



600/700 Series Profibus DP

PROFI  
BUS

# 600/700 Series Profibus DP

## Instruction Manual

Profibus DP Device Specification for Models:  
640S, 760S, 780S, and 780S-UHP  
Thermal Mass Flow Meters



Part Number: IM600/700 ProfibusDP Rev.V1  
May 2013



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### **CORPORATE HEADQUARTERS**

5 Harris Court, Building L Monterey, CA 93940  
Phone (831) 373-0200 (800) 866-0200 Fax (831) 373-4402  
[www.sierrainstruments.com](http://www.sierrainstruments.com)

### **EUROPE HEADQUARTERS**

Bijlmansweid 2 1934RE Egmond aan den Hoef  
The Netherlands  
Phone +31 72 5071400 Fax +31 72 5071401

### **ASIA HEADQUARTERS**

Second Floor Building 5, Senpu Industrial Park  
25 Hangdu Road Hangtouw Town  
Pu Dong New District, Shanghai, P.R. China  
Postal Code 201316  
Phone: + 8621 5879 8521 Fax: +8621 5879 8586

### **IMPORTANT CUSTOMER NOTICE- OXYGEN SERVICE**

Sierra Instruments, Inc. is not liable for any damage or personal injury, whatsoever, resulting from the use of Sierra Instruments standard mass flow meters for oxygen gas. You are responsible for determining if this mass flow meter is appropriate for your oxygen application. You are responsible for cleaning the mass flow meter to the degree required for your oxygen flow application.

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### **TRADEMARKS**

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# Warnings and Cautions



**Warning!** Agency approval for hazardous location installations varies between flow meter models. Consult the flow meter nameplate for specific flow meter approvals before any hazardous location installation.

**Warning!** Hot tapping must be performed by a trained professional. U.S. regulations often require a hot tap permit. The manufacturer of the hot tap equipment and/or the contractor performing the hot tap is responsible for providing proof of such a permit.

**Warning!** All wiring procedures must be performed with the power off.

**Warning!** To avoid potential electric shock, follow National Electric Code safety practices or your local code when wiring this unit to a power source and to peripheral devices. Failure to do so could result in injury or death. All AC power connections must be in accordance with published CE directives.

**Warning!** Do not power the flow meter with the sensor remote (if applicable) wires disconnected. This could cause over-heating of the sensors and/or damage to the electronics.

**Warning!** Before attempting any flow meter repair, verify that the line is de-pressurized.

**Warning!** Always remove main power before disassembling any part of the mass flow meter.



**Caution!** Before making adjustments to the device, verify the flow meter is not actively monitoring or reporting to any master control system. Adjustments to the electronics will cause direct changes to flow control settings.

**Caution!** All flow meter connections, isolation valves and fittings for hot tapping must have the same or higher pressure rating as the main pipeline.

**Caution!** Changing the length of cables or interchanging sensors or sensor wiring will affect the accuracy of the flow meter. You cannot add or subtract wire length without returning the meter to the factory for re-calibration.

**Caution!** When using toxic or corrosive gases, purge the line with inert gas for a minimum of four hours at full gas flow before installing the meter.

**Caution!** The AC wire insulation temperature rating must meet or exceed 80°C (176°F).

**Caution!** Printed circuit boards are sensitive to electrostatic discharge. To avoid damaging the board, follow these precautions to minimize the risk of damage:

- before handling the assembly, discharge your body by touching a grounded, metal object
- handle all cards by their edges unless otherwise required
- when possible, use grounded electrostatic discharge wrist straps when handling sensitive components

## **Note and Safety Information**

We use caution and warning statements throughout this book to draw your attention to important information.



### **Warning!**

This statement appears with information that is important to protect people and equipment from damage. Pay very close attention to all warnings that apply to your application.



### **Caution!**

This statement appears with information that is important for protecting your equipment and performance. Read and follow all cautions that apply to your application.

## **Receipt of System Components**

When receiving a Sierra mass flow meter, carefully check the outside packing carton for damage incurred in shipment. If the carton is damaged, notify the local carrier and submit a report to the factory or distributor. Remove the packing slip and check that all ordered components are present. Make sure any spare parts or accessories are not discarded with the packing material. Do not return any equipment to the factory without first contacting Sierra Customer Service.

## **Technical Assistance**

If you encounter a problem with your flow meter, review the configuration information for each step of the installation, operation, and setup procedures. Verify that your settings and adjustments are consistent with factory recommendations. Installation and troubleshooting information can be found in the [SteelMass™ 640S and FlatTrak™ 780S \(includes 760S and 780S-UHP\) Series product manuals](#).

If the problem persists after following the troubleshooting procedures outlined in the 640S or 780S product manuals, contact Sierra Instruments by fax or by E-mail (see inside front cover). For urgent phone support you may call (800) 866-0200 or (831) 373-0200 between 8:00 a.m. and 5:00 p.m. PST. In Europe, contact Sierra Instruments Europe at +31 20 6145810. In the Asia-Pacific region, contact Sierra Instruments Asia at +86-21-58798521. When contacting Technical Support, make sure to include this information:

- The flow range, serial number, and Sierra order number (all marked on the meter nameplate)
- The software version (visible at start up)
- The problem you are encountering and any corrective action taken
- Application information (gas, pressure, temperature and piping configuration)

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# Chapter 1: Introduction

This manual will explain how to add a Sierra flow meter to a Profibus DP network using the Profibus DP interface. The interface allows access to all relevant data available in the flow meter.

## ***Set Up Quick Step Plan***

To successfully add the flow meter to a Profibus DP network you need the following:

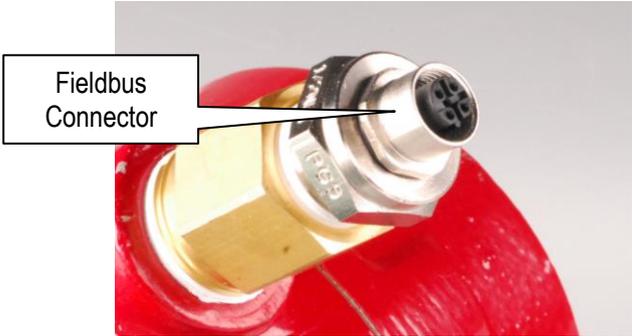
- Profibus network with a DP master
- GSD file
- Bitmap files
- Connection cable
- Power supply (for the flow meter)

Setup steps:

- Load GSD
- Copy bitmaps
- Add slave device to system
- Set slave configuration
- Set slave station address
- Download configuration
- Test configuration

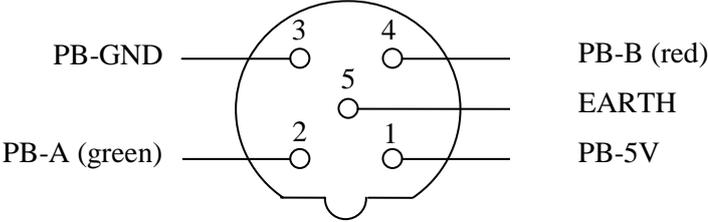
# Chapter 2: Field bus installation

All fieldbus connection for your Smart Meter is made on the right side:



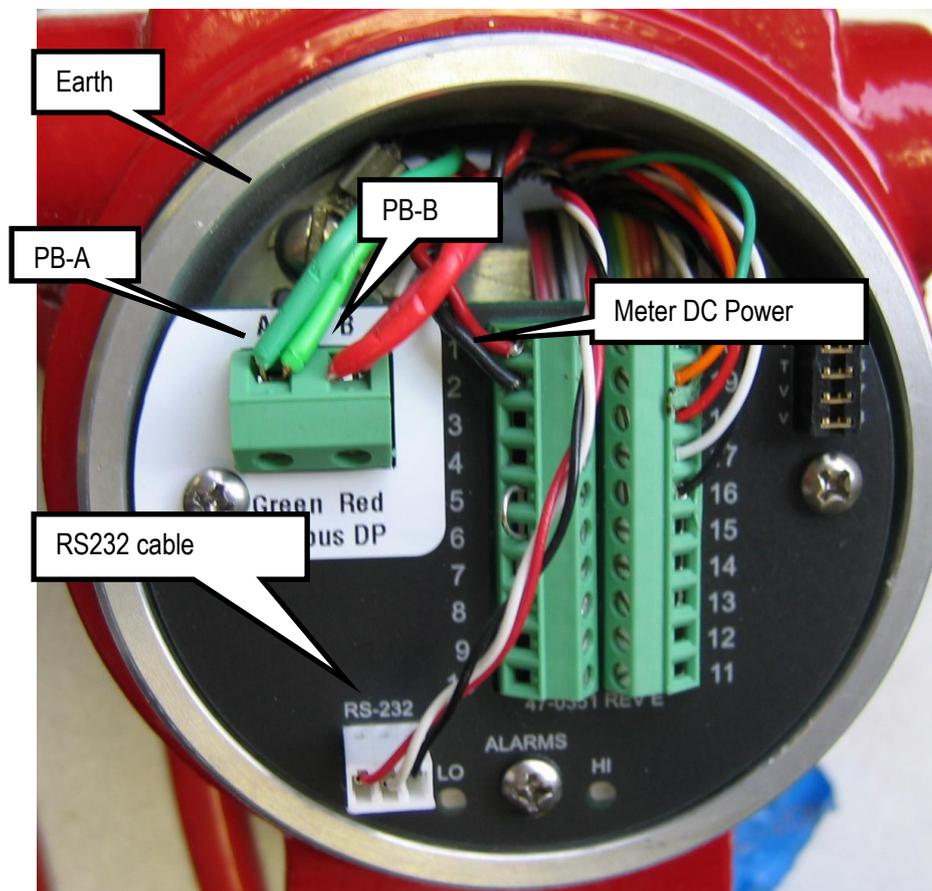
## Fieldbus Connector

The Profibus DP network is connected to the chassis female M12 connector (B-coded). The connector has the following pin configuration:



