SATEC

Phasor Measurement Unit

PMU PRO

IEC 61850 Communications Protocol

Reference Guide

BG0653 Rev. A1

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	June 2024	Initial release

Table of Contents

1 General

This document provides information on setting up and operating the IEC 61850 server in PMU PRO devices with IEC 61850-8-1 and IEC 61850-9-2 interfaces compliant with the IEC 61850 Ed2 set of standards.

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

The IEC 61850 device data model is described in the PMU PRO IED configuration description file “PMU PRO_2007B_RevXX.icd” provided with your device. Use this as a basic template to create custom CID and IID files for use in your installation.

Refer to the PMU PRO Installation and Operation Manual for basic information on configuring and operating the PMU PRO.

2 Protocol Implementation

2.1 Logical Device Mode

The logical device mode attribute given by LLN0.Mod is always ON.

2.2 Controls

The local control behavior attribute Loc is always OFF.

2.3 Measurement Units

Voltage, current and power units are selectable (see Section 4.3).

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 (0.001 kW/kVA/kvar)	kW, kVA, kvar or MW, Mvar, MVA (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		0	Current Scale × CT Ratio [1, 2] (Imax)
Voltage		0	Voltage Scale × PT Ratio [3] (Vmax)
Power signed (kW, kvar)		-Vmax × Imax × 2/1000	Vmax × Imax × 2/1000 [4]
Power unsigned (kVA)		0	Vmax × Imax × 2/1000 [4]
Power factor		-1.000	1.000
Unbalance		0	300.0
Analog inputs	+/-1mA	-AI full scale × 2	AI full scale × 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

1. CT Ratio = CT primary current/CT secondary current.
2. The default Current Scale is 2 × CT secondary current. It can be changed via the Basic Setup in PAS.
3. The default Voltage Scale is 144V. It can be changed via the Basic 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 attributes (textual description of the data) in the DC functional constraints are defined in the device. They can be modified using IEC 61850 services for measured/metered and status data. The maximum size of descriptions in the PMU PRO is limited to 65 characters.

2.7 Preconfigured Datasets

Predefined Non-deletable/Non-changeable Datasets

Dataset Name	Dataset Members
MET1/LLN0$DSetPhasor	MET1/phsrMMXU1MXPhV$phsA$cVal MET1/phsrMMXU1MXPhV$phsA$q MET1/phsrMMXU1MXPhV$phsA$t MET1/phsrMMXU1MXPhV$phsB$cVal MET1/phsrMMXU1MXPhV$phsB$q MET1/phsrMMXU1MXPhV$phsB$t MET1/phsrMMXU1MXPhV$phsC$cVal MET1/phsrMMXU1MXPhV$phsC$q MET1/phsrMMXU1MXPhV$phsC$t MET1/phsrMMXU1MXA$phsA$cVal MET1/phsrMMXU1MXA$phsA$q MET1/phsrMMXU1MXA$phsA$t MET1/phsrMMXU1MXA$phsB$cVal MET1/phsrMMXU1MXA$phsB$q MET1/phsrMMXU1MXA$phsC$t MET1/phsrMMXU1MXA$phsC$cVal MET1/phsrMMXU1MXA$phsC$q MET1/phsrMMXU1MXA$phsC$t
MET1/LLN0$DsetSequence	MET1/seqMSQI1MXSeqV$c1$cVal MET1/seqMSQI1MXSeqV$c1$q MET1/seqMSQI1MXSeqV$c1$t MET1/seqMSQI1MXSeqV$c2$cVal MET1/seqMSQI1MXSeqV$c2$q MET1/seqMSQI1MXSeqV$c2$t MET1/seqMSQI1MXSeqV$c3$cVal MET1/seqMSQI1MXSeqV$c3$q MET1/seqMSQI1MXSeqV$c3$t MET1/seqMSQI1MXSeqA$c1$cVal MET1/seqMSQI1MXSeqA$c1$q MET1/seqMSQI1MXSeqA$c1$t MET1/seqMSQI1MXSeqA$c2$cVal MET1/seqMSQI1MXSeqA$c2$q MET1/seqMSQI1MXSeqA$c2$t MET1/seqMSQI1MXSeqA$c3$cVal MET1/seqMSQI1MXSeqA$c3$q MET1/seqMSQI1MXSeqA$c3$t MET1/seqMSQI1MXImbNgV$mag MET1/seqMSQI1$MX$ImbNgV$q MET1/seqMSQI1MXImbNgV$t MET1/seqMSQI1$MX$ImbZroV$mag MET1/seqMSQI1MXImbZroV$q MET1/seqMSQI1$MX$ImbZroV$t MET1/seqMSQI1MXImbNgA$mag MET1/seqMSQI1$MX$ImbNgA$q

Dataset Name	Dataset Members
	MET1/seqMSQI1MXImbNgA$t MET1/seqMSQI1$MX$ImbZroA$mag MET1/seqMSQI1MXImbZroA$q MET1/seqMSQI1$MX$ImbZroAV$t

Predefined Deletable/Changeable Datasets

Dataset Name	Dataset Members
MET1/LLN0$DSetGOOSE1 (preconfigured GOOSE publisher data set)	MET1/phsrMMXU1MXPhV$phsA$cVal MET1/phsrMMXU1MXPhV$phsA$q MET1/phsrMMXU1MXPhV$phsA$t MET1/phsrMMXU1MXPhV$phsB$cVal MET1/phsrMMXU1MXPhV$phsB$q MET1/phsrMMXU1MXPhV$phsB$t MET1/phsrMMXU1MXPhV$phsC$cVal MET1/phsrMMXU1MXPhV$phsC$q MET1/phsrMMXU1MXPhV$phsC$t MET1/phsrMMXU1MXA$phsA$cVal MET1/phsrMMXU1MXA$phsA$q MET1/phsrMMXU1MXA$phsA$t MET1/phsrMMXU1MXA$phsB$cVal MET1/phsrMMXU1MXA$phsB$q MET1/phsrMMXU1MXA$phsC$t MET1/phsrMMXU1MXA$phsC$cVal MET1/phsrMMXU1MXA$phsC$q MET1/phsrMMXU1MXA$phsC$t MET1/phsrMMXU1MXHz$mag MET1/phsrMMXU1$MXHzq MET1/phsrMMXU1MXHz$t
PMU/LLN0$DSetSV1 (preconfigured MSV publisher data set)	PMU1/MMXU1MXPhV$phsA$cVal PMU1/MMXU1MXPhV$phsA$q PMU1/MMXU1MXPhV$phsA$t PMU1/MMXU1MXPhV$phsB$cVal PMU1/MMXU1MXPhV$phsB$q PMU1/MMXU1MXPhV$phsB$t PMU1/MMXU1MXPhV$phsC$cVal PMU1/MMXU1MXPhV$phsC$q PMU1/MMXU1MXPhV$phsC$t PMU1/MMXU1MXA$phsA$cVal PMU1/MMXU1MXA$phsA$q PMU1/MMXU1MXA$phsA$t PMU1/MMXU1MXA$phsB$cVal PMU1/MMXU1MXA$phsB$q PMU1/MMXU1MXA$phsB$t PMU1/MMXU1MXA$phsC$cVal PMU1/MMXU1MXA$phsC$q PMU1/MMXU1MXA$phsC$t PMU1/MMXU1MXHz$mag PMU1/MMXU1$MXHzq PMU1/MMXU1MXHz$t PMU1/MMXU1$MX$HzRte$mag PMU1/MMXU1MXHzRte$q PMU1/MMXU1$MX$HzRte$t PMU1/MMXU1STHealth$stVal

Dataset Name	Dataset Members
	PMU1/MMXU1STHealth$q PMU1/MMXU1$ST$Health$t PMU1/LPHDSTPhyHealth$stVal PMU1/LPHD$ST$PhyHealth$q PMU1/LPHDSTPhyHealth$t

2.8 Preconfigured Reports

Predefined RCB

See Section 4.3 about configuring the number of RCB instances in the device.

