Modbus for SKF IMx and MasCon 16

User Manual Part No. 32257600-EN
Revision F

> ⚠ *WARNING! – Read this manual before using this product. Failure to follow the instructions and safety precautions in this manual can result in serious injury, damage to the product, or incorrect readings. Keep this manual in a safe location for future reference.*

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1
Introduction

</div>

Modbus for IMx Units

This user manual describes how to use Modbus with IMx units' condition monitoring (CM) part. <mark>Okay to add a brief definition?</mark> **Modbus is an application layer messaging protocol that provides client/server communication between devices connected on different types of buses or networks.**

> <mark>➢ Information on how to use Modbus with the protection part of IMx-M units is described in "IMx-M User Manual". **Related Documentation – any part number?**</mark>

IMx units offer the Modbus protocol over 2-wire RS 485 which can run as a Modbus Master or a Modbus Slave.

The following are common scenarios of when to use Modbus functionalities with IMx:

- To transmit data to a control system

- To receive data from a control system

- To receive data from sensors such as oil particle counters

- To exchange data between IMx units (used only for testing)

This user manual document describes the following:

- How to physically configure Modbus/RTU protocol over RS 485 and cable connections – Modbus (RS 485) Interface

- How to use Modbus capabilities – Modbus and IMx CM Part

- How to configure condition monitoring (CM) part of IMx units through SKF @ptitude Observer software – Configuring Modbus Capability for CM Part

- Checking Modbus Interface / Troubleshooting

About This User Manual

This user manual describes how to use Modbus with IMx units' condition monitoring (CM) part.

> ➢ In writing this manual we assume you are familiar with common Windows® operations. Refer to your Windows guides for information in these areas.

As you use this manual, you'll discover certain conventions used:

Bold type is used to indicate text that appears on a menu, window, or dialog.

Italics are used to emphasize important information.

➢ – are used to indicate notes to the reader.

Related Documentation

Document	Part No.
IMx-M User Manual (referenced for Protection)	xxxxxx
SKF @ptitude Analyst Manual? Would this be SKF @ptitude Analyst and SKF Multilog On-Line Systems – Documents deatures applicable to SKF DMx, IMx, WMx	32296700

2
Modbus (RS 485) Interface

Terminal Blocks

The following are different terminal blocks available on ~~MasCon16 and~~ IMx units.

IMx-W and MasCon16 RS 485 terminal block*

IMx-T RS 485 terminal block

IMx-M RS 485 terminal block (CPU card rear connector, L3)

IMx-R RS 485 teminal block (Upper Rear Connector J9, pin D28 and D30)

Figure 2 - 1.
Examples of RS 485 Terminal Blocks. <mark>NEED UPDATED IMAGES</mark>

A = Non-inverting

B = Inverting

GND = Reference ground

* Note that the connections of red and black wires do not imply a particular polarity.

Note that some RS 485 equipment have the A and B naming reversed. In that case, connect the wires in reverse fashion in order to avoid the communication failure over RS 485.

When connecting IMx/MasCon16 to a third party equipment refer to **Notes on Implementation** under the chapter, Modbus and IMx CM Part, of this User Manual.

Transmission Characteristics

The supported transmission parameters are listed in the table, below. The most commonly used values are in bold.

Any combination of transfer rate, parity and stop bits can be chosen. However, these parameters must match those of other equipment on the network.

Table 2-1
Supported RS 485 Transmission Parameters.

RS 485 Transmission Parameter	Supported values
Transfer rate (bps)	9600 / **19200**
Parity	**None** / Even / Odd
Stop bits	**1** / 2

RS485 Bus Termination

IMx units have termination which is controlled manually with a DIP switch.

FIGURES PENDING IMx-S modbus termination DIP switch* IMx-T modbus termination DIP switch

Figure 2 - 2.
Modbus Termination DIP Switches.

- For IMx-S and IMx-T units switch OFF means no termination whereas switch ON means termination is 120 Ω.

3
Modbus and IMx CM Part

The Modbus Protocol

The Modbus protocol allows for only one Master, but many Slaves.

Modbus Slave

- Modbus Slaves respond to requests from Modbus Master.

- A Modbus Slave can export values or import values from Modbus registers, following requests of Modbus Master.

- An IMx Modbus Slave makes all of its measured analogue vibration and digital speed channels available for export at the request of any kind of Modbus Master.

Modbus Master

- An IMx Modbus Master can read data from one Modbus Slave device.

- When an IMx Master is appropriately configured, the Modbus registers are read into Protection channels. Protection channels are available for analysis in the same way as local measured channels.

Notes on Implementation

- IMx Modbus Master only polls for data.

- Master polling rate is about 1 to 2 times per second.

- When used as a Slave, data can both be imported and exported.

- Measurement points translate to exported modbus registers according to Table 3-2, below.

- Imported modbus registers translate protection channels according to Table 3-3, below.

- The read function code is 0x04.

- The write function code is 0x10.

- The data format is 16-bit signed integers.

- Slave speed channels are transmitted in cycles per minute (cpm).

- The number of available relay channels varies depending on the type of IMx unit.

Modbus Register, Protection Channel and Measured Channel

The correspondence between measurement points and exported modbus registers are listed in the following table.

Table 3-1
Correspondence Between Measurement Points and Exported Modbus Registers.

Exported Modbus Register	Content
0x0400001 to 0x0400016	Freely Configurable*
0x0400017	Speed digital channel 1
0x0400018	Speed digital channel 2
0x0400019	Speed digital channel 3
0x0400020	Speed digital channel 4
0x0400021	Speed digital channel 5
0x0400022	Speed digital channel 6
0x0400023	Speed digital channel 7
0x0400024	Speed digital channel 8
0x0400025	Relay mask **
0x0400026	Alert mask**
0x0400027	Danger mask**
0x0400028	Heartbeat
0x0400029	Reserved
0x0400030	Reserved
0x0400031 to 0x0400100	Freely Configurable*

The correspondence between imported modbus registers and protection channels are listed in the following table.

Table 3-2
Correspondence Between Imported Modbus Registers and Protection Channels.

Protection channel	Imported Modbus register
1	0x0300001
2	0x0300002
3	0x0300003
4	0x0300004
5	0x0300005
6	0x0300006
7	0x0300007
8	0x0300008
9	0x0300009
10	0x03000010
11	0x03000011
12	0x03000012
13	0x03000013
14	0x03000014
15	0x03000015

Protection channel	Imported Modbus register
16	0x03000016
17	0x03000017
18	0x03000018
19	0x03000019
20	0x03000020
21	0x03000021
22	0x03000022
23	0x03000023
24	0x03000024
25	0x03000025
26	0x03000026
27	0x03000027
28	0x03000028
29	0x03000029
30	0x03000030
31	0x03000031
32	0x03000032

*Any IMx measurement point can be selected and exported via Modbus on these registers.

**Mask is a 16-bit mask which shows conditions of each channel in hex decimal. See Bit Representation of Mask below for detailed information.

***Modbus register number 1 is equivalent to Modbus address 0x0000. [I DON'T SEE *** IN THE TABLES ABOVE]

Bit Representation of Mask

Bit representations of Relay Mask, Warning Mask and Alarm Mask can be combinations of more than one channel condition. The following table lists those possible combinations in channel numbers.

Table 3-3
Bit Representation for Relay Mask, Warning Mask and Alarm Mask.

Bit Represen-tation in Hex	Channel Numbers	Bit Represen-tation in Hex	Channel Numbers
0x1000	13	0x0010	5
0x2000	14	0x0020	6
0x3000	14,13	0x0030	6,5
0x4000	15	0x0040	7
0x5000	15,13	0x0050	7,5
0x6000	15,14	0x0060	7,6
0x7000	15,14,13	0x0070	7,6,5
0x8000	16	0x0080	8
0x9000	16,13	0x0090	8,5
0xA000	16,14	0x00A0	8,6
0xB000	16,14,13	0x00B0	8,6,5
0xC000	16,15	0x00C0	8,7
0xD000	16,15,13	0x00D0	8,7,5
0xE000	16,15,14	0x00E0	8,7,6
0xF000	16,15,14,13	0x00F0	8,7,6,5
0x0100	9	0x0001	1
0x0200	10	0x0002	2
0x0300	10,9	0x0003	2,1
0x0400	11	0x0004	3
0x0500	11,9	0x0005	3,1
0x0600	11,10	0x0006	3,2
0x0700	11,10,9	0x0007	3,2,1
0x0800	12	0x0008	4
0x0900	12,9	0x0009	4,1
0x0A00	12,10	0x000A	4,2

Bit Represen-tation in Hex	Channel Numbers	Bit Represen-tation in Hex	Channel Numbers
0x0B00	12,10,9	0x000B	4,2,1
0x0C00	12,11	0x000C	4,3
0x0D00	12,11,9	0x000D	4,3,1
0x0E00	12,11,10	0x000E	4,3,2
0x0F00	12,11,10,9	0x000F	4,3,2,1

4
Configuring Modbus Capability for CM Part

Configuration Scenarios

The configuration for Condition Monitoring (CM) part of IMx ~~and~~ units is done through the SKF @ptitude Analyst software. Refer to <mark>SKF @ptitude Analyst User Manual</mark>.

There are different procedures for configuring Modbus capabilities depending on the scenario. Select a matching scenario and follow the steps.

- [Export Data from IMx Modbus Slave to Generic Modbus Master](#)

- [Import Data from Generic Modbus Master to IMx Modbus Slave](#)

- [Import Data from Generic Modbus Slave to IMx Modbus Master](#)

- [Data Transfer between IMx Units](#)

Export Data from IMx Modbus Slave to Generic Modbus Master

IMx Modbus Slaves can export data to generic Modbus Master via Modbus register:

- All analogue measurement point types of IMx units.

- All digital measured channels of IMx units.

Refer to Table 3-2 for the correspondence measurement points and export register number, described in the chapter, [Modbus and IMx CM Part](#).

To have an IMx unit perform in this setting, follow the listed steps in order.

1. Determine RS 485 network parameters, such as bps, parity and stop bit, described in [Transmission Characteristics](#) in the chapter, Modbus (RS 485) Interface.

2. Determine a unique Modbus Slave address for the unit to use in the Modbus network.

3. Configure the unit as a Modbus Slave by following the instructions described in the chapter, [Configuring Modbus Capability for CM Part](#), then continue with Configuring Modbus Slave.

4. Check the configuration setup by performing the steps described in the chapter, [Checking Modbus Interface / Troubleshooting](#)

Import Data from Generic Modbus Master to IMx Modbus Slave

IMx Modbus Slaves can import values from generic Modbus Master via Modbus registers.

To have an IMx unit to perform in this setting, follow the listed steps in order.

1. Decide which Modbus register is of interest to you.

2. Translate the register number according to Table 3-3: Correspondence between Modbus registers and export register number " in Modbus and IMx CM Part to determine which Protection channel to set up.

3. Determine RS 485 network parameters, such as bps, parity and stop bit described in Transmission Characteristics in Modbus (RS 485) Interface chapter.

4. Determine a unique Modbus Slave address for the unit to use in the Modbus network.

5. Configure the unit as a Modbus Slave by following the instructions described in Configuring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM Part, then continue with Configuring a Modbus Slave.

6. Set up a channel for the IMx Modbus Slave by following the instructions described in Protection Analog Channel in the chapter, Setting up a Channel for Modbus chapter. Use the Protection analog channel number from step 2.