(Front view)

The Profibus DP network can be connected with a special terminal block connection. This must be requested at the time of ordering. The down side of this is the PB-5V and PB-GND will not be available to power a terminator. You should also pull 2 Profibus cables to maintain the daisy chain topography, to avoid spur lines.



## Cable

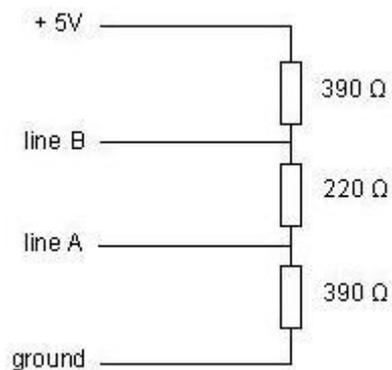
Profibus cables are shielded twisted-pair copper cables which differ from each other in the type of wire (fixed/flexible) and/or sheath. The two inner cores of a Profibus cable have green and red insulation. The specifications in this chapter are primarily intended to provide a general introduction and describe the cable properties to be considered (see also IEC 61784-5-3). A good cabling guide can be found online at: [http://verwertraining.com/wp-content/uploads/InstallationGuideV9\\_2.pdf](http://verwertraining.com/wp-content/uploads/InstallationGuideV9_2.pdf).

The cable must conform to the following specifications:

- Impedance: 150 Ohm (nominal) at frequencies from 3 to 20 MHz.
- Cable capacitance: < 30 pF per meter.
- Core diameter: > 0,34 mm<sup>2</sup>, corresponds to AWG 22.
- Cable type: twisted pair cable. 1x2 or 2x2 or 1x4 lines.
- Resistance: < 110 Ohm per km.
- Signal attenuation: max. 9 dB over total length of line section.
- Shielding: CU shielding braid or shielding braid and shielding foil.
- Max. Bus length: 200 m at 1500 Kbit/s, up to 1,2 km at 93,75 Kbit/s.

## Termination

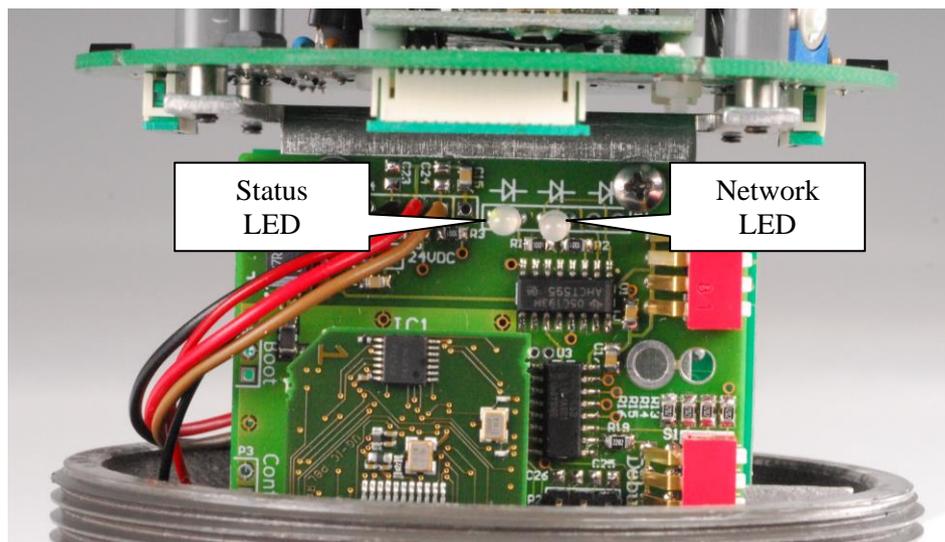
The Profibus physical layer is based on RS-485, and therefore termination resistors are needed at both ends of the network. The image below shows how to connect the terminators:



Ready-made terminators are available for easy installation.

## Status Leds

The interface has two multi-color LED's mounted inside the enclosure to indicate the status. To access the LED's, remove the front cap.



The left LED shows the status of the interface, the right LED shows the network status.

### Status LED:

Status	Description
Flashing green/red	Initializing
Steady green	Device operational
Flashing red	Recoverable hardware failure
Steady red	Hardware failure – attention required

### Network LED:

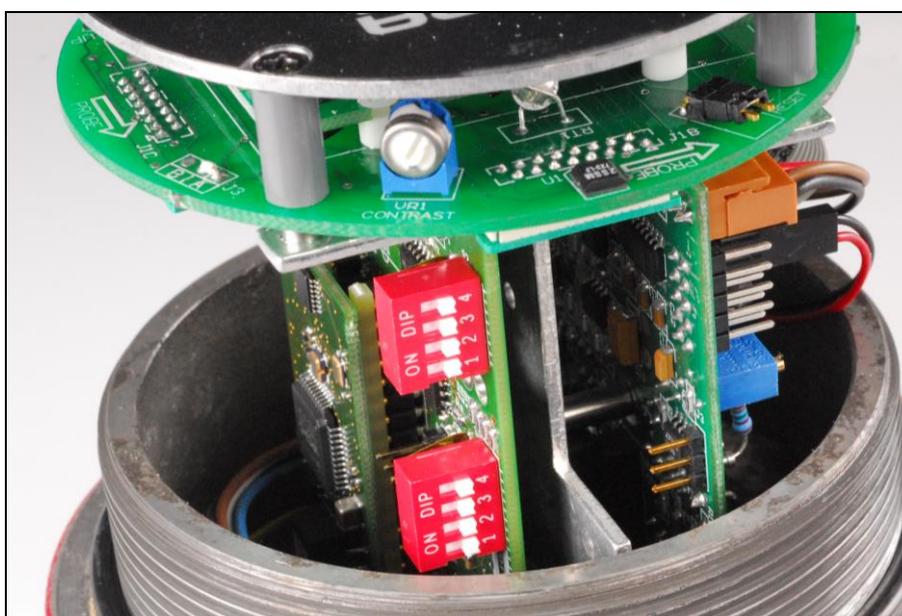
Status	Description
Off	Not online – waiting for configuration
Steady green	Data exchange
Flashing red	Connection lost

## Slave Address

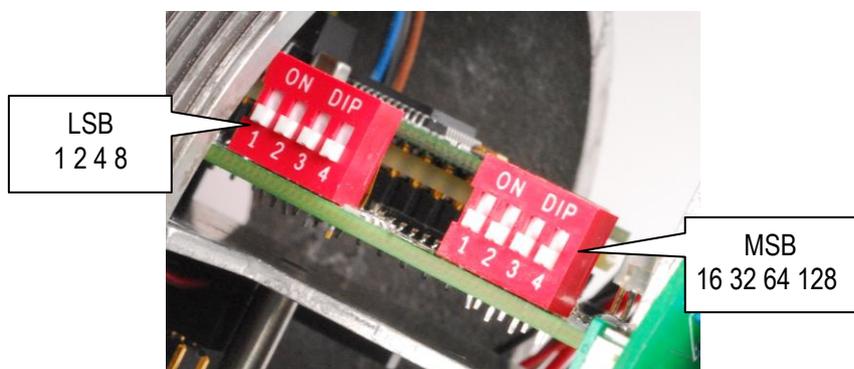
Once the interface is installed, the slave address of the interface can be set. Default instruments will be delivered with slave address 126. This address has been agreed by the Profibus organization to be free for installing new devices to the bus. Changing the station address is done in two ways, either through a dip switch or through the master.

## Dip Switch

The dip switches are located inside the meter. Remove the display cover to expose the switches:



The dip switch is binary encoded with the LSB (lowest bit) on the left side. The switch is only read during power-up.