Number of Instances	Report ID
Number of RCB instances = 1 (non-indexed RCBs)	8 URCB: MET1/LLN0RPURep01 MET1/LLN0RPURep02 MET1/LLN0RPURep03 MET1/LLN0RPURep04 MET1/LLN0RPURep05 MET1/LLN0RPURep06 MET1/LLN0RPURep07 MET1/LLN0RPURep08 8 BRCB: MET1/LLN0BRBRep01 MET1/LLN0BRBRep02 MET1/LLN0BRBRep03 MET1/LLN0BRBRep04 MET1/LLN0BRBRep05 MET1/LLN0BRBRep06 MET1/LLN0BRBRep07 MET1/LLN0BRBRep08
Number of RCB instances = 1 (indexed RCBs, RptEnabled max=1)	8 URCB: MET1/LLN0RPURepA01 MET1/LLN0RPURepB01 MET1/LLN0RPURepC01 MET1/LLN0RPURepD01 MET1/LLN0RPURepE01 MET1/LLN0RPURepF01 MET1/LLN0RPURepG01 MET1/LLN0RPURepH01 8 BRCB: MET1/LLN0BRBRepA01 MET1/LLN0BRBRepB01 MET1/LLN0BRBRepC01 MET1/LLN0BRBRepD01 MET1/LLN0BRBRepE01 MET1/LLN0BRBRepF01 MET1/LLN0BRBRepG01 MET1/LLN0BRBRepH01
Number of RCB instances = 2 (indexed RCBs, RptEnabled max=2)	4 URCB x 2 clients: MET1/LLN0RPURepA01 MET1/LLN0RPURepA02 MET1/LLN0RPURepB01

Number of Instances	Report ID
	MET1/LLN0RPURepB02 MET1/LLN0RPURepC01 MET1/LLN0RPURepC02 MET1/LLN0RPURepD01 MET1/LLN0RPURepD02 4 BRCB x 2 clients: MET1/LLN0BRBRepA01 MET1/LLN0BRBRepA02 MET1/LLN0BRBRepB01 MET1/LLN0BRBRepB02 MET1/LLN0BRBRepC01 MET1/LLN0BRBRepC02 MET1/LLN0BRBRepD01 MET1/LLN0BRBRepD02
Number of RCB instances = 4 (indexed RCBs, RptEnabled max=4)	2 URCB x 4 clients: MET1/LLN0RPURepA01 MET1/LLN0RPURepA02 MET1/LLN0RPURepA03 MET1/LLN0RPURepA04 MET1/LLN0RPURepB01 MET1/LLN0RPURepB02 MET1/LLN0RPURepB03 MET1/LLN0RPURepB04 2 BRCB x 4 clients: MET1/LLN0BRBRepA01 MET1/LLN0BRBRepA02 MET1/LLN0BRBRepA03 MET1/LLN0BRBRepA04 MET1/LLN0BRBRepB01 MET1/LLN0BRBRepB02 MET1/LLN0BRBRepB03 MET1/LLN0BRBRepB04

Predefined RCB Attributes

Dataset Reference: not defined.

Optional fields: sequence-number, report-time-stamp, reason-for-inclusion, data-set-name, data-reference.

Trigger options: data-change, quality-change, general-interrogation.

Integrity period: 0

Report Service Information

Any predefined RCB attribute value may be written when RptEna is FALSE. Only existing data sets may be selected in the DatSet attribute.

Internal events caused by data-change and quality-change trigger options result in immediate sending of reports or buffering events for transmission (limited by a buffer size of 64 Kbytes per report).

2.9 Client-server Communications

IEC 61850 TCP server uses the standard IANA assigned port number 102. The TCP server supports up to 5 client-server associations simultaneously.

Keepalive Probes

The PMU PRO uses TCP keepalive probes to detect dead connections and prevent resource leaks by default. If the connection is idle longer than configured, the device sends a keepalive request to check if the connection is alive. If no response is received after 5 successive keepalive retransmissions, the connection is considered dead and will be closed.

The TCP keepalive idle time is configurable from 1 to 60 seconds and is set to 20 seconds by default. The keepalive probe interval is fixed at 2 seconds. The total lost connection detection time before closing the connection is equal to the keepalive idle time + 5 times the keepalive probe time.

Client Connection Timeout

The client connection idle timeout can be used to terminate a connection if it has been inactive for too long. It can be configured from 1 to 10 minutes or set to 0 to disable the idle timeout. It is disabled in the device by default.

If the idle timeout is enabled, then the master station should periodically send probe requests to the device to maintain some kind of activity on the connection socket if it wants to keep the connection open.

2.10 GOOSE Communications

The PMU PRO provides a GOOSE publisher for fast distribution of measurement data over Ethernet for real-time distributed control within a substation. See Sections 4.4 and 4.6 for how to configure the GOOSE publisher settings and GOOSE dataset.

GOOSE messages are continuously retransmitted across the multicast association using a configurable multicast MAC address. The fastest retransmission time is half-cycle for the first 5 messages after an event occurred, then geometric with a time multiplier of 2 until the maximum configured retransmission time.

3 Synchrophasor Data Communications

3.1 PMU Data Model

Synchrophasor data transfer in the context of IEC 61850 uses IEEE C37.118 to IEC 61850 mapping mechanism defined in IEC 61850-90-5.

PMU is modeled as a dedicated logical device within the PMU PRO IED. The detailed PMU data model is shown as a part of the ICD definition file provided with your device.

The PMU logical device is responsible for the publishing of the synchrophasor measurements as defined in IEEE C37.118.2. It includes:

a) MMXU measurement logical node that represents voltage and current synchrophasor data, frequency and ROCOF measurements; the new data object of HzRte is added to the MMXU logical node to accommodate the ROCOF data.

b) LTIM time management logical node that gives indication of the local time configuration and status, like offset of local time from UTC and the flag indicating if daylight saving time is in effect.

c) LTMS time master supervision logical node that is used for supervision of the time synchronization function; it indicates the current time source and time synchronization status according to IEC 61850-9-2.

3.2 IEC 61850 SV Publisher

The PMU PRO multicast SV publisher is responsible for publishing of the synchrophasor data over Ethernet. The SV publisher options and the sampled values dataset can be configured using the PAS configuration software tool as described in Section 4.7.

3.3 Encoding Phasor Data in Multicast SV APDU

IEEE C37.118.2 synchrophasor data stream is mapped to IEC 61850-9-2 sampled values APDU (application protocol data unit). The sampled values dataset is user configurable (see Section 4.4).

Encoding of the sampled values APDU frame is shown in Figure 3-1.

The APDU contains a single ASDU (application service data unit), 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 APDU 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.

An example of the multicast sampled values frame that carries a synchrophasor data stream over an Ethernet LAN is shown in **Figure 3-2**.