7. Check the configuration setup by performing the steps described in Checking Modbus Interface / Troubleshooting chapter.

Import Data from Generic Modbus Slave to IMx Modbus Master

IMx Modbus Master can import data from a generic Modbus Slave via Modbus register.

To have an IMx unit perform in this setting, follow the listed steps in order.

1. Decide which register is of interest to you.

2. Translate the register number according to "Table 3-3: Correspondence between imported modbus registers and Protection channels " in Modbus and IMx CM Part chapter to determine which Protection channel to set up on the Master.

3. Determine RS 485 network parameters, such as bps, parity and stop bit described in Transmission Characteristics in Modbus (RS 485) Interface chapter.

4. Find out the Slave address of the generic Modbus Slave with which IMx Modbus Master will communicate.

5. Configure the unit as a Modbus Master by following the instructions described in the chapter, Configuring Modbus Capability for CM Part. Then continue with Configuring a Modbus Master. Use the Modbus Slave address from step 4.

6. Set up a channel for the unit configured as a Modbus Master:

   – To set up an analog channel, follow the instructions described in Protection Analog Channel in Setting up a Channel for Modbus chapter.

   – To set up a digital channel on units, follow the instructions described in Protection Digital Channel in Setting up a Channel for Modbus chapter.

7. Modbus Master has to have a measurement point in order to be able to import data. Set up an appropriate measurement point on the channel created in step 6.

8. Check the configuration setup by performing the steps described in the chapter, Checking Modbus Interface / Troubleshooting.

Data Transfer between IMx Units

A transfer of measurement data from an IMx unit to another IMx unit is used for test only.

To have data transfer between two IMx units, follow the listed steps in order.

1. Decide which unit is to export data and which unit is to import data:

   – The unit which is to export data has to be configured as a Modbus Slave.

   – The other unit which is to import data has to be configured as a Modbus Master.

2. Decide which register is of interest to you.

3. Translate the register number according to "Table 3-2: correspondence between measurement points and export register number " and "Table 3-3 Correspondence between import modbus registers and Protection channels " in the chapter, Modbus and IMx CM Part.

   – The corresponding Protection channel number is used when setting up a channel on the Master.

   – The corresponding measurement point and export register number is used when setting up a channel on the Slave.

4. Determine RS 485 network parameters, such as bps, parity and stop bit for both units. Refer to Transmission Characteristics in Modbus (RS 485) Interface chapter.

5. For the unit that is to export data (Modbus Slave):

   – Configure a Modbus Slave with a unique Slave address on the export unit by following instructions described in the chapter, Configuring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM PartConfiguring Modbus Capability for CM Part. Then, continue with Configuring Modbus Slave.

   – Set up a channel (refer to SKF @ptitude Analyst Manual).
     Use the corresponding measured channel number from step 3.

     ➢ Note that in order to set up a speed data transfer between IMx units, set up an analogue channel assigned to a speed Protection channel then set up a process measurement point. See Protection Analog Channel. [pending implementation]

   – Set up a measurement point.

6. For the unit that is to import data (Modbus Master):

   – Configure a Modbus Master with the Slave address from step 5 to create a Modbus Master-Slave pair. Follow the instructions described in Configuring IMx Units for Modbus chapter, then continue with Configuring Modbus Master.

   – Set up a Protection channel by following the instructions in Protection Analog Channel.
     Use the corresponding Protection channel number from step 3.

> ➢ Note that in order to set up a speed data transfer between IMx units, set up an analogue channel assigned to a speed Protection channel and then set up a process measurement point. ==[pending implementation]==

  – Set up a measurement point.

7. Check the configuration setup by performing the steps described in the chapter, [Checking Modbus Interface / Troubleshooting](#).

Configuring IMx Units for Modbus

The configuration of Modbus for IMx units' condition monitoring (CM) part is done through @ptitude Analyst software. ==[pending implementation]==

1. First start the SKF @ptitude Analyst software located in the SKF @ptitude Monitoring Suite. For more detailed information about @ptitude Analyst software, refer to "@ptitude Analyst User Manual".
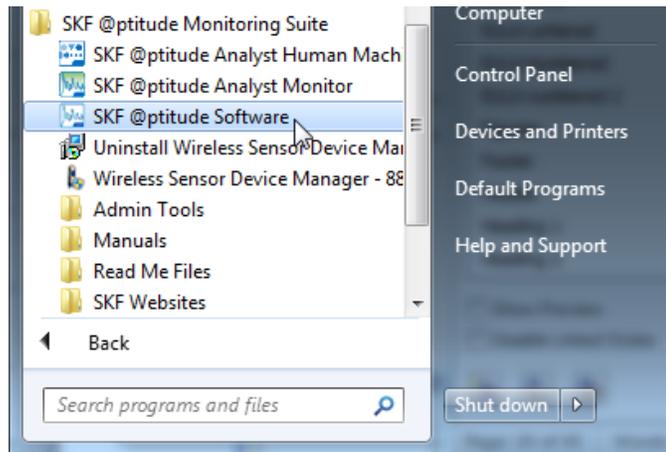
Figure 4 – 1.
@ptitude Analyst in the Start Menu.

2. In @ptitude Analyst, select the specific IMx device in the hierarchy.

3. Click **Customize** to open the menu.
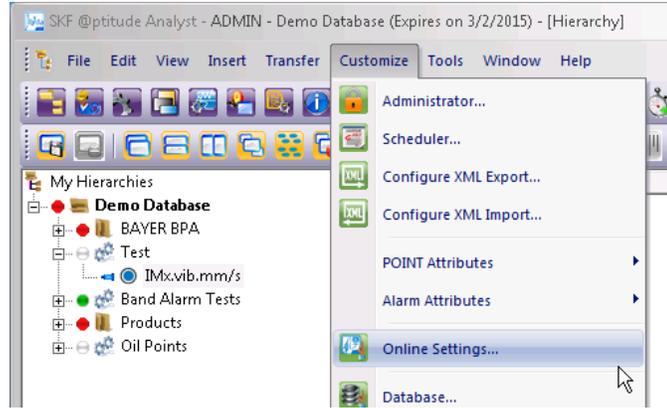
Figure 4 – 2.
Customize > **Online Settings**.

4. Select **Online Settings...**to open the dialog.
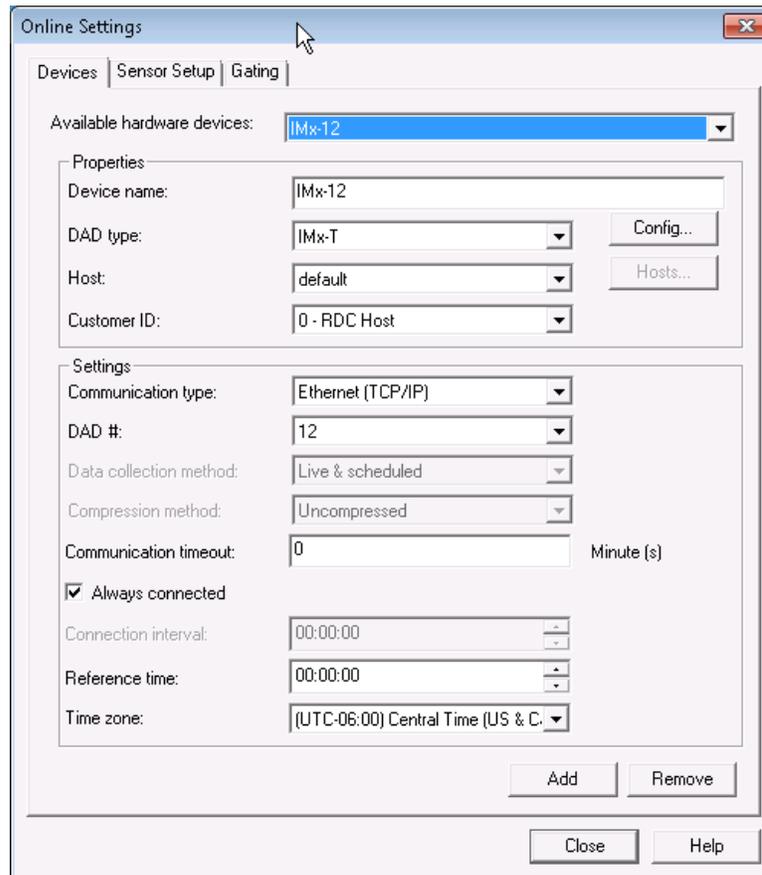
Figure 4 – 3.
Online Settings Dialog.

5. Then, select **MasCon/IMx units** in the menu of the main window. HOW? The **Available Hardware devices** field?

6. The **MasCon/IMx units** window displays any previously configured MasCon and IMx units in the left frame. From here you can create new units or edit or delete previously configured units.
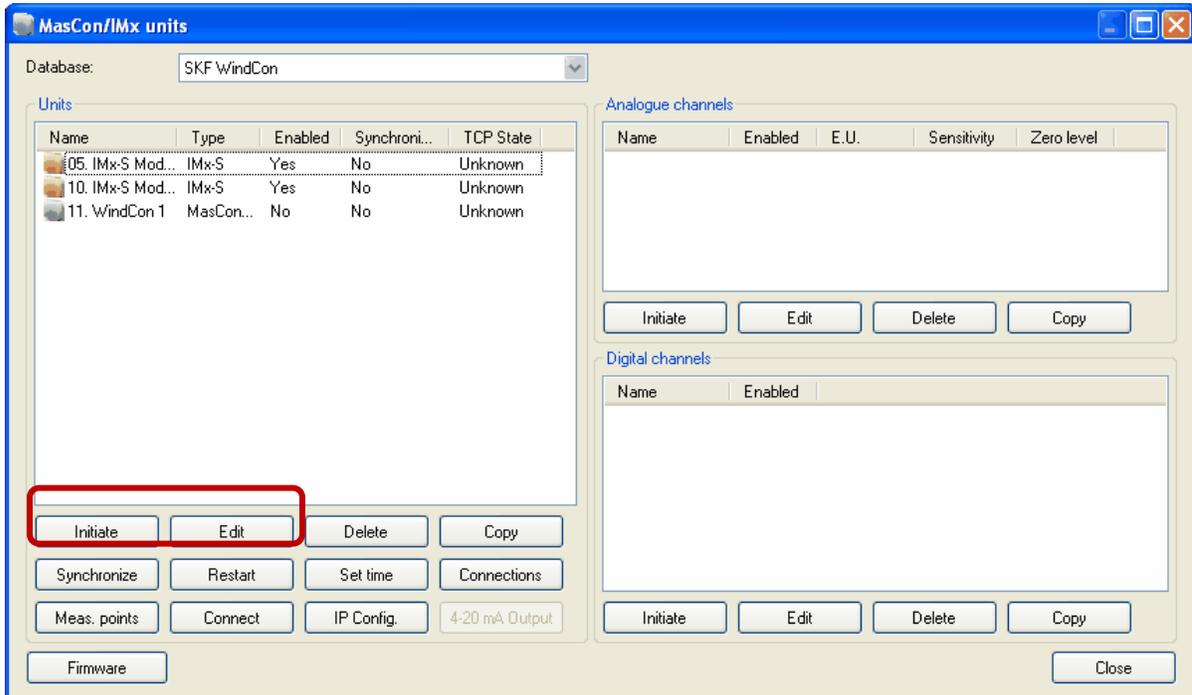
Figure 4 – 4.
Example of **MasCon/IMx Units Screen**.