The switch becomes active when the slider is moved upwards. Here some examples of some addresses (1 = on/up, 0 = off/down):

Address ID	Dip Switch							
	1	2	3	4	1	2	3	4
1	1	0	0	0	0	0	0	0
14	0	1	1	1	0	0	0	0
60	0	0	1	1	1	1	0	0
125	1	0	1	1	1	1	1	0

Note: An address set with the dip switch has the highest priority and the slave address will use this address when powering up!

### **Server Assigned Address**

It is possible to change the address of the unit through the server. Perform the following steps to change the address:

1. Assign a new address from the server
2. Set the dip switch to 128 (pin 8 on) or higher.

The assigned address will be used each time that the unit is powered.

### **Set Address (126)**

It is possible to force the address of the unit to 126. Set the dip switch to zero and power cycle the unit. The address is set to 126. The address can be changed by the server if needed. Do keep in mind that if the dip switch remains set to zero, the address will be set to 126 at each power-up.

# Chapter 3: Configuration

## GSD File

Each Profibus DP instrument comes with its own GSD-file. The GSD file can be obtained from the documents and downloads page (<http://www.sierrainstruments.com/products/downloads/profibus-dp>). The GSD file contains the instrument specifications telling the master configuration software which facilities/features the instrument offers to the Profibus system.

The GSD-file is a text-file containing:

- Identification info:
  - Model name: “SteelMass™ 640S - Profibus”
  - Vendor name: “Sierra Instruments Inc.”
  - Identification number: 0x013E
  - Bitmap device: “640S\_dev”
  - Bitmap diagnostics: “640S\_dia”
  - Bitmap SF: “640S\_spf”  
(Bitmap files are used in configuration software to indicate instrument status)
- Revision numbers
- Hardware characteristics:
  - VPC3+C dependable properties
- Software characteristics:
  - Supported features of Profibus: Freeze, Sync, auto baud rate detection
- Maximum bus data lengths
- Size of used data buffers
- Modules with cyclic input / output variables for the instrument.

## Cyclic Data Overview

The following table shows the cyclic input & output buffer supported by the device. Module 1 has 42 bytes in of process data in, and 12 bytes out. The actual data address will depend on preceding devices on your bus. The matrix example below shows the actual data addresses, assuming the 640S/780S is the first device on your Profibus network.

### Incoming Cyclic Data (Slave To Master Module 1)

Data Address	Description	Size (bytes)	Format
0	Flow	4	REAL
4	Totalizer	4	REAL
8	User full scale	4	REAL
12	Factory full scale	4	REAL
16	K-factor	4	REAL
20	Serial number	12	ASCII
32	Flow unit	5	ASCII
37	Totalizer unit	3	ASCII
40	Status	2	INT

42 bytes

### **Outgoing Cyclic Data (Master To Slave Module 1)**

<b>Data Address</b>	<b>Description</b>	<b>Size (bytes)</b>	<b>Format</b>
0	Reset totalizer	4	REAL
4	User full scale	4	REAL
8	K-factor	4	REAL

12 bytes

### **Cyclic Data Explained**

#### **Flow (R):**

Data type: 32 bit floating point (LSB – MSB)

Description: The actual flow as measured by the instrument

#### **Totalizer (R):**

Data type: 32 bit floating point (LSB – MSB)

Description: Accumulated flow

#### **User full scale (R):**

Data type: 32 bit floating point (LSB – MSB)

Description: The user full scale value allows you to re-range the instrument. Any value between

50% and 100% of the factory full scale is allowed. The new value will also redefine the analog outputs of the instrument (when used). The 20mA/5 VDC will represent the new full scale value.

#### **Factory Full Scale (R):**

Data type: 32 bit floating point (LSB – MSB)

Description: Factory full scale value of the instrument.

#### **K-Factor (R):**

Data type: 32 bit floating point (LSB – MSB)

Description: K-factor which can be used to adjust the flow reading

#### **Serial Number (R):**

Data type: 16 bits ASCII

Description: Serial number of the instrument (12 characters).

#### **Flow Unit (R):**

Data type: 16 bits ASCII

Description: Flow unit of the instrument (5 characters).

#### **Totalizer Unit (R):**

Data type: 16 bits ASCII

Description: Totalizer unit of the instrument (3 characters).

#### **Status (R):**

Data type: 16 bit integer

Description: Status indicates if the quality of the data in the registers (0 = bad, 1 = good).

#### **Reset Totalizer (W):**

Data type: 32 bit floating point (LSB – MSB)

Description: Accumulated flow

### **K-Factor (W):**

Data type: 32 bit floating point (LSB – MSB)

Description: K-factor which can be used to adjust the flow reading

### **User Full Scale (W):**

Data type: 32 bit floating point (LSB – MSB))

Description: The user full scale value allows you to re-range the instrument. Any value between

50% and 100% of the factory full scale is allowed. The new value will also redefine the analog outputs of the instrument (when used). The 20mA/5 VDC will represent the new full scale value.

## **Sycon Software**

Sycon is a tool for the configuration of a Fieldbus network using a Hilscher CIF50-PB master. You may be using different configuration software and hardware Master. However you will need to accomplish the same functions. No specific slave DTMs of the equipment are available, which are generated from the device description files, called generic slave DTMs.

Online diagnostic indicators and auto-scan function for the reading of network participants assist in the commissioning of the network.

This guide will explain step by step how to configure the system to support various fieldbus slaves on a Hilscher CIF50-PB master.

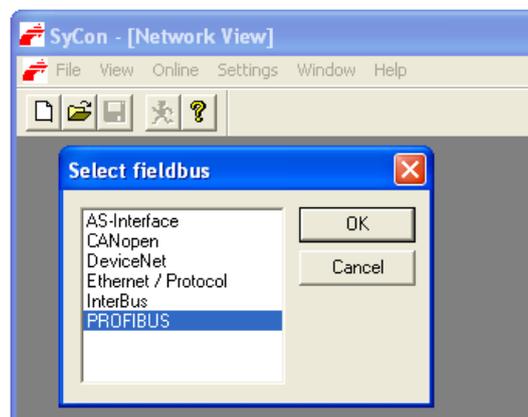
Before starting make sure that the necessary device description files (GSD & bit maps) are available in your device catalog. These are available on our web site.

## **Import Device Description Files**

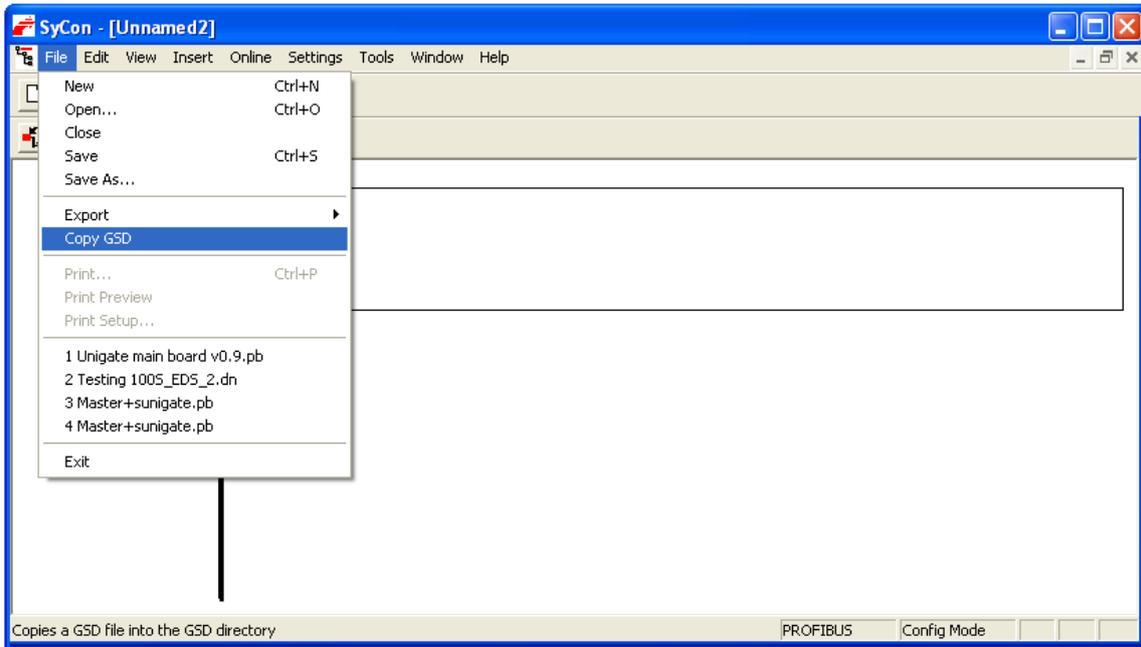
In order to use a fieldbus device its properties need to be added to the server. This is done by importing the device description files into Sycon.