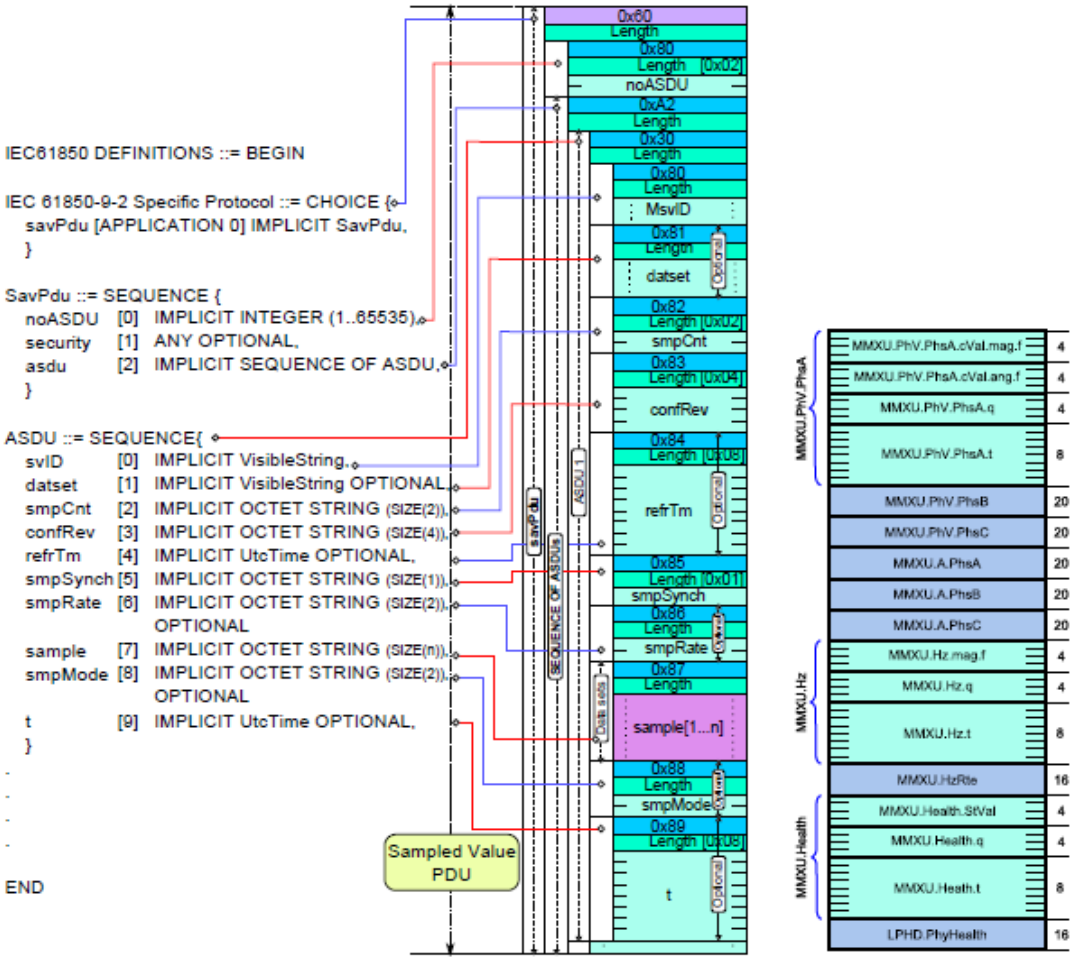


Figure 3-1 Encoding of the SV APDU frame and synchrophasor data

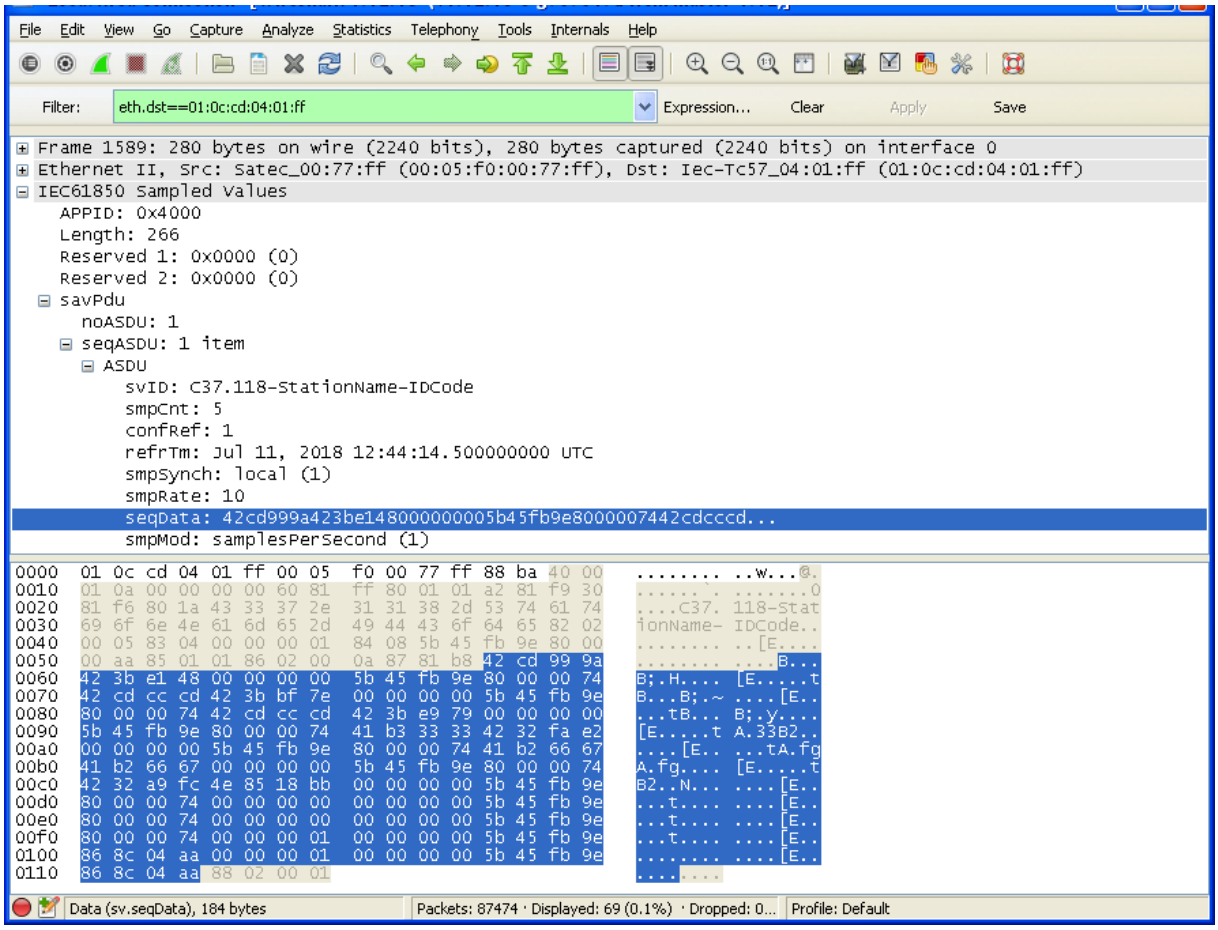


Figure 3-2 Captured synchrophasor multicast sampled values frame

4 Configuring IEC 61850

The PAS software provides an IED configuration tool for customizing your device's settings and exporting IED configuration description files (CID/IID/ICD) for use with IEC 61850 client applications. See the PMU PRO Installation and 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.

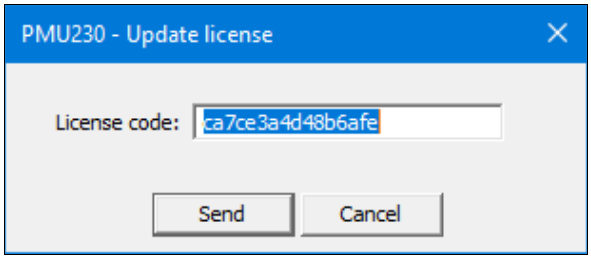
Click the Receive button on the configuration tab to display online device settings.

4.1 Licensing IEC 61850

A valid license key must be provided in the PMU PRO for IEC 61850 communications. A 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 come with a customized license upon prepayment.

To program a license key in your device:

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



2. Type in or paste the license code and click Send.

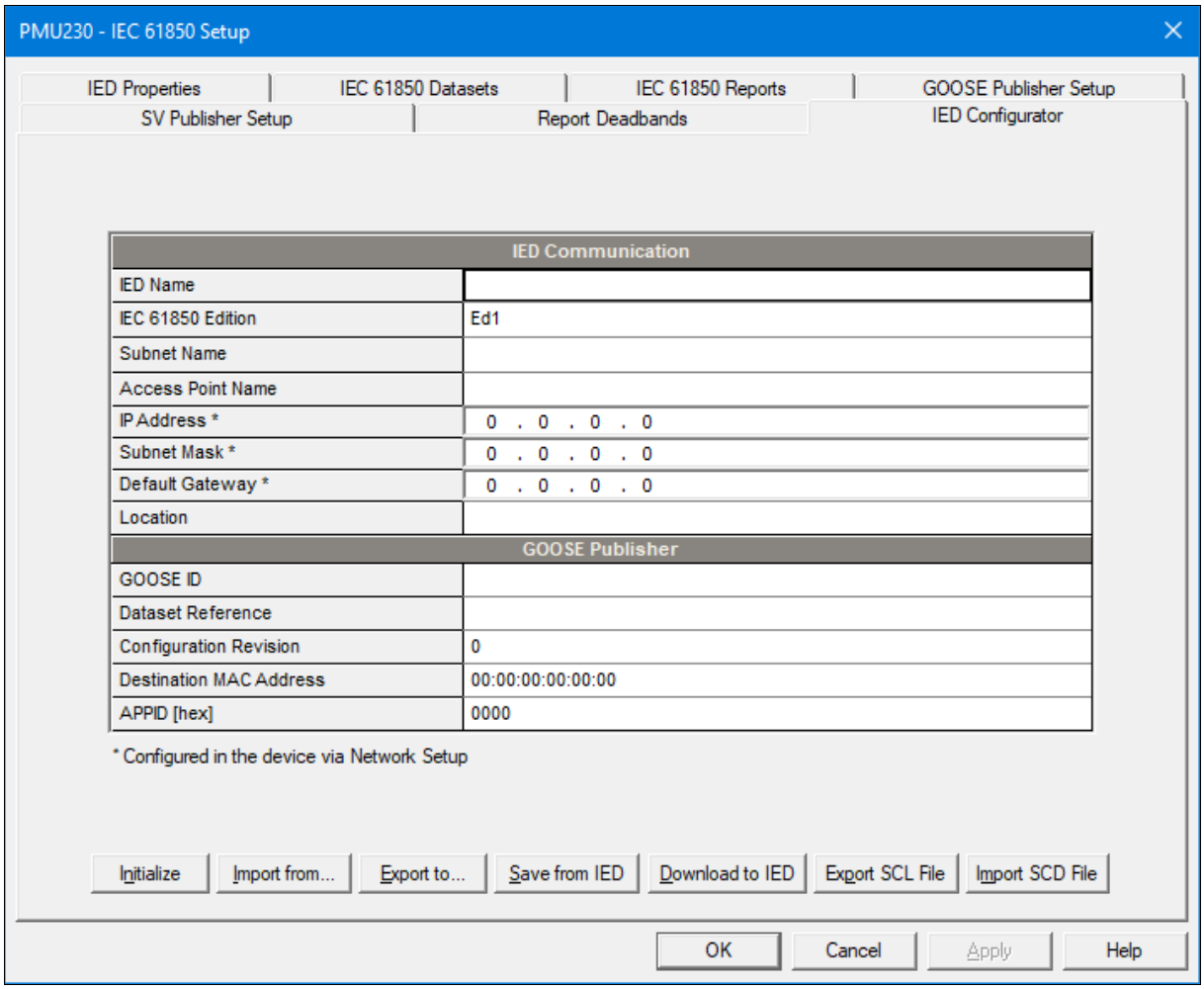
4.2 Initializing the IED Site Database

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 PMU PRO 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:

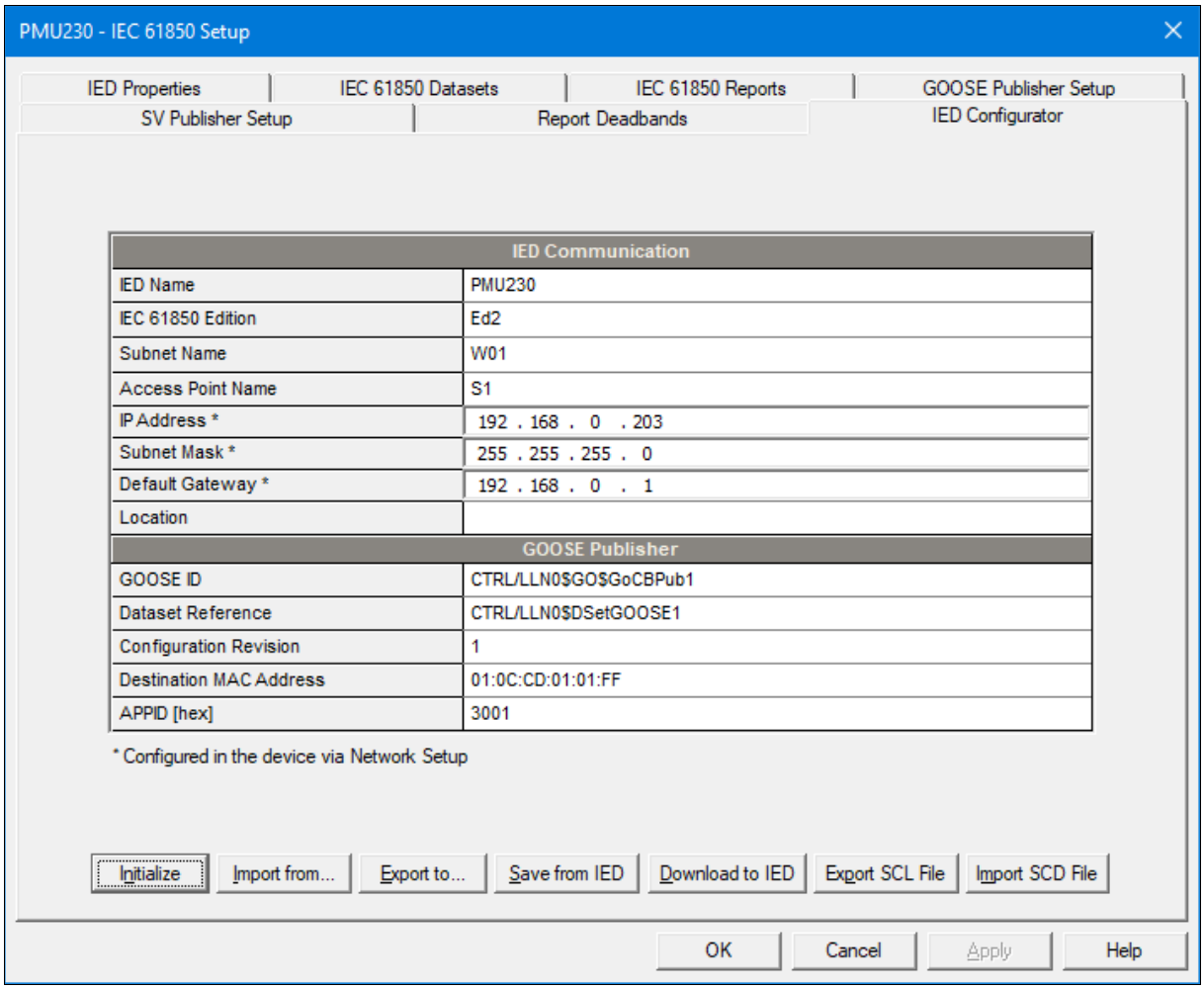
1. Select IEC 61850 Setup from the Meter Setup menu and click on the IED Configurator tab. The settings shown on the tab indicate the communication parameters of the IED stored in the IED database.



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.



4.3 Configuring IED Properties

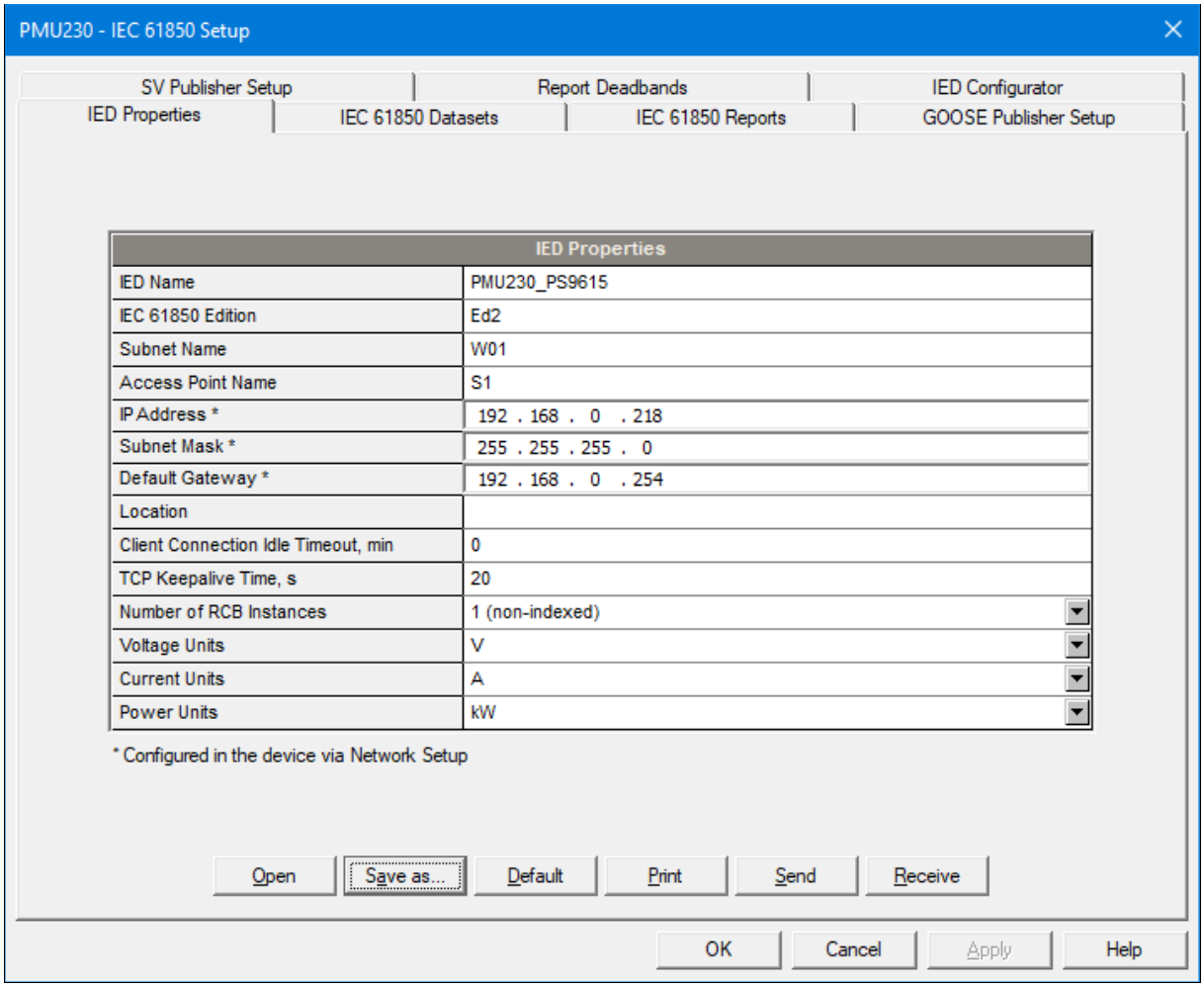
To configure the IED identification parameters and general IEC 61850 protocol options for your IED:

1. Select IEC 61850 Setup from the Meter Setup menu and click on the IED Properties tab.
2. Configure 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 the logical device instance's names in IEC 61850 object references.
   - 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 client connection idle timeout can be used to terminate a connection if it has been inactive for too long (see Section 2.10). It can be configured from 1 to 10 minutes or set to 0 to disable the idle timeout. It is disabled in the device by default.
- The TCP keepalive probes are used to detect dead connections and prevent resource leaks (see Section 2.9). The TCP keepalive idle time is configurable from 1 to 60 seconds and is set to 20 seconds 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 4.11).

4.4 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.

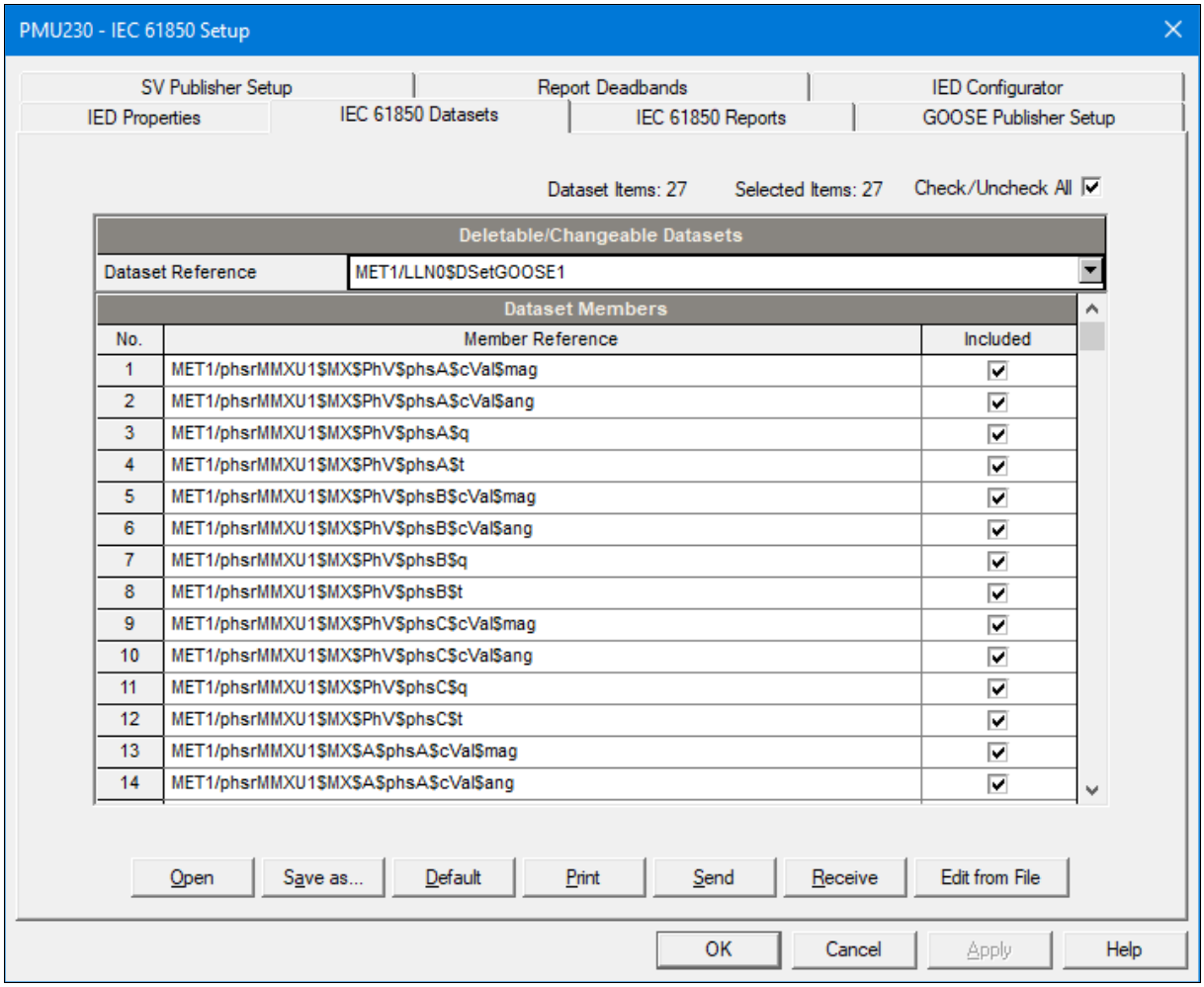
NOTES:

1. 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.

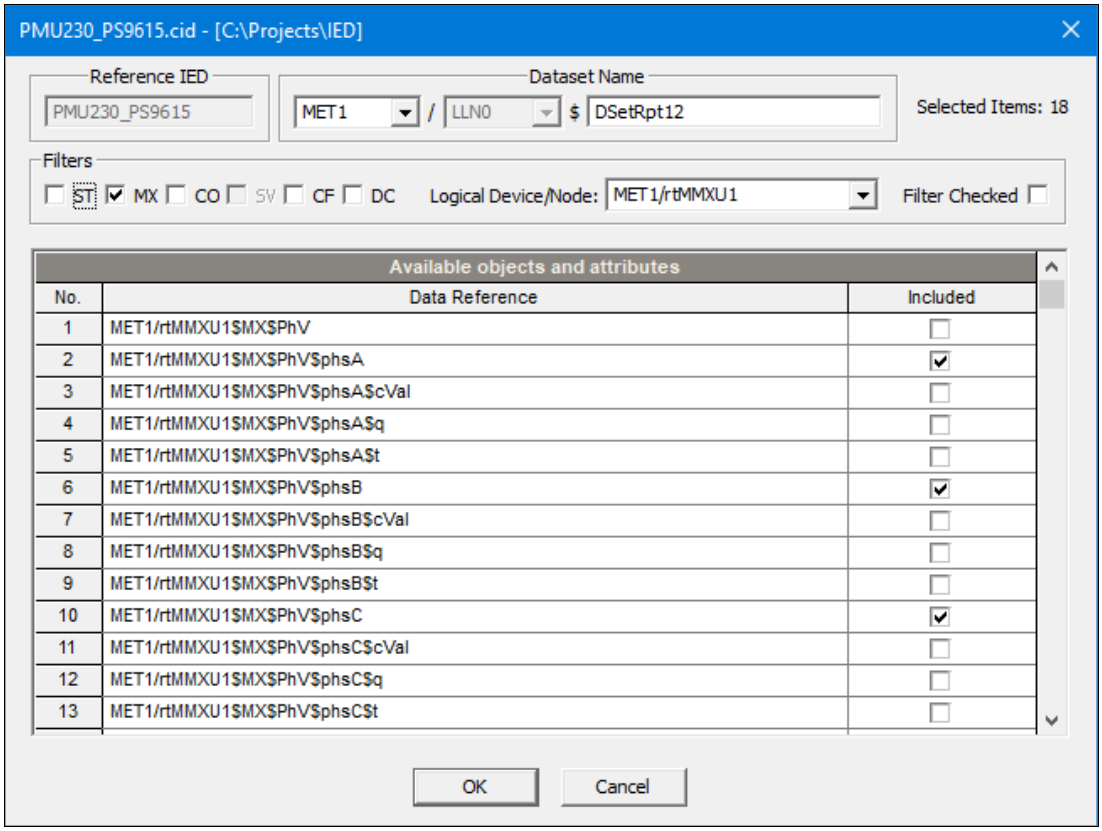
4. To add or change dataset members, you need to use a preconfigured CID or IID configuration description file for your IED. See Section 4.9 “Exporting IEC 61850 IED Configuration Files” for instructions on creating a CID/IID file for your device. Click “Edit from file”, select the type of the IED configuration 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.