7. If you are creating a Modbus functionality on a new unit, click the **Initiate** button inside the "Units" frame to the left. Then, select a **Type** for the new unit.

8. If you are configuring a Modbus functionality on a previously configured unit, select a specific unit from the list of units, then click the **Edit** button.
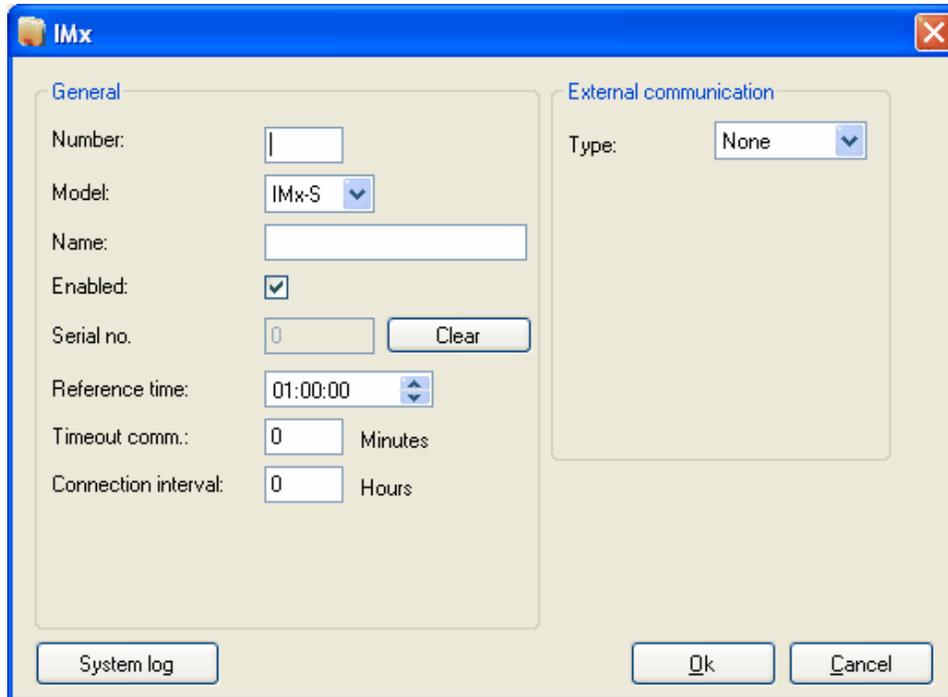
Figure 4 – 5.
Example of **IMx**, **General** Settings.

9. Assign or change the general parameters for the unit you are initiating or editing.

10. If you are configuring a Modbus Slave, continue with Configuring a Modbus Slave in this chapter.

11. If you are configuring a Modbus Master, continue with Configuring a Modbus Master in this chapter.

Configuring a Modbus Slave
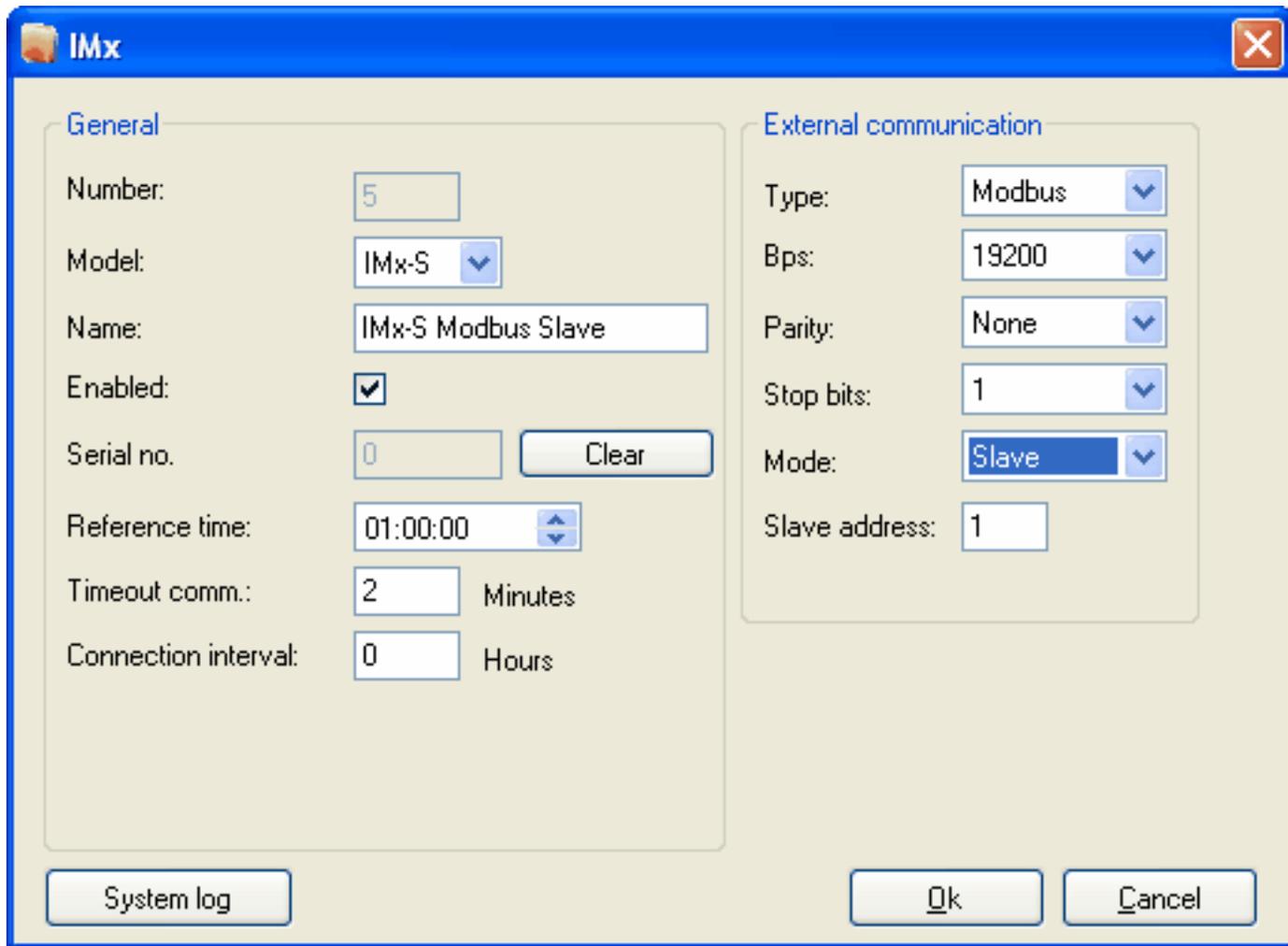
Figure 4 – 6.
Example of IMx – External Communication for Slave. [pending @Analyst implementation]

The "External communication" fields are described below:

- **Type** sets the external communication as Modbus or Modbus/RTU when selected.

- **Bps** defines the speed of Modbus, transfer rate in bps. Refer to Transmission Characteristics for detailed information.

- **Parity** can be set to None, Even or Odd.

- **Stop bits** defines the number of stop bits in use. It can be 1 or 2.

- **Mode** is to be set to **Slave** for it to act as a Modbus Slave.

- **Slave address** becomes the Modbus address of this Slave. This Slave address number is the address with which a Modbus Master will communicate. Therefore, this exact

Slave address number is to be entered when creating a Modbus Master if the Master will be communicating with this Slave and become a Modbus Master-Slave pair.

- Click **Ok** to return to the **MasCon/IMx units** window.

1. You should now see the new or edited unit configured as a Modbus Slave in the list.

2. The window may be closed. [pending @Analyst implementation]

Configuring a Modbus Master

Figure 4 – 7.
Example of IMx Unit – External Communication for Master. [pending @Analyst implementation]

The "External communication" fields are described below:

- **Type** sets the external communication as Modbus or Modbus/RTU when selected.

- **Bps** defines the speed of Modbus. Refer to Transmission Characteristics for detailed information.

- **Parity** can be set to None, Even or Odd.

- **Stop bits** defines the number of stop bits in use. It can be 1 or 2.

- **Mode** is to be set to **Master** for it to act as a Modbus Master.

- **Slave address** is the Slave address number with which this Modbus Master will communicate. Therefore, it is important to enter the exact Slave address number of the Modbus Master–Slave pair.

- Click **Ok** to return to the **MasCon/IMx units** window.

1. You should now see the new or edited unit configured as a Modbus Master in the list.

2. The window may be closed. [pending @Analyst implementation]

5
Setting up a Channel for Modbus

Before configuring a channel for Modbus, you need to know the channel/input number of a channel which will correspond to exported/imported Modbus registers and Protection channels in the unit configured as a Modbus Master or Slave.

The correspondence between between imported Modbus registers and Protection channels can be found in Table 3-3 in the chapter, Modbus and IMx CM Part.

Protection Analog Channel

Protection analog channel setup is done on IMx units units configured as Modbus Slave or Modbus Master.
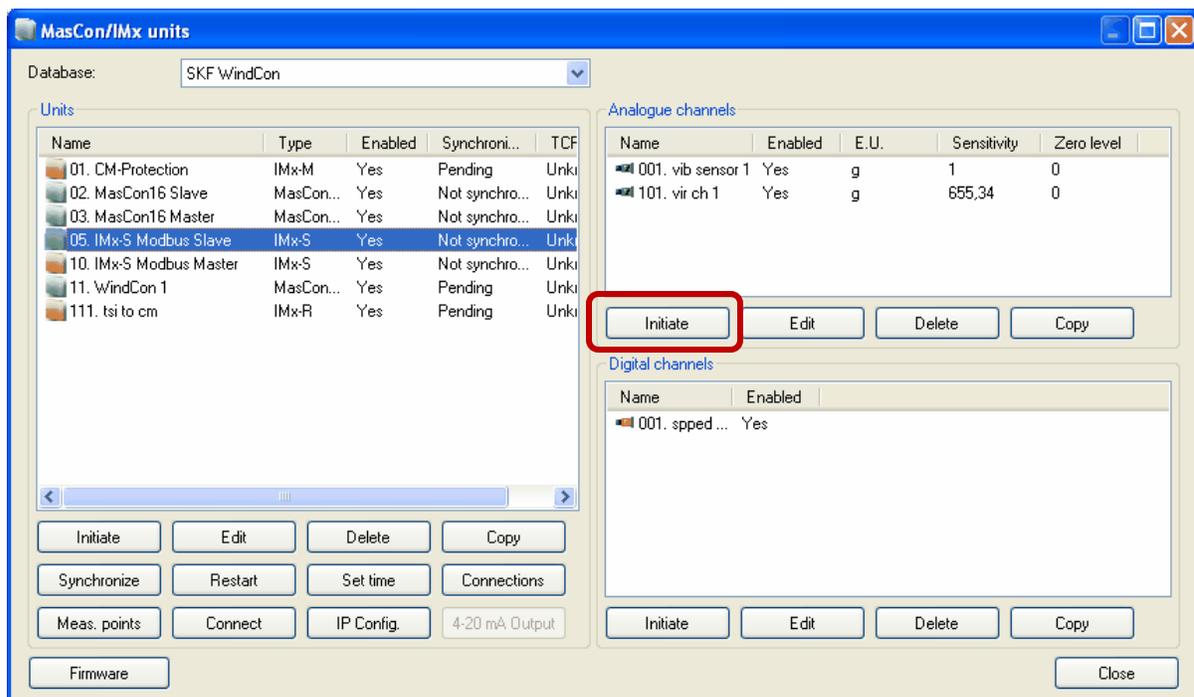
Figure 5 - 1.
Example of IMx Unit – Select Modbus Slave.