- Start Sycon and create a new document (File -> New)

A dialog window appears asking to select a fieldbus. For this example select Profibus:

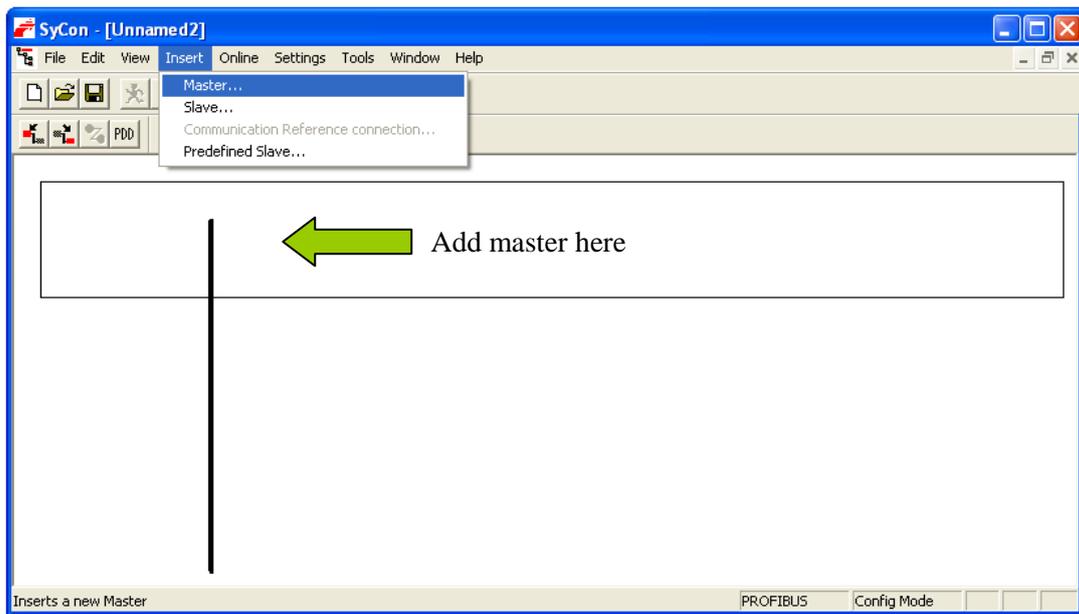


The main window is loaded. Go to the file menu and select "Copy GSD":



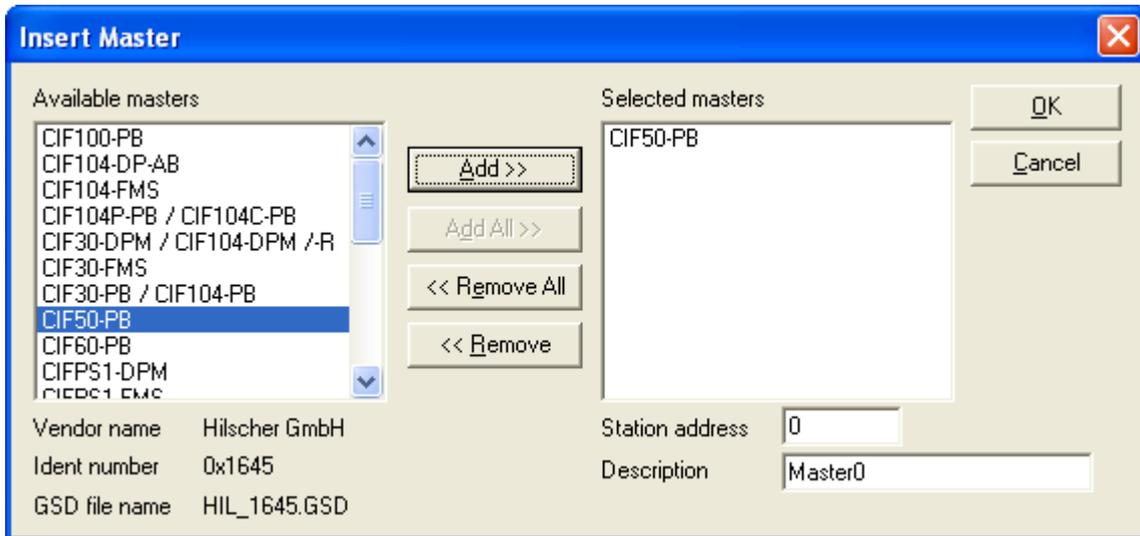
Locate the desired GSD file and load it. The GSD data is added to the Sycon library but it isn't available yet. Quit the program and restart it to make it available.

### **Configure A Slave**



### **Create A New Document And Insert A Master:**

Place the master at the top of the line. A dialog window appears where a master needs to be selected from a list. The list shows every type of master supported by Sycon. Select the Profibus master which has been installed on the PC:



Leave the station address set to zero. Press the “Add” button and then the “OK” button.

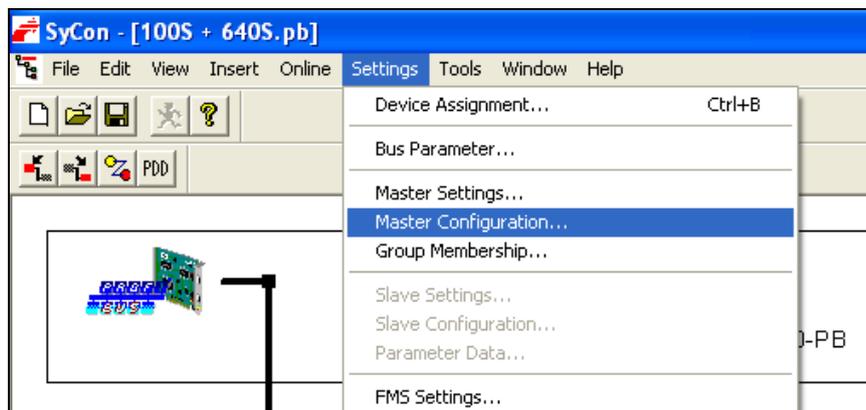
A window pops up showing the driver linked to the selected master. Press “Yes” to use the hardware.



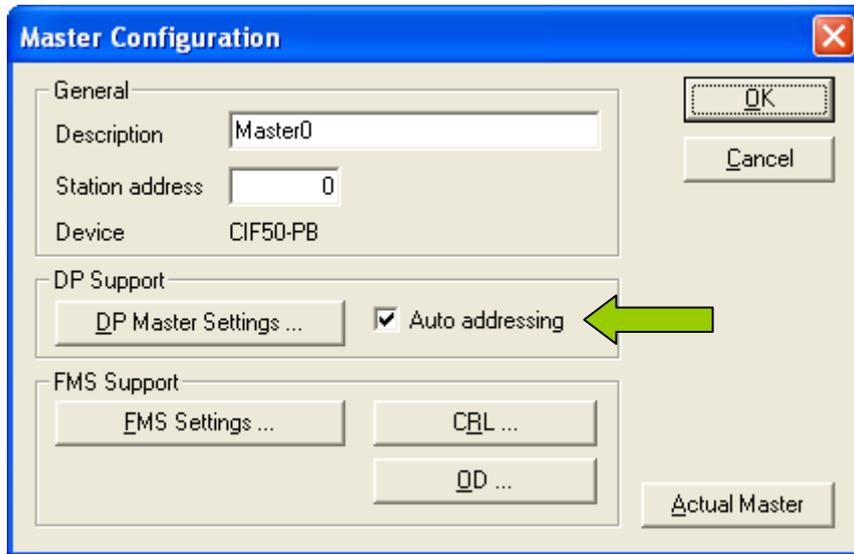
Note: The board ID number changes when extra PCI cards are added to the PC. Older configurations must be checked before trying to run them.