4.5 Configuring Reports

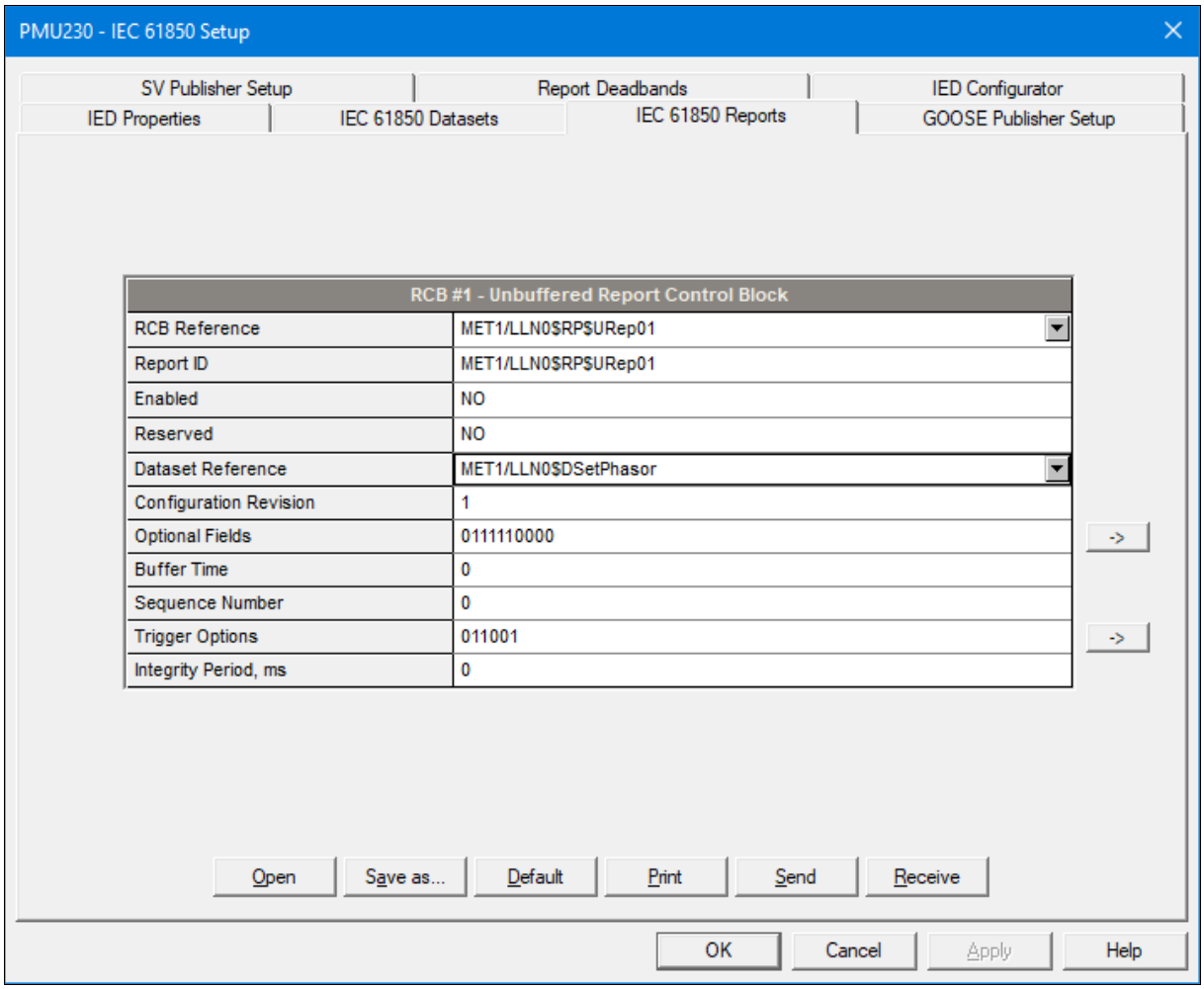
NOTES:

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.



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.

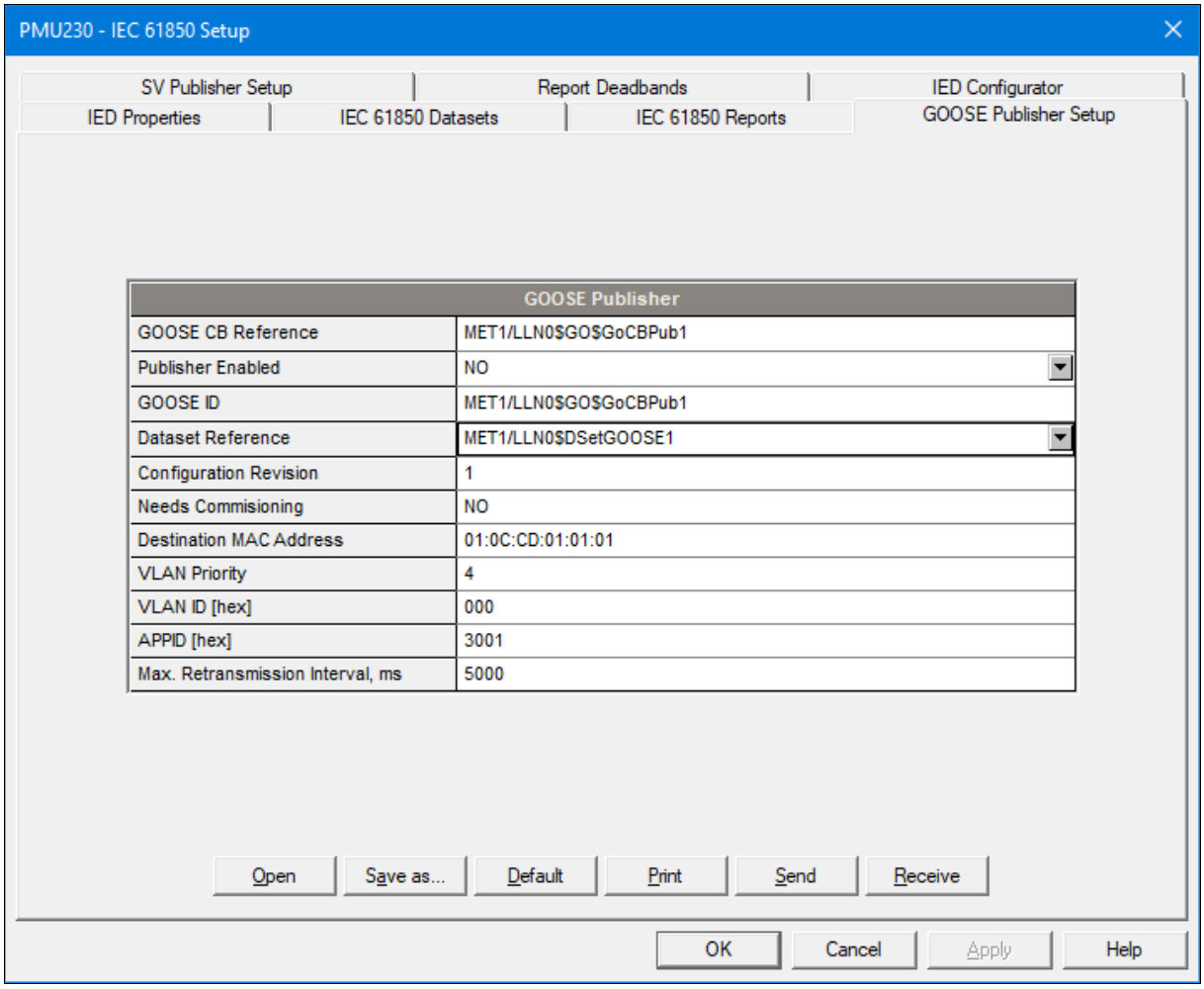
4.6 Configuring the GOOSE Publisher

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. Configure the destination multicast MAC address, GOOSE ID, application ID and the maximum message retransmission interval for your application. You can also preset VLAN attributes and 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 or the dataset reference can be replaced by another dataset selected from the list (see Section 4.4). Note that only datasets located in the same logical device as the GOOSE publisher are displayed.