1. At the **MasCon/IMx units** window under the **Online Settings** dialog, select a unit configured as a Modbus Slave if setting up a Protection analog channel on Modbus Slave. Otherwise, select a unit configured as a Modbus Master.

2. In the "Analogue channels" frame to the upper right, click **Initiate** to set up a Protection analog channel on a Modbus Slave or Modbus Master.
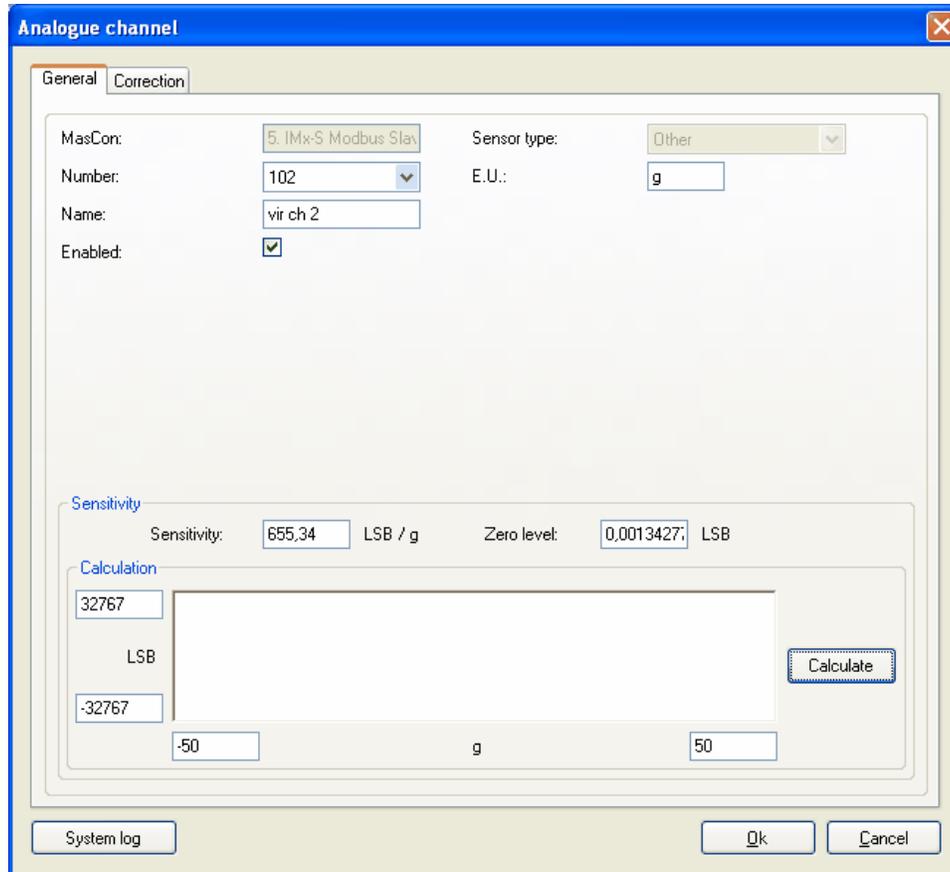
Figure 5 - 2.
Example of IMx Unit – Protection Analog CH for Modbus Slave.

3. In the "Analogue channel" window, enter a meaningful name in the **Name** field.

4. Select a Protection channel number between 101 and 116 for **Number**, depending on from which Modbus register you wish to retrieve data.

   – However, if you are setting up a speed data transfer between IMx units, select a Protection channel number between 117 and 124 which corresponds to a speed measured channel.

   – For the correspondence between measured channels, Modbus registers and Protection channels, refer to "Table 3-2: Correspondence between measured channels, Modbus registers and Protection channels" in the chapter, Modbus and IMx CM Part.

5. Parameter values for analogue measured channel:

   – The channel values correspond to maximum 32 767 and minimum –32 767.

   – Parameters such as **E.U.** and minimum and maximum range of **Sensitivity** calculation must reflect the values of the corresponding channel.

   – It is important that the minimum and maximum scale values of "Calculation" must always be symmetrical and linear regardless whether the corresponding exporting channel has them set up symmetrical or not

6.   You should now see the newly initiated analog channel in the "Analogue channels" list

   –   The channel values correspond to maximum 32 767 and minimum -32 767.

   –   **E.U.** should be set to rpm. [Suggest combining the entries with the explanation of the fields above]

   –   **Sensitivity** should be set to 1 LSB/rpm.

7.   Click **Ok** to continue. On the Analog channel dialog?
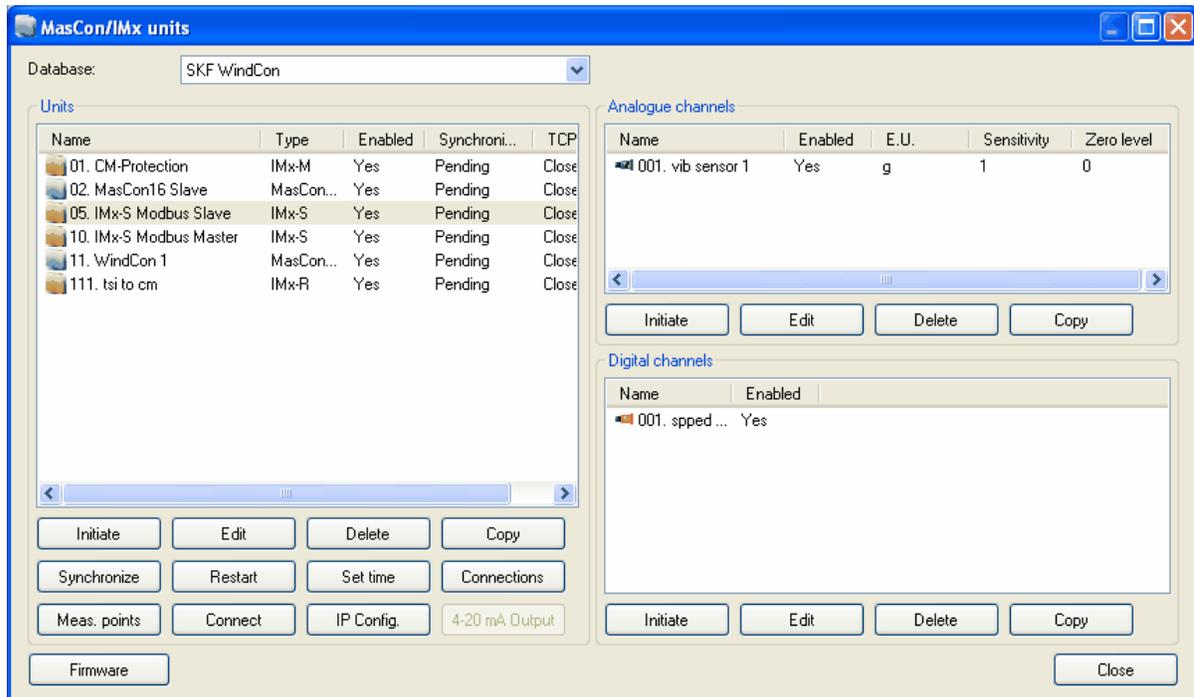
Figure 5 - 3.
Example of IMx Unit – Protection Analog CH on Modbus Slave Created.

8.   You should now see the newly initiated analog channel in the "Analogue channels" list. Is this repeat of step 6?

9.   The **MasCon/IMx units** window may be closed.

Protection Digital Channel

Protection Digital channel setup is done on IMx units configured as Modbus Master.
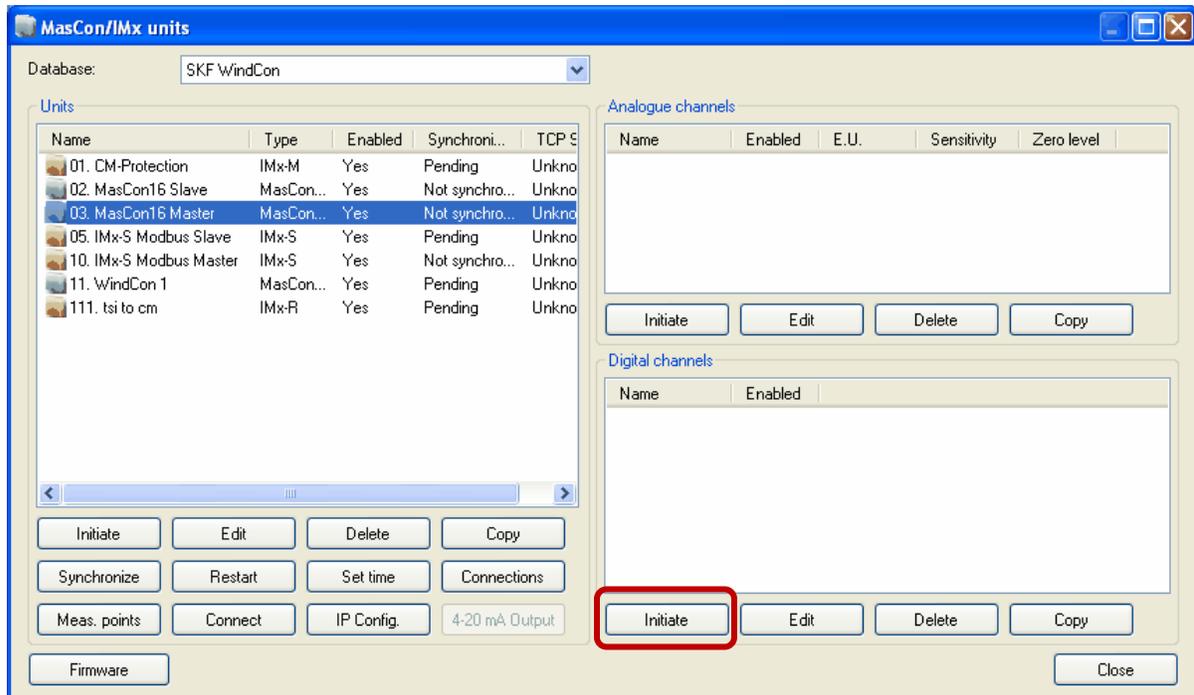
Figure 5 – 4.
Example of IMx Unit – Select Modbus Master.

1. At the **MasCon/IMx** units window, select a unit configured as a Modbus Master.

2. In the "Digital channels" frame to the lower right, click **Initiate** to set up Protection digital channel on the Modbus Master.
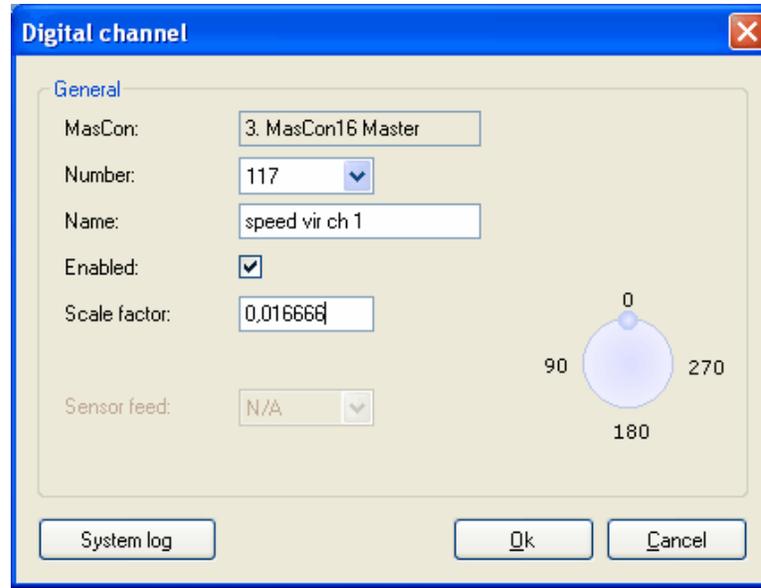
Figure 5 - 5.
Example of unit – digital Protection CH for Modbus Master.