## Auto Addressing

The master needs to be set to auto addressing. Click on the master and from the file menu select “Settings -> Master configuration”:



Make sure the “Auto addressing” is checked:

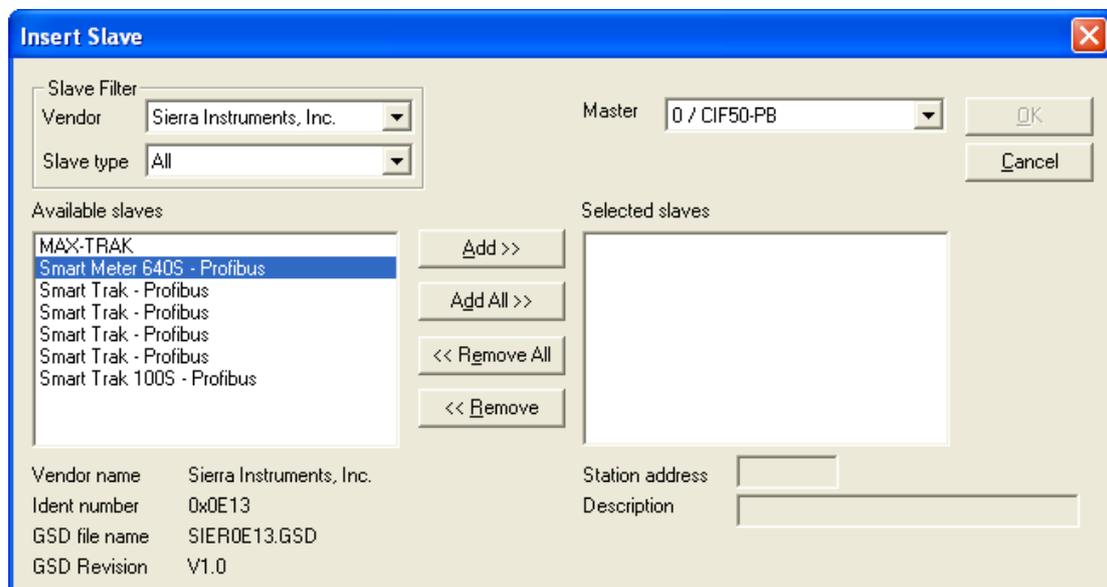


### Insert A Slave To The System.

File menu: Insert -> Slave. Place it below the master:

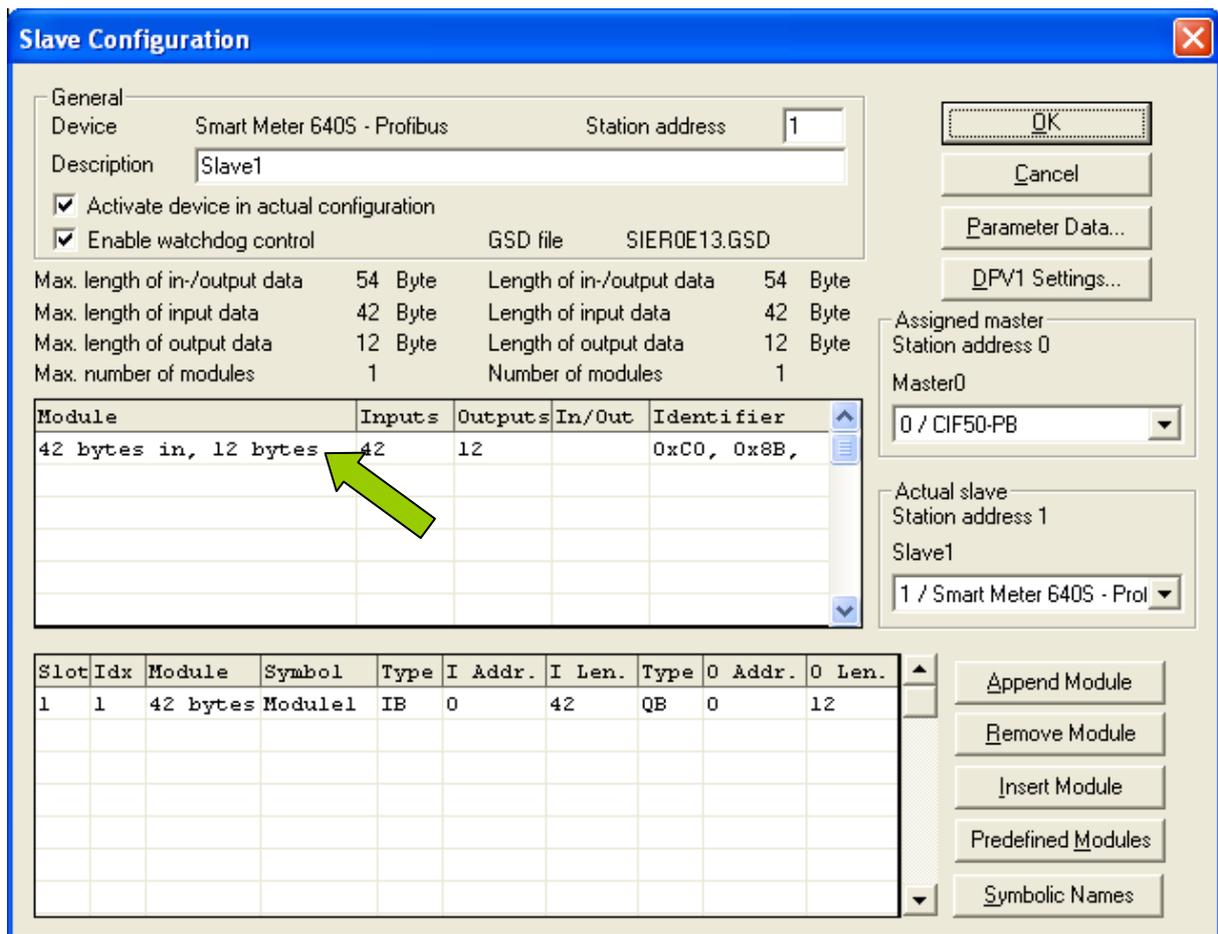


Set the slave filter to “Sierra Instruments Inc.”. Select the desired GSD file, press the “Add” button, set the slave address and description to match the slave and press the “OK” button.



Note: If no slave device appears in the window then the GSD file hasn't been copied into Sycon.

Double click on the added slave in the main window. The slave configuration window appears:

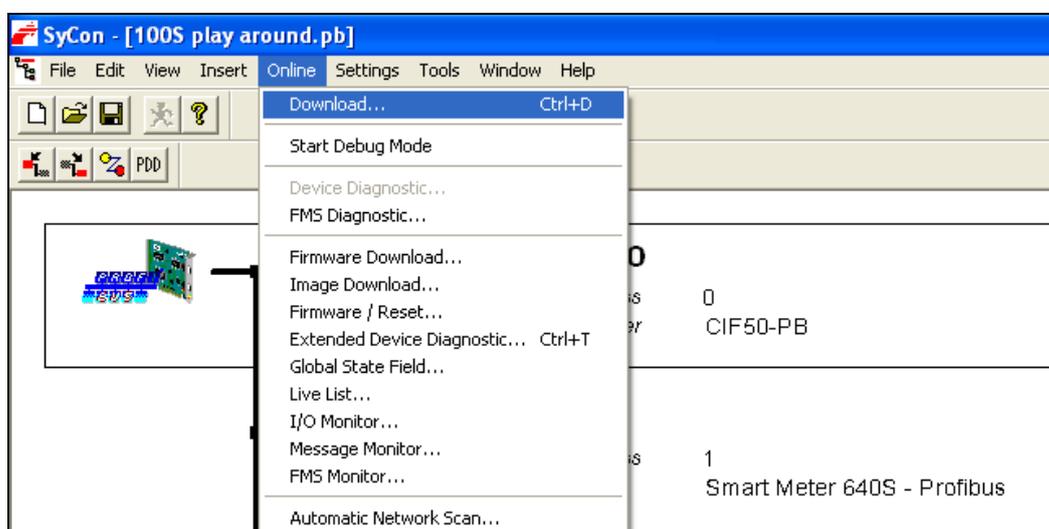


Select the desired modules by double clicking on the module name. Press the “OK” button.

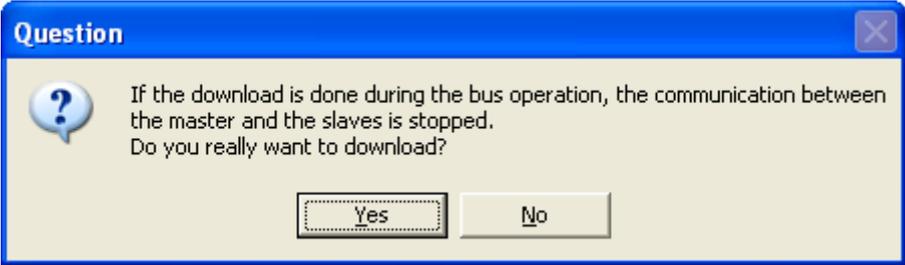
When done save the new configuration to disk (File -> save as).

