| Dataset Reference       | CTRLALLN0\$DSetGOOSE1   |
| Configuration Revision  | 1                       |
| Destination MAC Address | 01:0C:CD:01:01:01       |
| APPID [hex]             | 3001                    |

\* Configured in the device via Network Setup

2. Click the "Export SCL file" button.
3. Select the type of the source template file in the "Files of type" box, locate the PM180 IED template ICD file or a preconfigured CID/IID/ICD file for your device you wish to update and click Open.

**Use the basic template ICD file provided with your device (PM180\_2003\_RevXX.icd for Ed1 or PM180\_2007B\_RevXX.icd for Ed2) as a primary template for creating new CID/IID/ICD files.**

4. Select the type of the output file in the "Files of type" box, locate the folder and type the name of the target CID/IID/ICD file where to store your new IED configuration description, and then click Open. You can point to the same CID/IID/ICD file you used as the source if

you intend to update the existing IED configuration. In case that the \*.icd file extension is selected for the output file, the generic “TEMPLATE” name will be written in place of the actual IED name.

#### NOTES

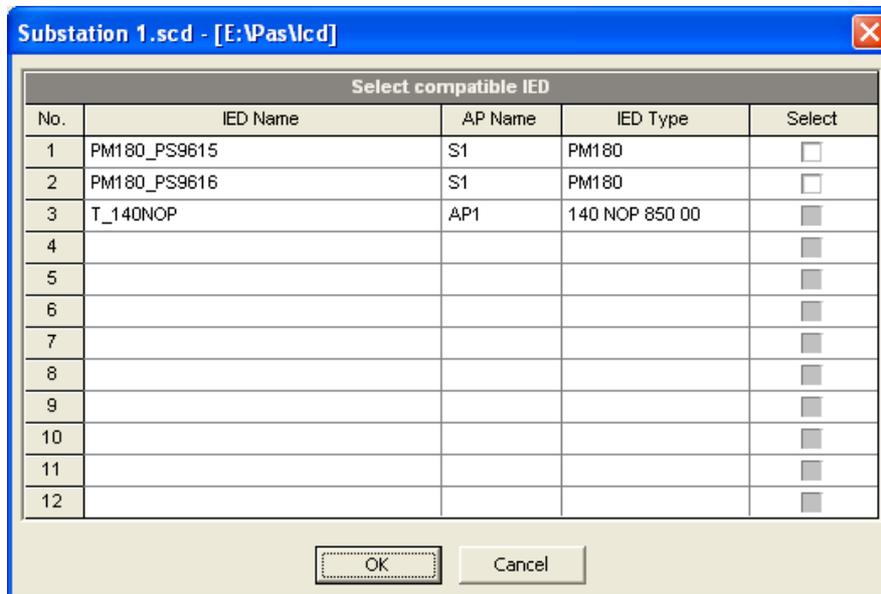
- In the event an RCB reference is used as the Report ID (the default setting for non-indexed RCBs), update the IED configuration file after changing the IED name even if no changes to RCBs have been made to keep consistency with your device.
- Breaker/switch nodes prefixes are configured in a CID/IID file as they are defined in the device database while updating the IED properties. If you change the default breaker/switch prefixes in your device via the Bay Control setup, update the setup in the device database, and then update the IED properties in an IED configuration file even if no other properties have been changed.

### 3.11 Importing IEC 61850 SCD Configuration

Basic IED communication settings can be imported from the communication part of an SCD substation configuration file to the IED database. These include the IED name, IED network and subnet parameters, access point name, and communication and configuration settings of the GOOSE and sampled values publishers.

To import the IED settings from an SCD file:

1. Click on the IED Configurator tab.
2. Click the “Import SCD file” button.
3. Locate an SCD substation configuration file and click Open.



4. The list of IEDs found in the SCD file is displayed. IEDs of incompatible types will have a shaded Select box.
5. Check the “Select” box for the IED whose configuration description you want to import.

### 3.12 Downloading the IEC 61850 Configuration to the Device

**Make sure the IED database is up to date and all configuration settings are consistent with the device before downloading the IED configuration to the device.**

To download the IED configuration settings to the device:

1. Make sure the On-line checkbox on the PAS toolbar is checked.
2. Click on the IED Configurator tab.
3. Click the “Download to IED” button.

#### **NOTE**

**The IP network settings are not changed in the device online by downloading the IEC 61850 configuration, as this could immediately affect communication with other parts of the PM180 device. To change the device’s IP address and subnet settings, select Communication Setup from the Meter Setup menu, make the required changes in the Network Setup dialog tab, and then send your new network settings to the device.**

### 3.13 Resetting the IEC 61850 Configuration in the Device

If required, the IEC 61850 configuration settings in your device can be reset to the factory defaults.

To reset the IEC 61850 configuration settings in the device:

1. Select Administration->Master Reset from the Monitor menu.
2. Click the “Reset IEC 61850 Configuration” button, and then confirm the command.

After the command is executed, the device's network restarts, so communication with the device may be lost for a while if you are connected to the device through the network port.