3. In the **Digital channel** dialog, select an appropriate **Number** for the Protection channel that will pair with a sensor and a Modbus register from which the Master will retrieve data. The available digital Protection channel numbers are 117 and 118.

> ➢ For the correspondence between measured channels, Modbus registers and Protection channels, refer to "Table 3-2: Correspondence between measured channels, Modbus registers and Protection channels" in the chapter, Modbus and IMx CM Part.

4. You may need to enter a scale factor. When the Modbus number is in rpm (as is the case when the slave is another IMx/), the number is the fraction 1/60 evaluates (approximately 0,01666667). This is to convert the expected rpm or cpm calculation back to a normal value.

5. Enter a meaningful **Name** and change anything else according to your preferences.

6. Click **Ok**.
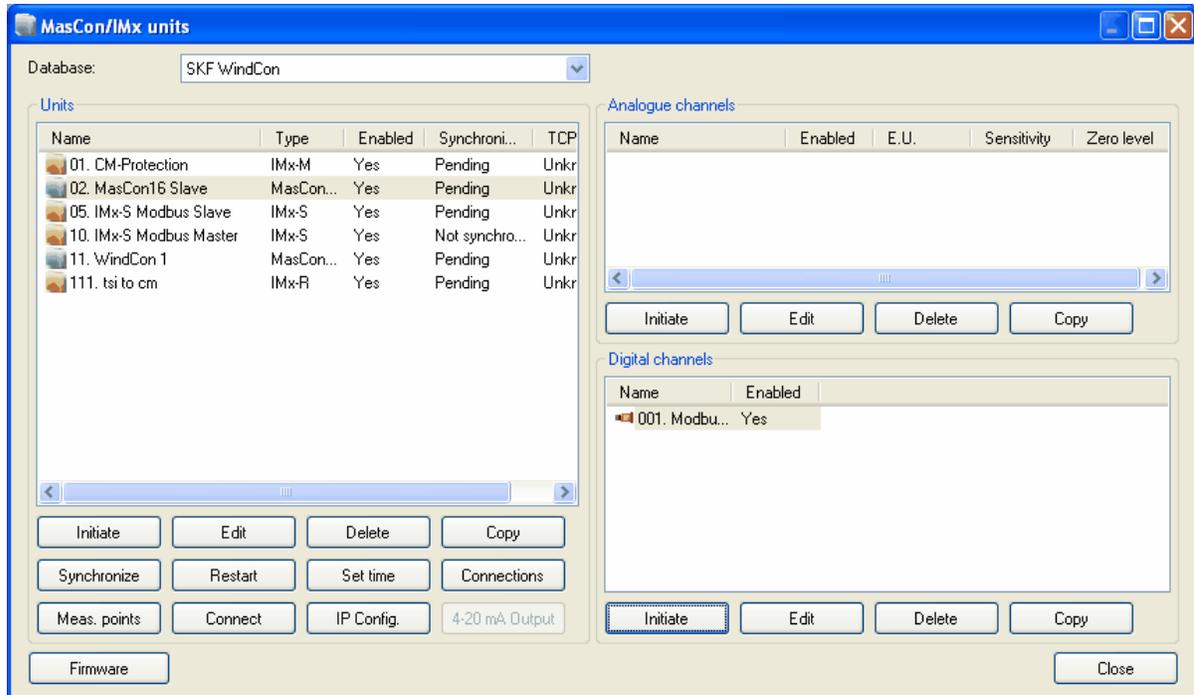
Figure 5 – 6.
Example of IMx Unit – Digital Protection CH for Modbus Slave Created.

7. You should now see the newly initiated digital Protection channel in the "Digital channels" list.

8. The **MasCon/IMx** units window may be closed.

Setting up a Measurement Point for Modbus

Measurement Point Scenario

After channels have been set up on a unit, it is time to configure measurement points as needed.

Both Modbus Master and Slave on IMx units are required to have measurement points in the following scenario:

- Import data to IMx Modbus Master:

    – Process measurement point to read Protection vibration channels or virtual process channels

    – Speed measurement point to read Protection speed channels

    – Counter measurement point to read Protection channels

    – Counter Rate measurement point to read Protection channels

- Export data from IMx/ Modbus Slave:

    – Vibration measurement point

    – Speed measurement point for only

    – Process measurement point to export process data or speed data

Vibration Measurement Point

Vibration measurement point setup can be set up for IMx /MasCon16 Modbus Slave channel.

1. Click on a machine or a sub machine that a measurement point is to be added in the hierarchy view and select **Vibration** measurement point. Note that only non-enveloped measurement points are supported.

Figure 6 – 1.
Example of Vibration Measurement Point General Setting for Modbus Slave.

2. At the General tab screen, enter a meaningful name for the measurement point.

3. Select a unit with a Modbus Slave configured and a channel to which a sensor is connected. Note that only one measurement per channel is allowed.
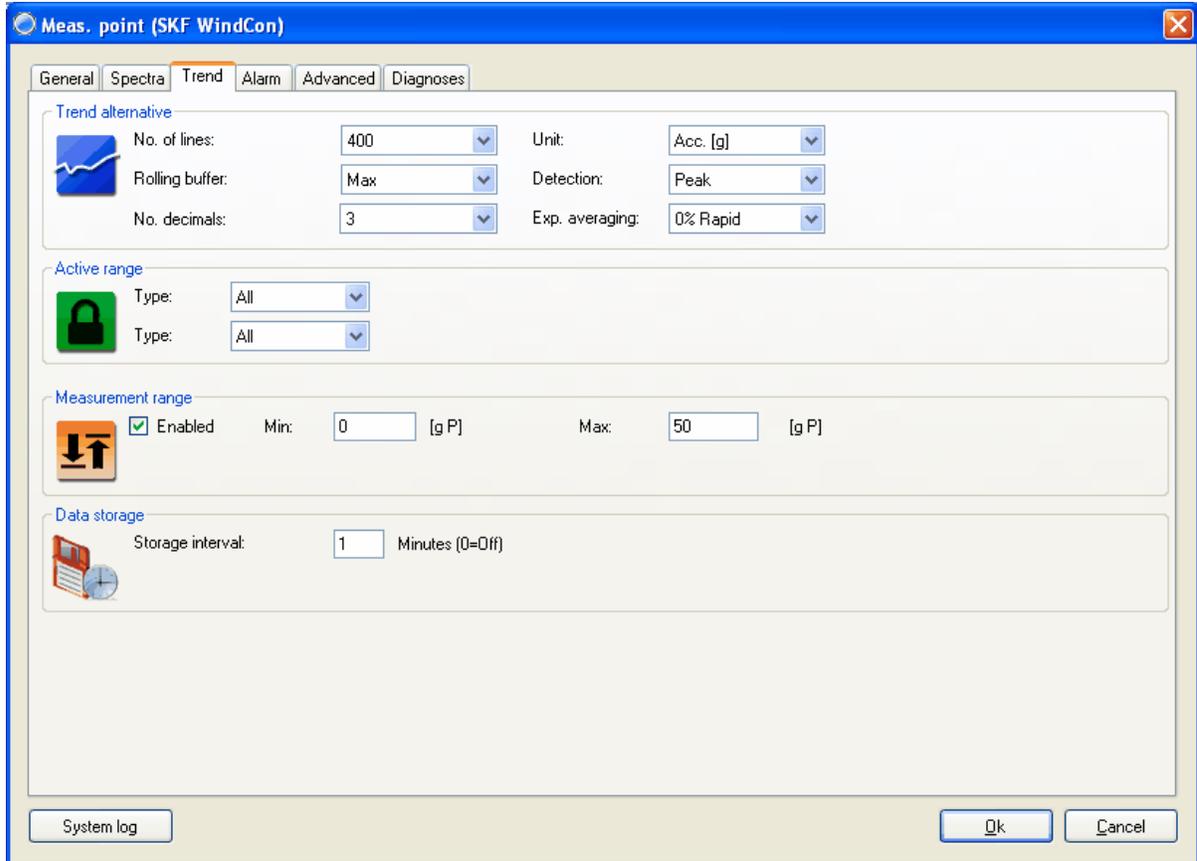
Figure 6 – 2.
Example of Vibration Measurement Point Trend Setting for Modbus Slave.

4. At the Trend tab screen, you need to set a **Measurement range** by enabling it and assigning minimum and maximum values. This measurement range decides the scaling of the Modbus register when the channel for this measurement point is exported.

5. When you are done making any other changes click **Ok**.

Speed Measurement Point

Speed measurement point setup can be set up only for MasCon16 Modbus Slave or Master channels.

1. Click on a machine or a sub machine that a measurement point is to be added in the hierarchy view and select **Speed** measurement point.

Figure 6 – 3.
Example of Speed Measurement Point for MasCon16 Modbus Master.

2. At the General tab setting screen, enter a meaningful name for the measurement point.

3. For MasCon16 Modbus Slave, select a MasCon16 unit configured as a Modbus Slave and a channel to which a speed sensor is connected.

4. For MasCon16 Modbus Master, select a MasCon16 unit which is configured as a Modbus Master and select a virtual speed channel that was initialized in the "MasCon/IMx units" window.

5. When you are done making any other changes, click **Ok**.

Process Measurement Point

Process measurement point setup can be set up for IMx/MasCon16 Modbus Slave or Master channel.