## Download Configuration

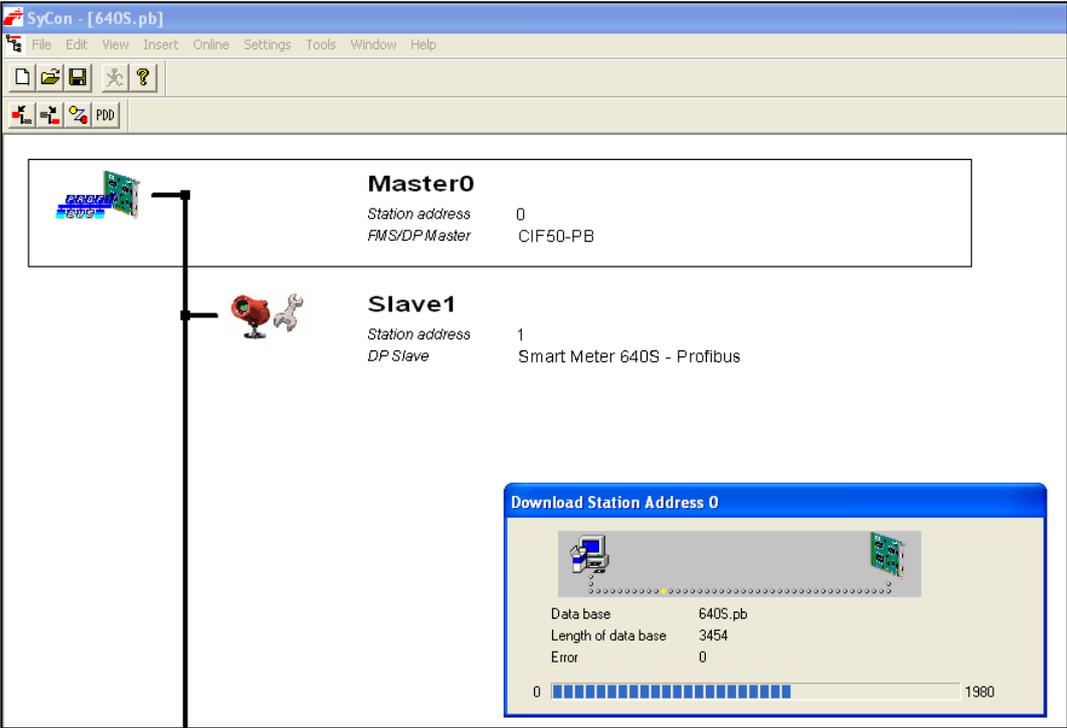
The configuration needs to be downloaded to the master (Online -> Download):



A pop-up may appear warning you that the communication may stop:



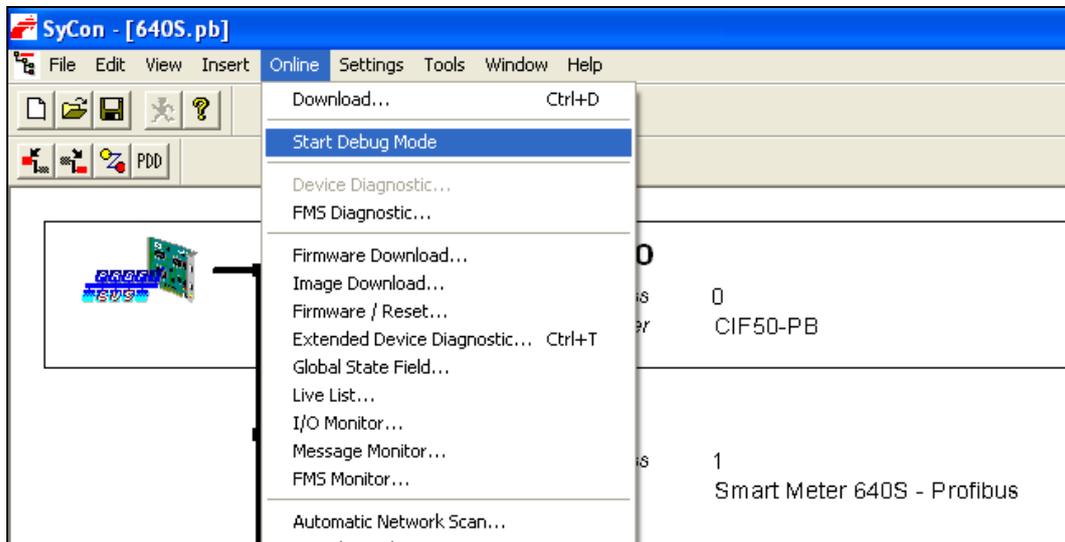
Press "Yes" to continue. The data is downloaded to the master:



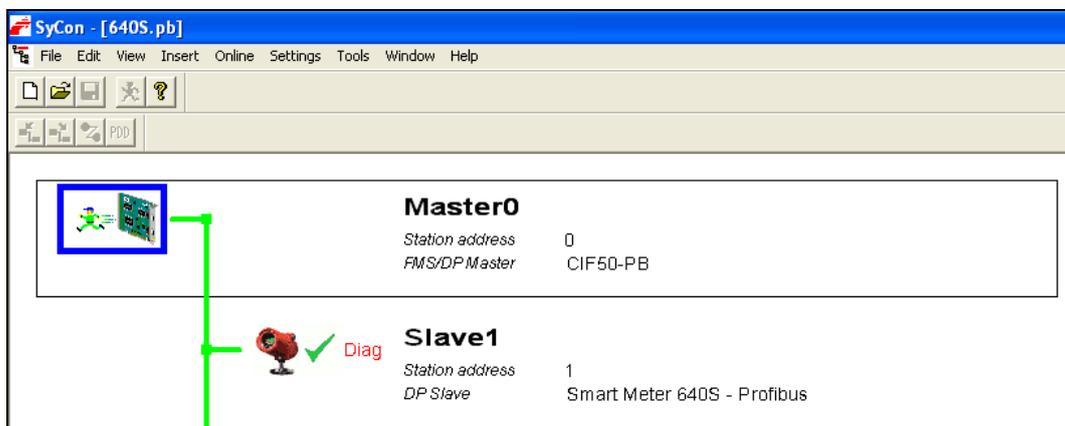
The system is ready to be used.

## Check The Configuration

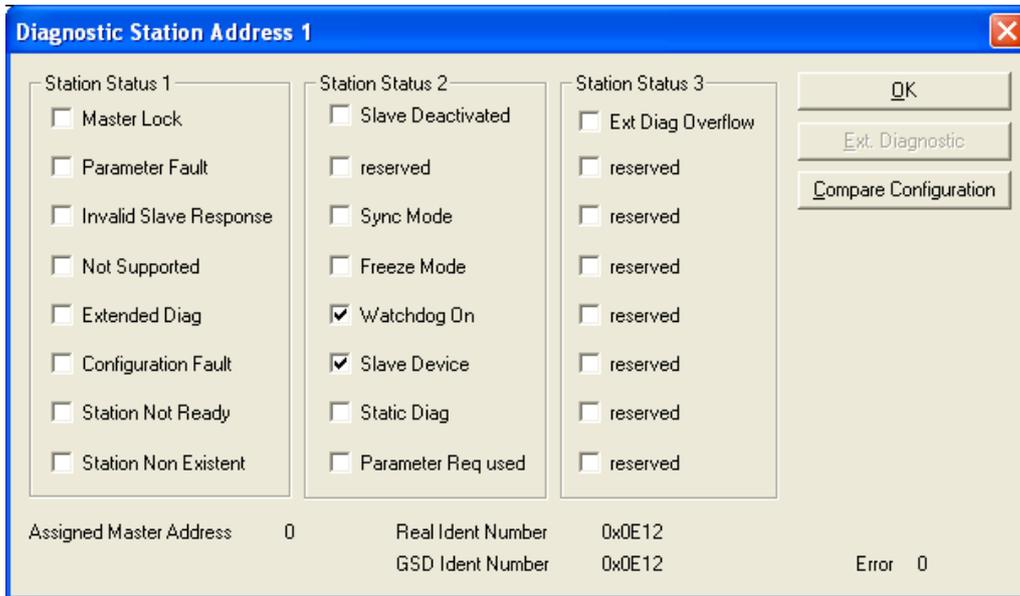
To make sure things are working start the debug mode:



If everything is working correctly then the line between the master and the slave will be green and the bit map shows a green check:

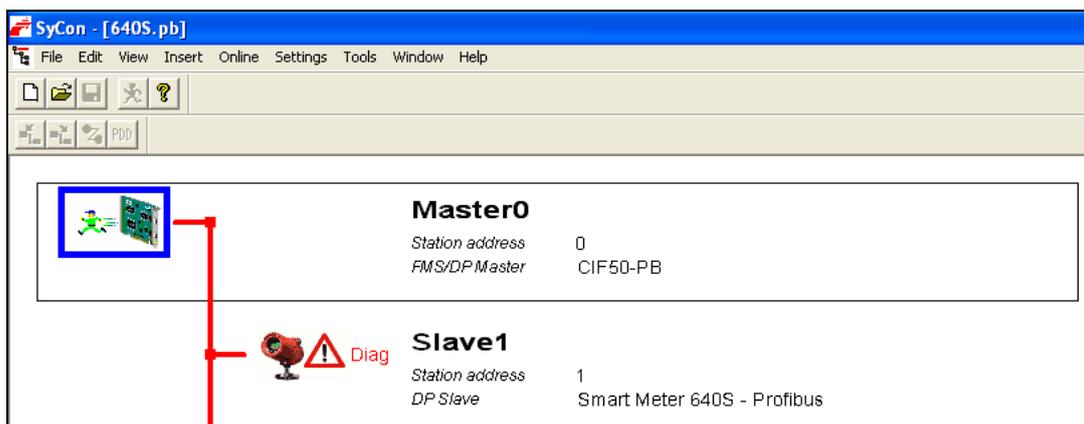


Double click on the slave to see the diagnostic status:

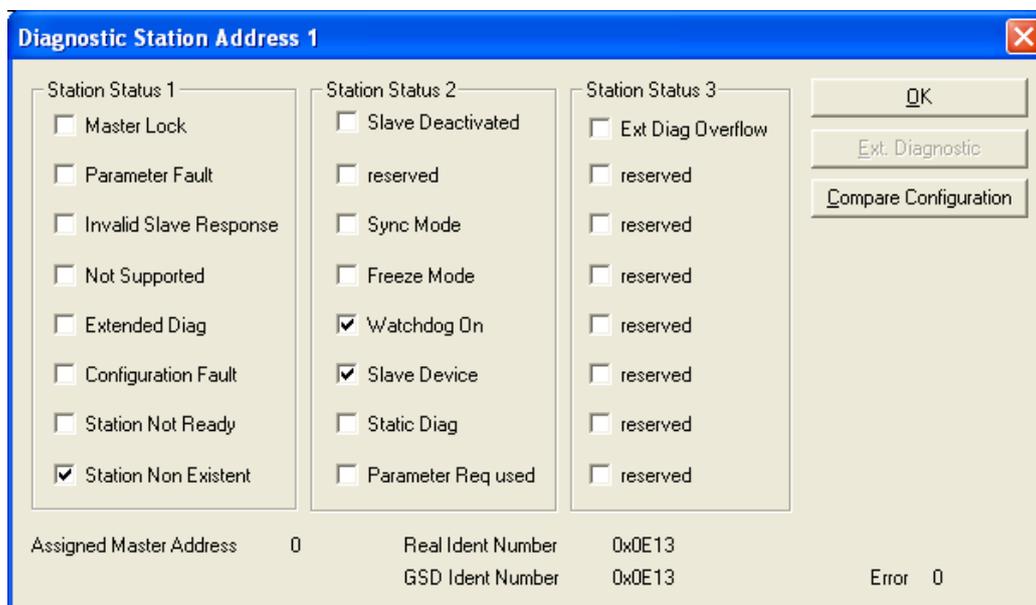


Press the “OK” button and leave the debug mode (Online -> Stop Debug Mode).

Should the line be red (error) then double click the slave to find out what the problem is:



The diagnostic window gives an indication of a problem, wrong address here:



In this case the slave is deactivated. Check the address of “Slave1” to see if it matches with the physical address of the hardware slave.

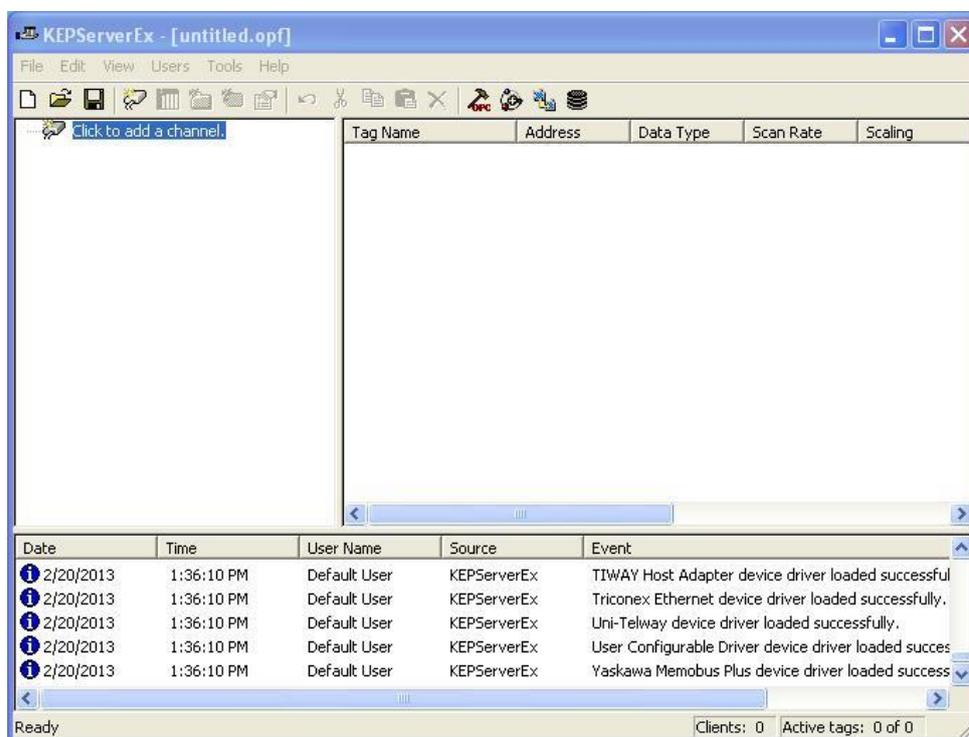
Correct any error. If the slave address in the configuration is incorrect, adjust it and download the configuration.

## ***Kepserverex 4.0***

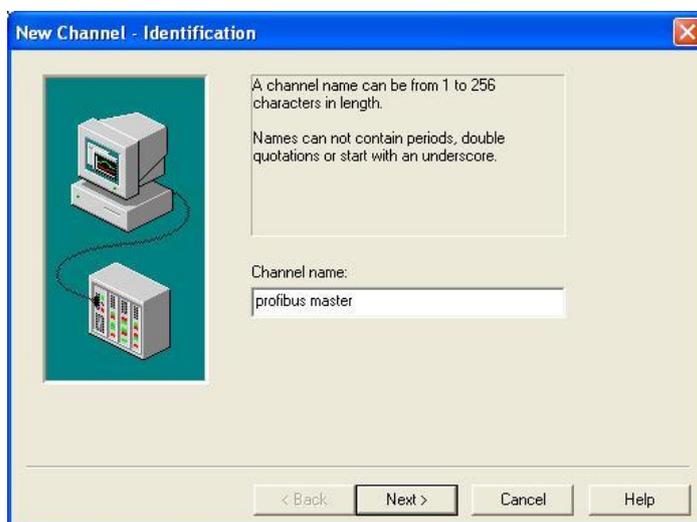
You may be using different server software or a PLC. This example shows how to use the KepserverEx 4.0 free demo software on a windows PC. For your convenience we put a copy on our web site.

After you have installed the KepserverEx software start a new project.

Click to add a channel.



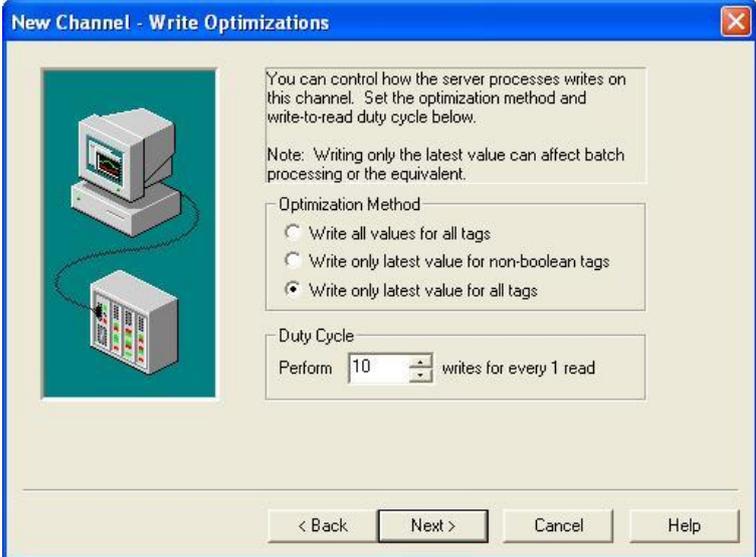
Give the channel a name. Click Next.