NOTE

If you change the dataset reference, the device automatically increments the configuration revision when the new settings are downloaded to the device, unless you set it to a different value.

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.

4.7 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. See Section 3 for information on mapping the synchrophasor data stream to IEC 61850-9-2 sampled values APDU.

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 or replaced by another pre-configured dataset selected from the list (see Section 4.4). Note that only datasets located in the same logical device as the SV publisher are displayed in the list.

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

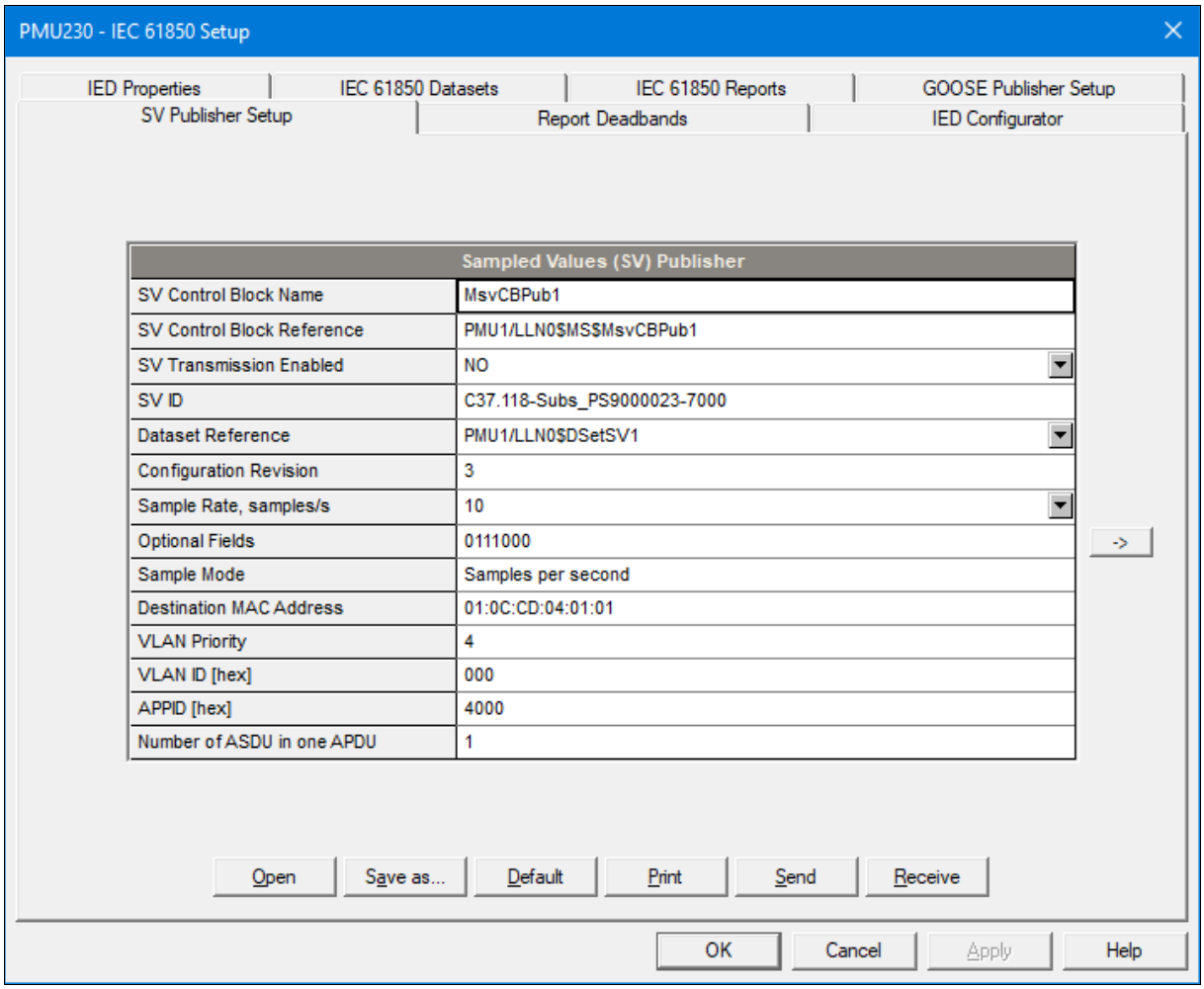
   The IEC 61850-90-5 recommended format for the multicast sampled values ID is as follows:

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

   where the IDCode is the C37.118-2 data stream ID number.

   NOTE

   If you change the dataset reference or any other attribute value, the device automatically increments the configuration revision when the new settings are downloaded to the device, unless you set it to a different value.



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 PMU PRO 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.

4.8 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 the deadbands for individual variables using your IEC 61850 application software.

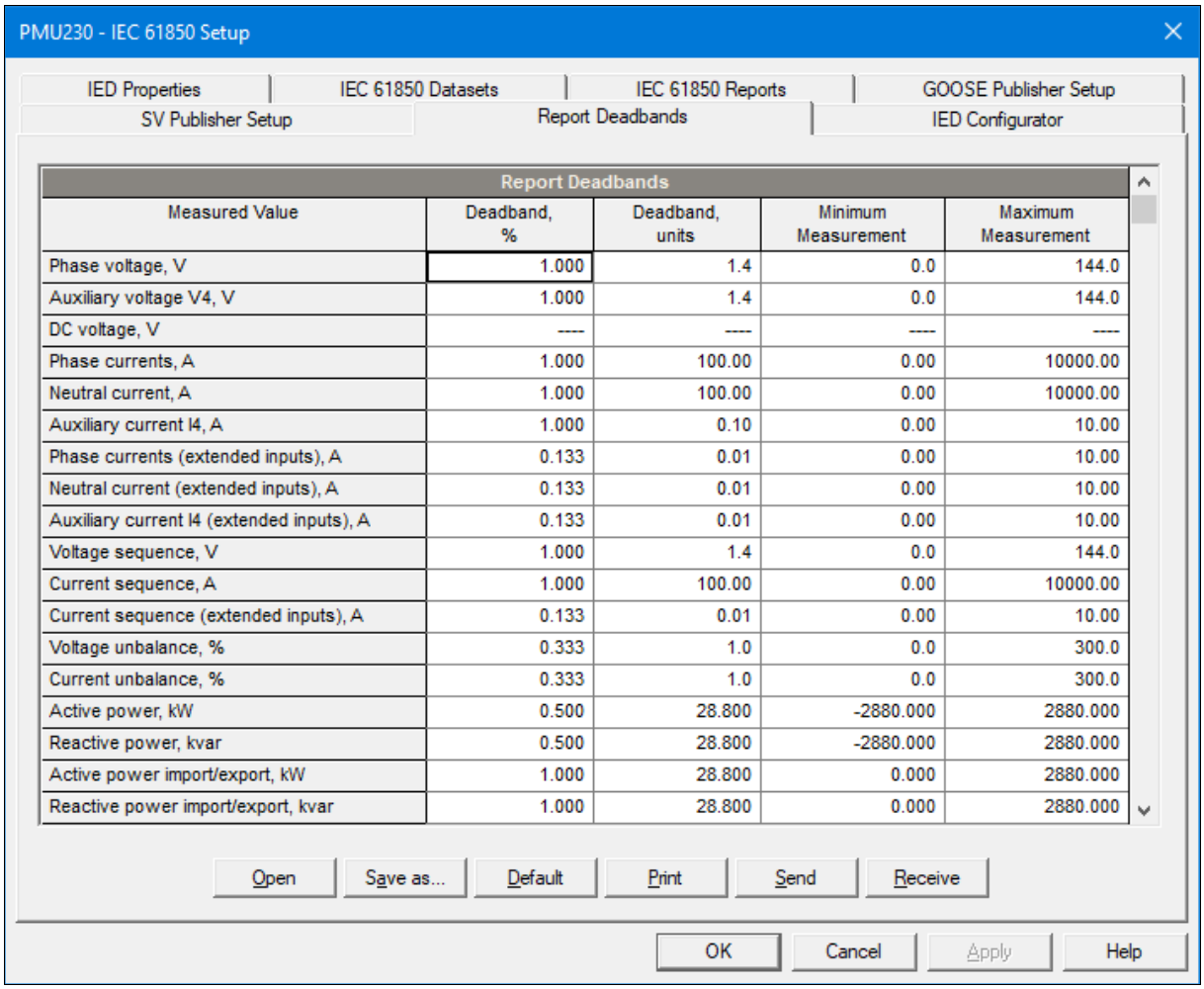
Downloading new report deadbands to the device changes deadbands for all analog data of the same type in all logical nodes, so it is recommended to do that before you make your individual deadband adjustments.