1. Click on a machine or a sub machine that a measurement point is to be added in the hierarchy view and select **Process** measurement point. Note that only non-enveloped measurement points are supported.
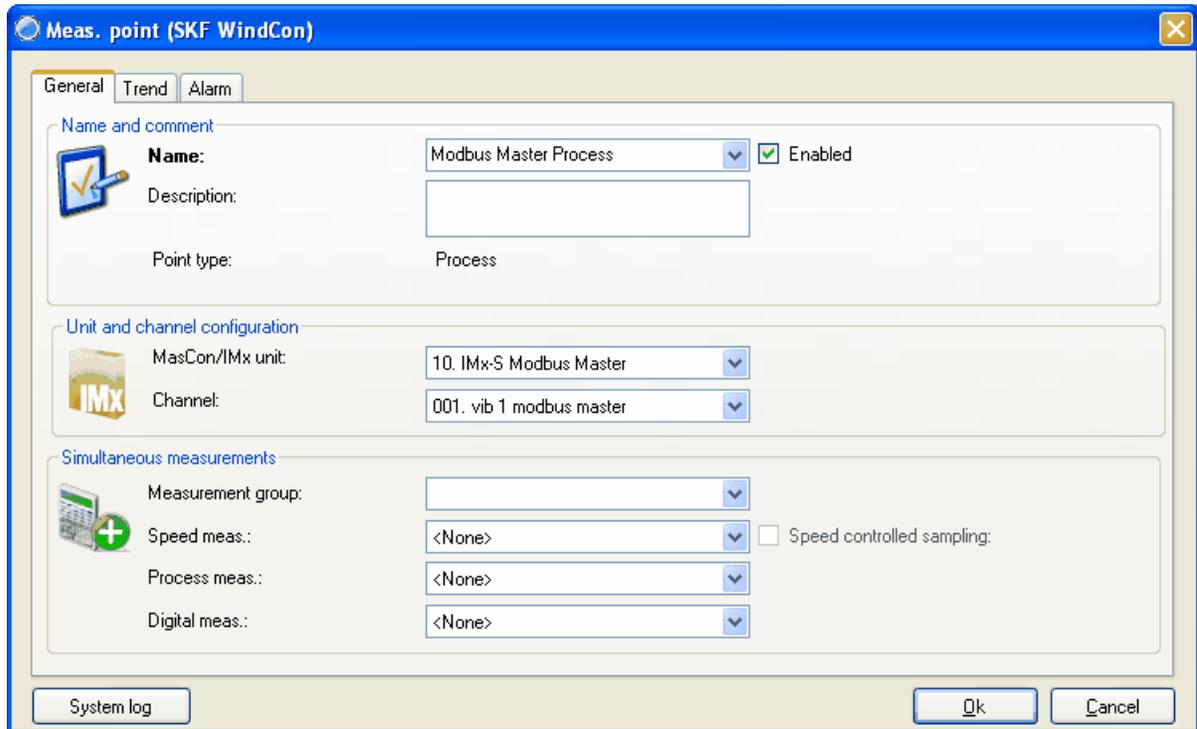
Figure 6 - 4.
Example of Process Measurement Point General Setting for Modbus Master.

2. At the General tab screen, enter a meaningful name for the measurement point.

3. Select a unit with a Modbus Slave or Modbus Master configured and a channel to which a sensor is connected. Note that only one measurement per channel is allowed.

4. When setting up a speed data transfer between IMx units, select an analogue channel assigned to a speed virtual channel.

5. When you are done making any other changes, click **Ok**.

Counter Measurement Point

Counter measurement point setup can be set up for IMx/ MasCon16 Modbus Slave or Master channel.

1. Click on a machine or a sub machine that a measurement point is to be added in the hierarchy view and select **Counter** measurement point.

2. At the General tab screen, enter a meaningful name for the measurement point. Select a unit with a Modbus Slave/Master configured and a channel to which a sensor is connected. Note that only one measurement per channel is allowed.
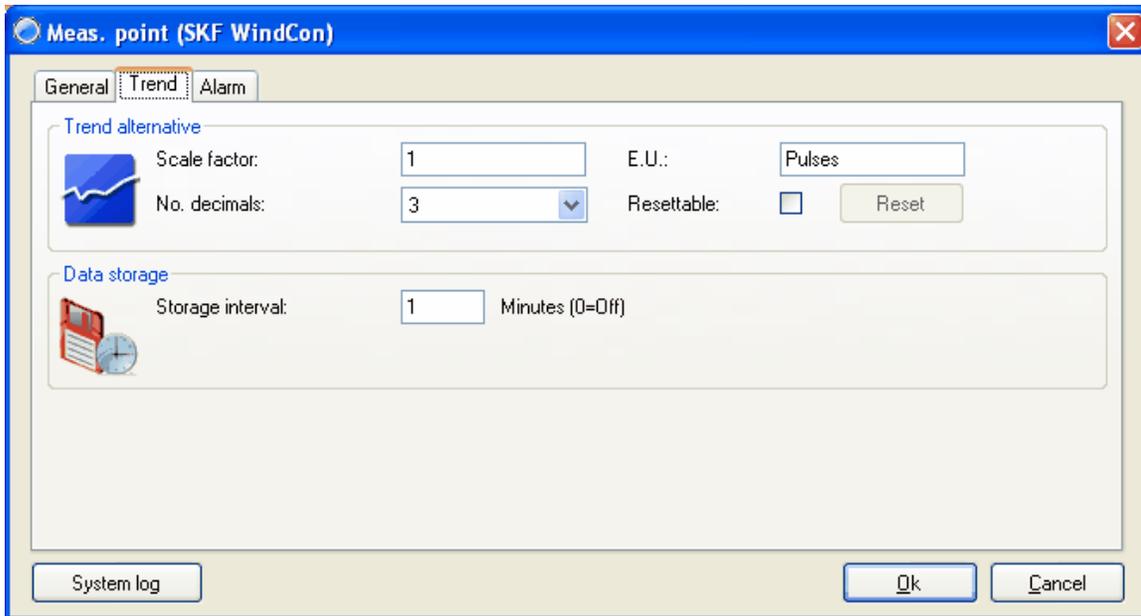
Figure 6 – 5.
Example of Counter Measurement Trend Setting for Modbus Slave.

3. At the Trend tab screen, enter the scale factor and no. decimals which would reflect a desired measurement that counts digital pulse changes.

Counter Rate Measurement Point

Counter Rate measurement point setup can be done for IMx/ MasCon16 Modbus Slave or Master channel.

1. Click on a machine or a sub machine that a measurement point is to be added in the hierarchy view and select **Counter Rate** measurement point.

2. At the General tab screen, enter a meaningful name for the measurement point. Select a unit with a Modbus Slave/Master configured and a channel to which a sensor is connected. Note that only one measurement per channel is allowed.
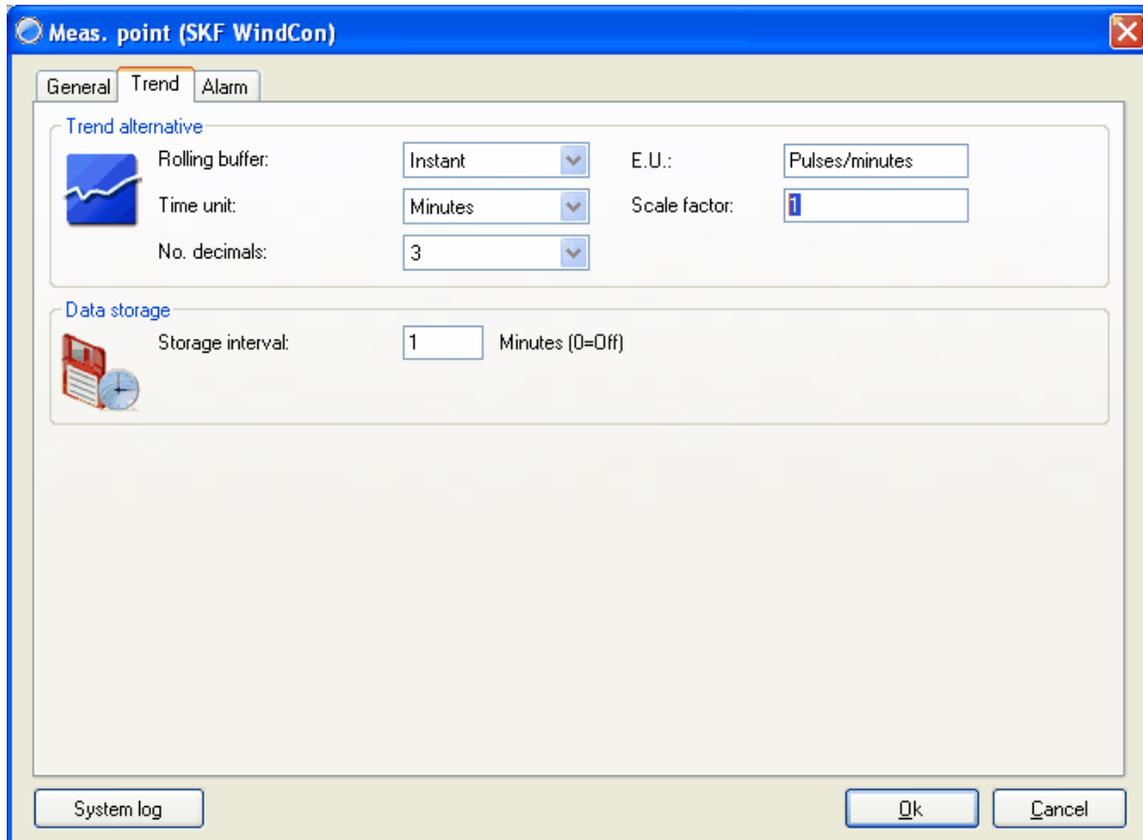
Figure 6 – 6.
Example of Counter Rate Measurement Trend Setting for Modbus Slave.

3. At the Trend tab screen, select desired **Rolling buffer** and **Time unit**.

4. Enter **E.U.** to match the Time unit selection. This is used as a legend for graph display only.

5. **Scale factor** is always 1.

6. When you are done making any other changes click **Ok**.

Modbus Import through SKF @ptitude Analyst

Configuring the Modbus Import

<mark>The Modbus Import feature</mark>…

 in SKF @ptitude Analyst applies to IMx-S and IMx-T only. It is supported by IMx firmware version 4.2, or later. If you are using IMx firmware version 4.1, or earlier, the Modbus Export features will appear dimmed in SKF @ptitude Analyst.

Modbus Export through SKF @ptitude Analyst

Configuring the Modbus Export

The Modbus Export feature in SKF @ptitude Analyst applies to IMx-S and IMx-T only. It is supported by IMx firmware version 4.2, or later. If you are using IMx firmware version 4.1, or earlier, the Modbus Export features will appear dimmed in SKF @ptitude Analyst.

The Modbus Export tab page is used to configure which SKF @ptitude Analyst points associated with an IMx device will be exported through the Modbus interface in slave mode to external consumers. It enables you to map @Analyst points to specific Modbus registers and save the desired configuration into the @Analyst database.

To select the Modbus Mode:

- In @ptitude Analyst, select the specific IMx device in the hierarchy.
- Click the **Customize** option.
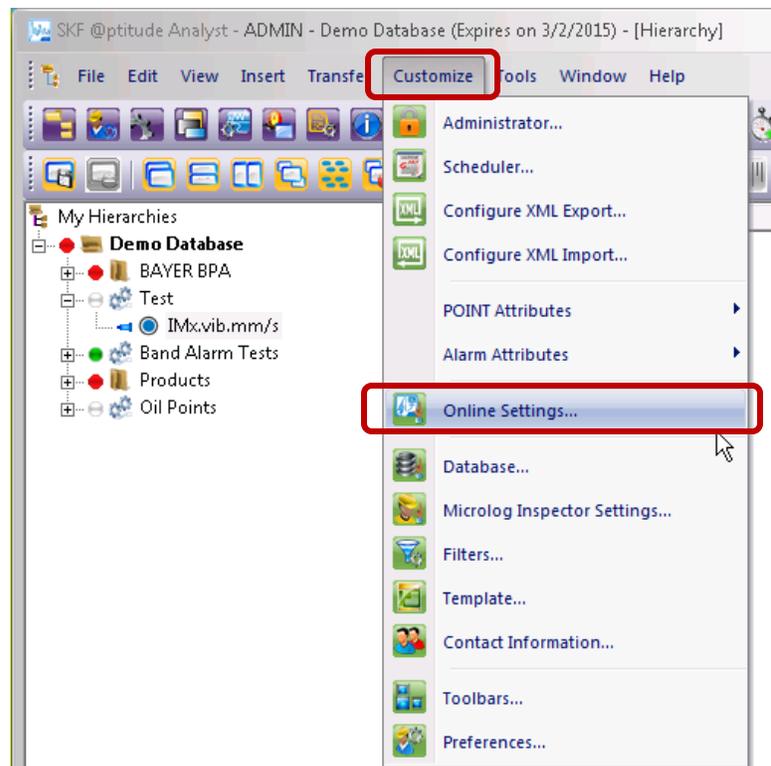
Figure 8 – 1.
Customize Menu > **Online Settings**.

- From the menu, select **Online Settings...** to open the dialog.
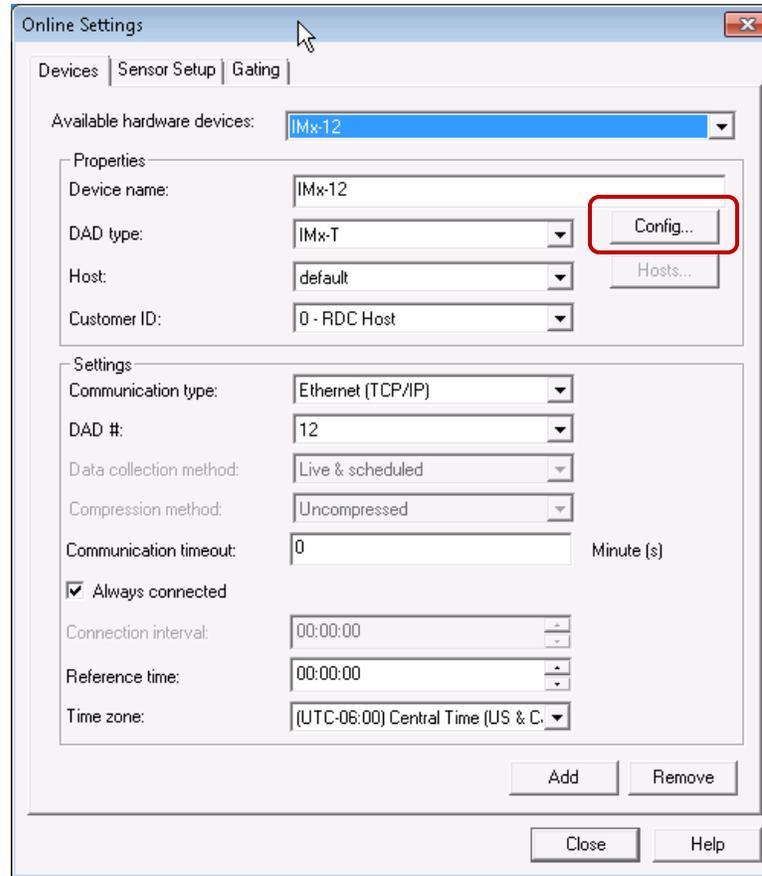
Figure 8 – 2.
Online Settings Dialog with **Config... Button**.

- In the **Online Settings** dialog, click the **Config...** button. The **Channel Properties** configuration dialog opens for the selected IMx device.

- Click Communication to open the Communication tab.
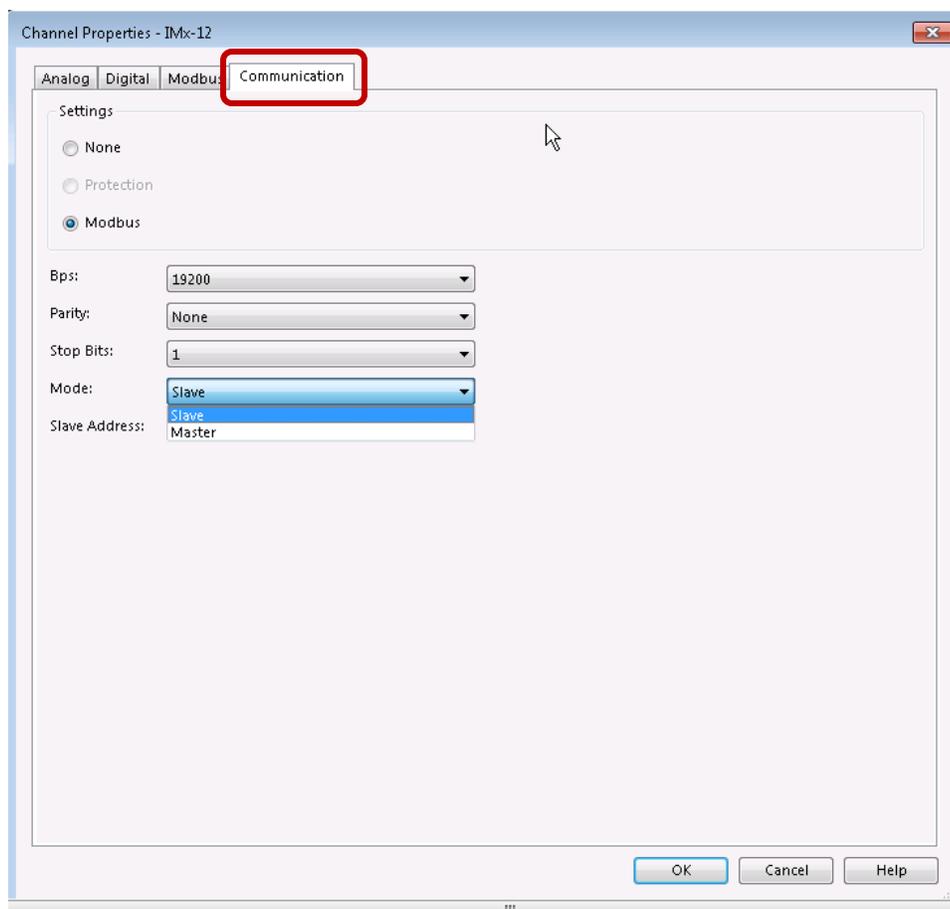
Figure 8 – 3.
Channel Properties, Communication dialog in @aptitude Analyst.

- Under **Settings**, select **Modbus**. Additional fields display in the dialog.

- Select **Slave** as the **Mode**.

- Click **OK**.

Next, you will set up the Modbus export properties.

The Modbus Export Properties

- Click Modbus Export to open the Modbus Export tab.
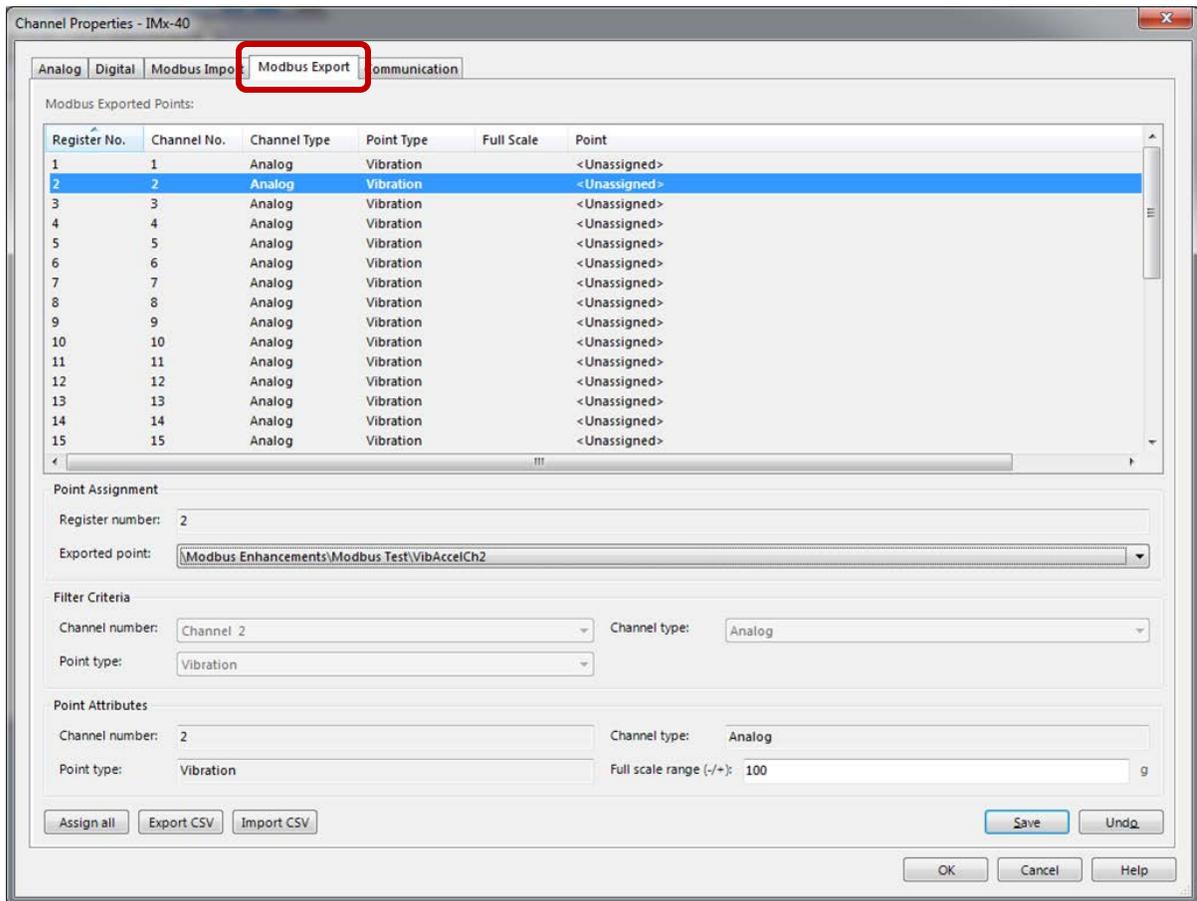
Figure 8 – 4.
Modbus Export Tab in @aptitude Analyst.

The summary table at the top displays existing Modbus export configuration settings from the @Analyst database along with all known register assignments. If there are no existing Modbus register assignments, the Point column displays <Unassigned>.

Each line shows information from a single record in the database table that associates a Modbus register with a specific point in @Analyst.

The critical action to take is to assign an **Exported point** to the selected **Register number**. You can use one of two methods to assign a point to the register number:

- The **Exported Point** drop-down list with optional filter criteria

- The **Assign All** automated function

Both methods are presented below in detail. But first, we'll describe the general button controls located in the lower right of the tab.

Buttons

Save – Saves any modified configuration information from the lower edit fields to the summary table.

> ➢ It is the **OK** button rather than the **Save** button that saves the configuration data to the @ptitude Analyst database. [true?]

Undo – Discards any modifications made to configuration information in the lower edit fields and returns values to what they were before the modifications were made.

> ➢ When **Modbus Export** first opens, the **Save** and **Undo** buttons are unavailable and appear dimmed. When you have made entries or edits in the fields, these buttons will activate.

At any time during the configuration process, you have the option to use the following buttons:

OK – Saves the Modbus export register configuration information shown in the summary table to the @ptitude Analyst database and closes the **Modbus Export** tab.

Cancel – Discards any recent edits and closes the **Modbus Export** tab.

Help - Opens help window providing guidance on how to use the **Modbus Export** tab.

Method 1 – To assign an Exported Point with optional Filter Criteria:

- Highlight a register in the summary table. The number selected for configuration is reflected in the **Register number** field in the **Point Assignment** section below.