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 the PMU PRO Installation and Operation Manual on how to configure these parameters in your device.

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.

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 applicable for the PMU PRO.

Measured Value	Default Deadband, %
Phase voltage	1.000
Phase currents	1.000
Neutral current	1.000
Voltage sequence	1.000
Current sequence	1.000
Voltage unbalance	0.333
Current unbalance	0.333
Active power	0.500
Reactive power	0.500
Apparent power	1.000
Power factor	5.000
Frequency	0.100
Analog input #1	1.000

4.9 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.

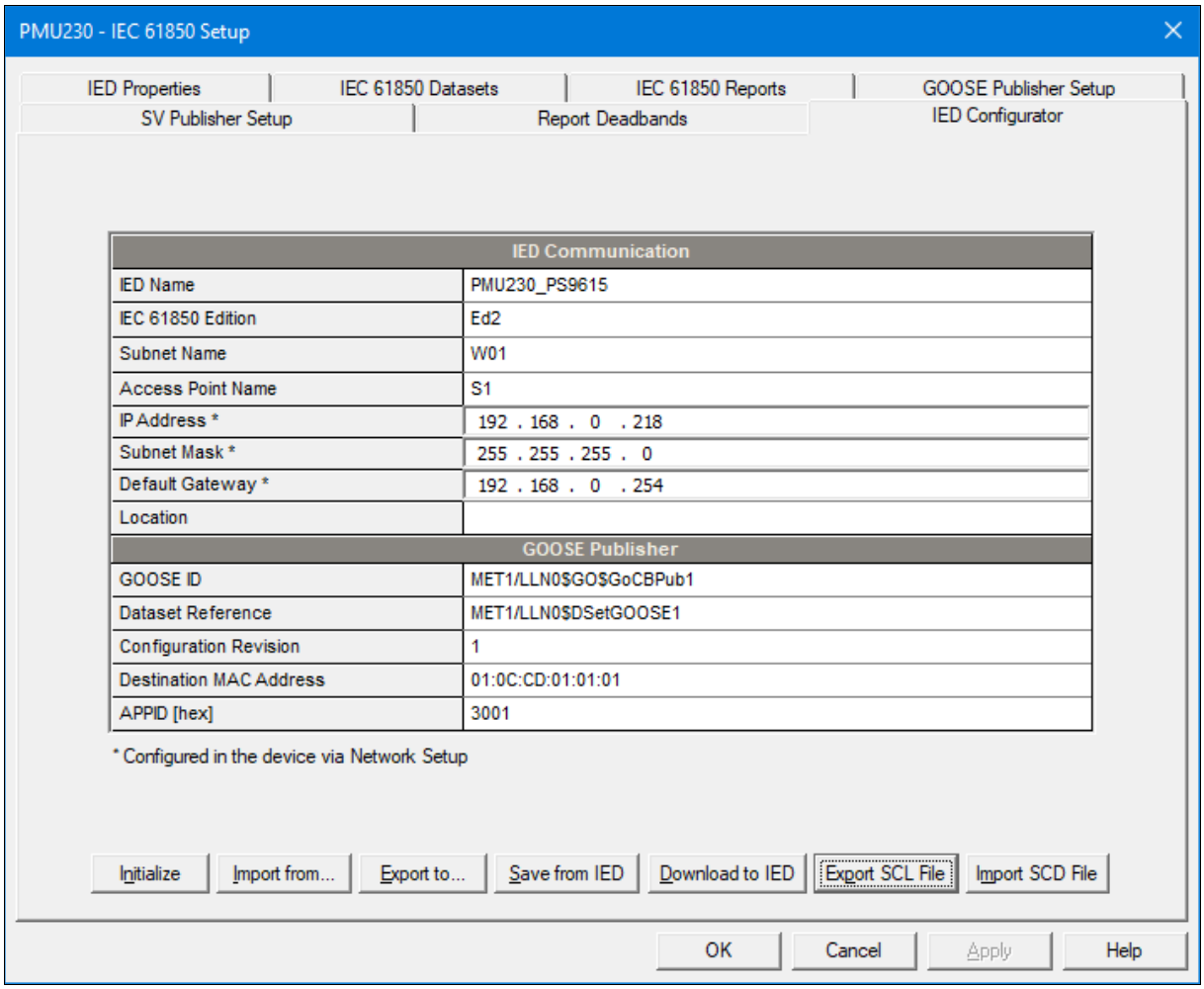
To create or update a device CID/IID/ICD file:

1. Click on the IED Configurator tab.
2. Click the "Export SCL file" button.
3. Select the type of the source template file in the “Files of type” box, locate the PMU PRO 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 PMU PRO_2007B_RevXX.icd file provided with your device 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.

   NOTE

   In the event an RCB reference is used as the Report ID (the default setting for non-indexed RCB), update the IED configuration file after changing the IED name even if no changes to RCB have been made to keep consistency with your device.

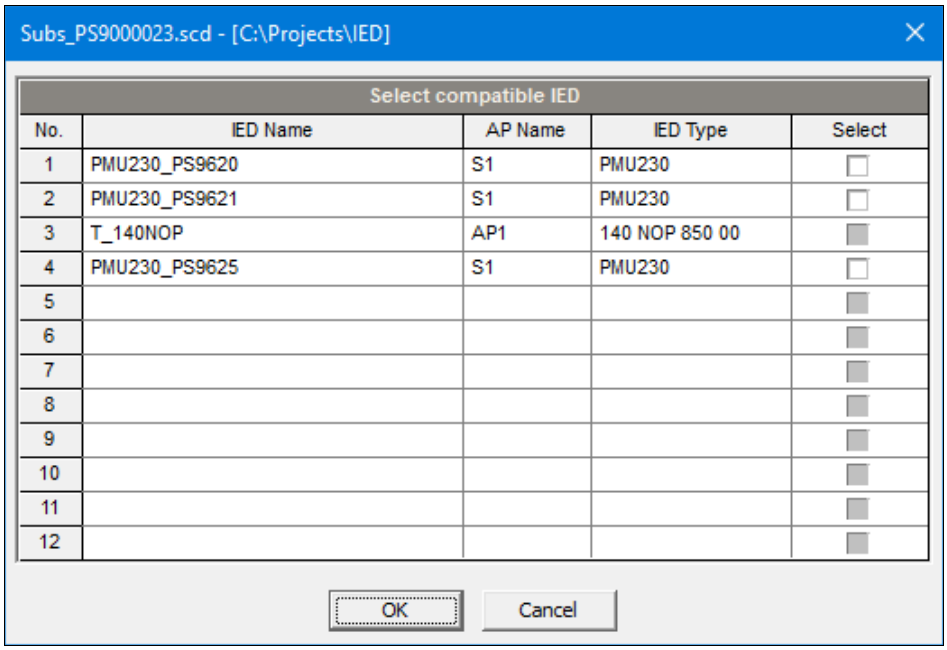


4.10 Importing IEC 61850 SCD Configuration

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.

4.11 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 PMU PRO 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.

4.12 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.