- Use the **Exported Point** drop-down arrow and select a point from the drop-down list.
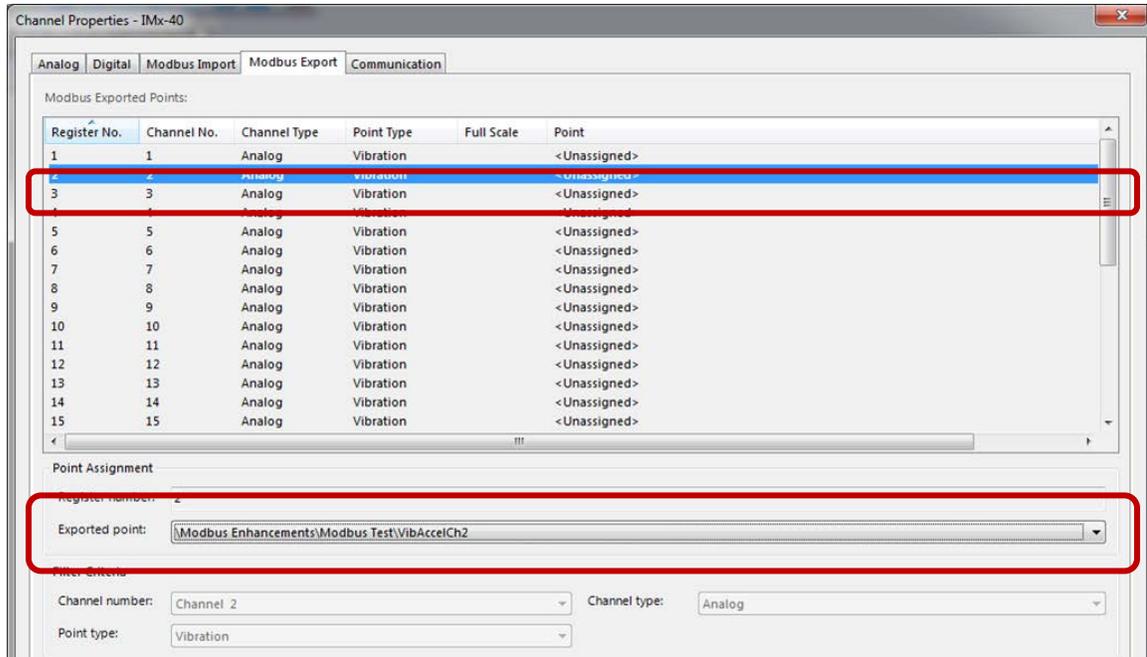
Figure 8 – 5.
Register Number and **Exported Point**

All of the points in the Analyst database (Up to how many? What numbers?) are displayed in the **Exported point** list unless you use the **Filter Criteria** to narrow the list options, as described below. WHAT MAKE THE FIELDS ACTIVE? GET AN IMAGE
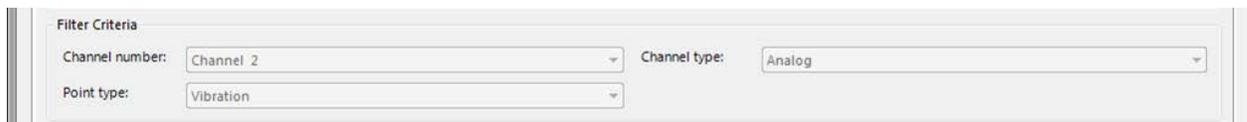
- To limit the exported point options to a specific channel number, click the **Channel Number** drop-down arrow and select the desired channel. Only points related to that channel will display in the **Exported Point** options.

- To limit the point options to a specific type of point, click the **Point Type** drop-down arrow and select the type. Only points of the selected type will display in the **Exported Point** options.

- **Channel Type** is always Analog?

More than one filter criterion may be used to further reduce the number of available points listed in the **Exported Point** options.

The **Point Attributes** section in the lower part of the page is informational only. It provides information about the selected **Exported point**.

Not informational? **Full scale range (-/+)** enables you to enter a value for the full scale range of measurement values for the selected point. This range will be from the negative of the value entered to the value.

Method 2 – To assign points by using the Assign All function and optional CSV functions:

Instead of selecting an exported point, you can use an automatic assignment function, **Assign All**. **Export CSV** and **Import CSV** are additional functions that work with **Assign All**. We'll describe how this works below.
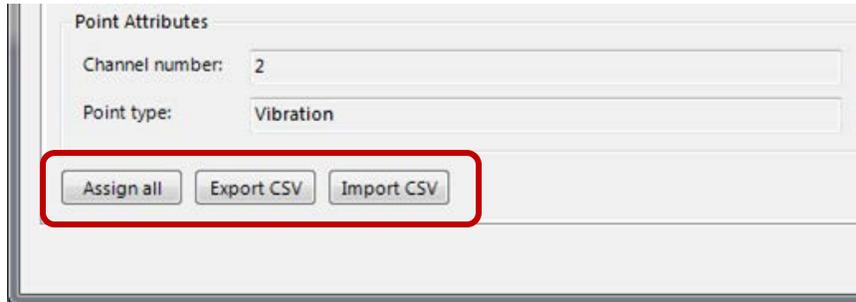
Figure 8 – 6.
Register Number and **Exported Point**.

- If you click **Assign All**, an informational dialog [GET AN IMAGE] warns you that continuing with automatic Modbus register assignment will clear all existing configuration information from the summary table. [Populates the list view with associations between all IMx points found in @Analyst for the selected IMx device and Modbus export registers supported by the IMx firmware.]

- If you agree to **Continue**, the summary table is populated with Modbus register assignments with all supported points found to be associated with the current IMx device configuration.

  ➢ The Exported points drop-down list will no longer display any points.

You will probably want to establish the order of the register assignments and/or? the assigned points. You can export the data into a CSV (comma separated values) format file. Then, open the file and reorder the list in another application, such as Microsoft Excel, that can facilitate this process.

- To export the summary table, click **Export CSV**. In the Windows dialog, specify the folder location and file name.

- Click **OK**. The Windows dialog closes and a CSV formatted file that contains the current Modbus register assignments is generated.

- After using the file to establish the order you want, save the revised data in CVS format to import it.

- Click **Import CSV**. In the Windows dialog, browse to the updated CSV file and select it for import into SKF @ptitude Analyst.

- Click **OK**. The Windows dialog closes and the summary table is then updated with the imported Modbus export register configuration information.

Checking Modbus Interface / Troubleshooting

Procedure

In order to check that Modbus configurations are done correctly, perform the following steps:

1. Start **@ptitude Analyst Multilog IMx Configurator** program located in the @ptitude Analyst / Administrative Tools directory.
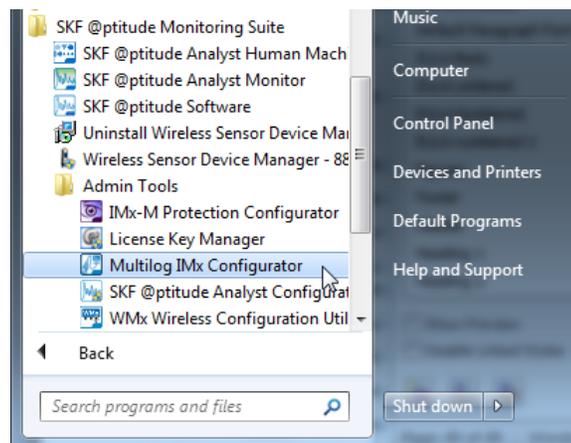
Figure 9 – 1.
Admin Tools > Multilog IMx Configurator.
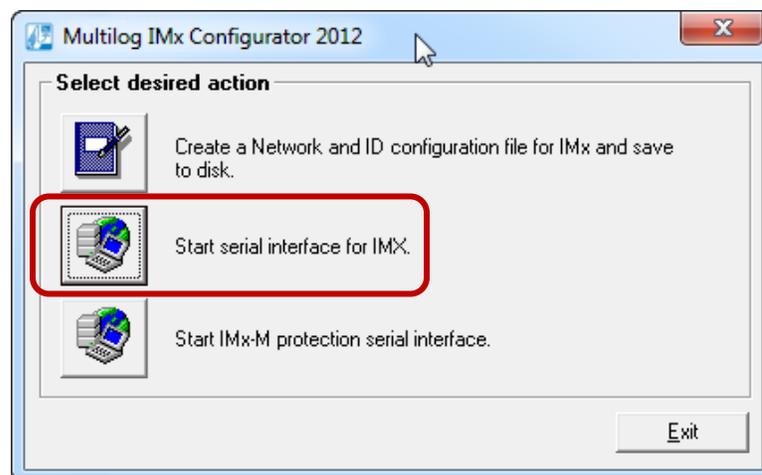
Figure 9 – 2.
Multilog IMx Configurator, Desired Actions.

2. On the opening window, click **Start serial interface for IMx**. The **Serial interface** dialog opens.
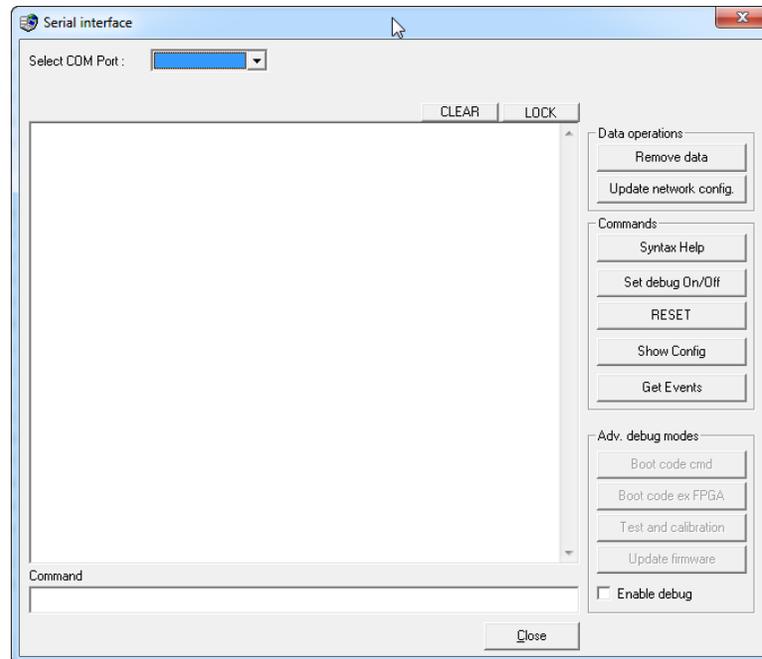
Figure 9 - 3.
Multilog IMx Configurator, **Serial Interface** Dialog.

3. On the **Serial interface** dialog, enter the COM port number and type in the word **modbus** in the command box.

4. Statistics on communication and the contents of the import registers will appear on the screen. The statistics are the following:

    – Frame errors (short and long)

    – Checksum errors

    – The number of messages sent

    – The number of messages received

    – The number of timeouts of requests

5. A properly working Modbus communication should exhibit increasing sent and received messages. However, it should not exhibit significant increase of errors or timeouts.

6. In case of errors or timeouts, check that all of the following:

    – The physical connections of RS 485 cable wires are done correctly as described in Modbus (RS 485) Interface.

    – The transmission characteristics are defined correctly as described in Transmission Characteristics.

    – The Modbus Master–Slave pair address is entered correctly as described in Configuring a Modbus Master.

7. This process of checking the Modbus sensor can be done several times during the installation/test to diagnose the communication activity, or lack of it.