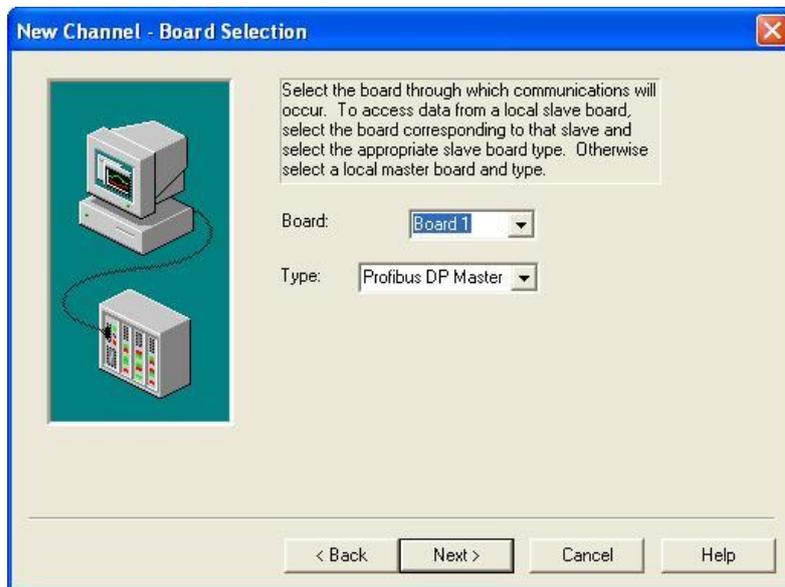
Choose a Master, we are using a Hilscher CIF50 master. Click, Next.



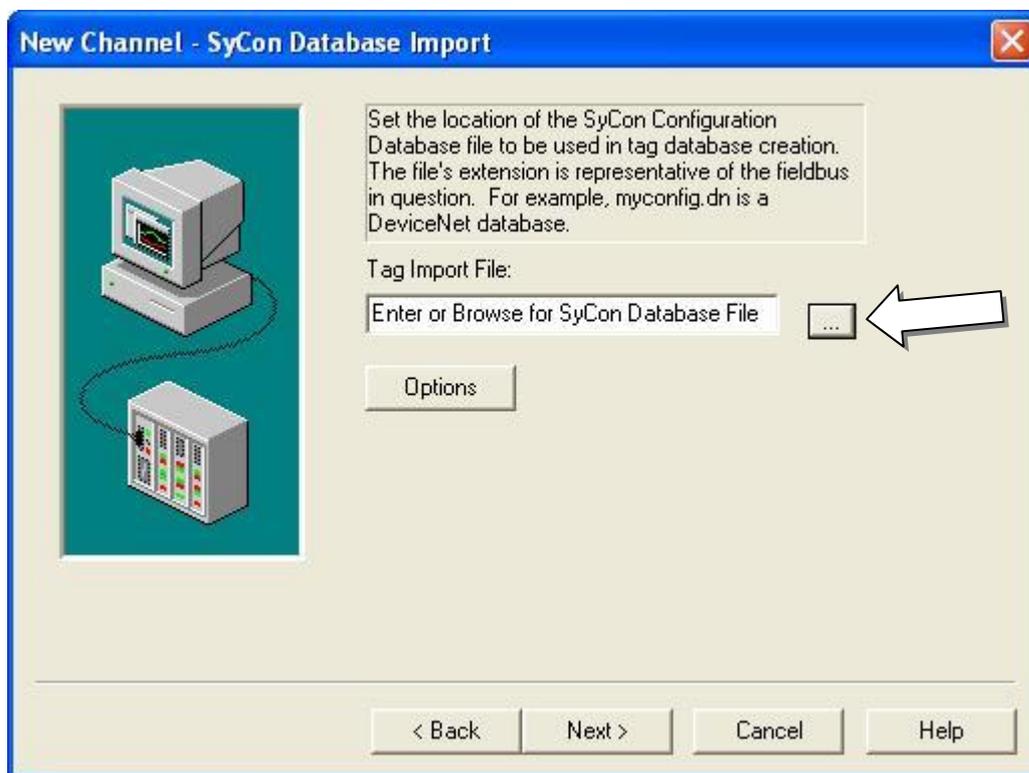
The defaults will work, click Next.



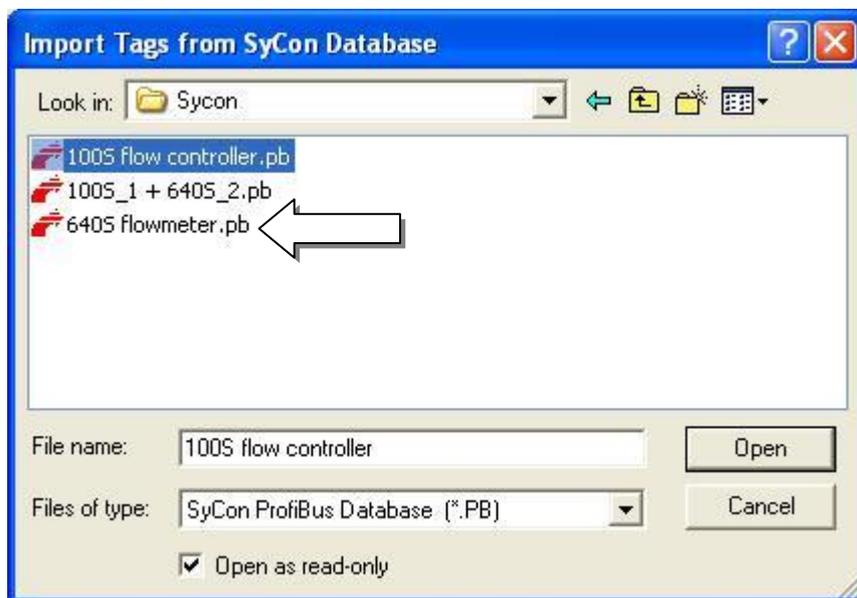
Chose the board and type, click next.



You'll need to import the setup .pb file that we created earlier in Syscon. You may browse to the location where you saved it. Click on the Browse button.



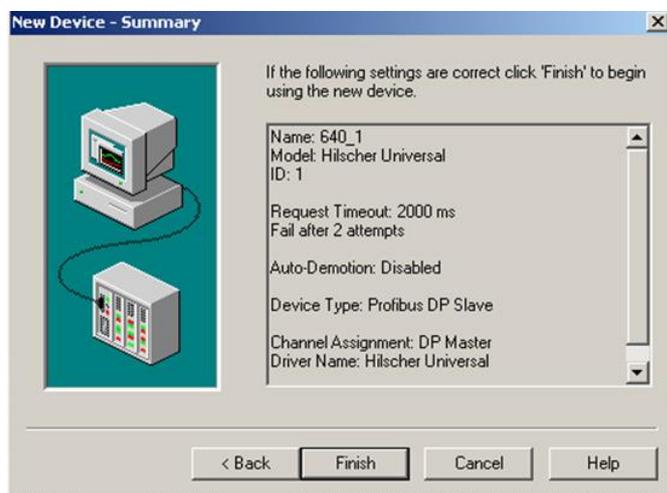
Browse the 640S flowmeter.pb you just created in Syscon. Once highlighted, click Open.



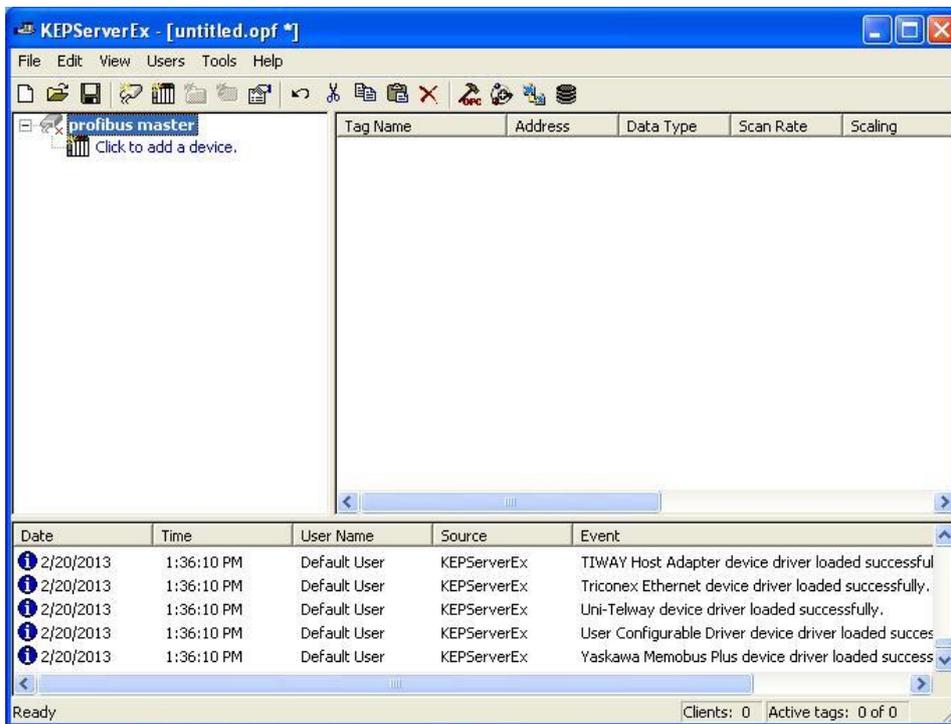
You should see this warning.



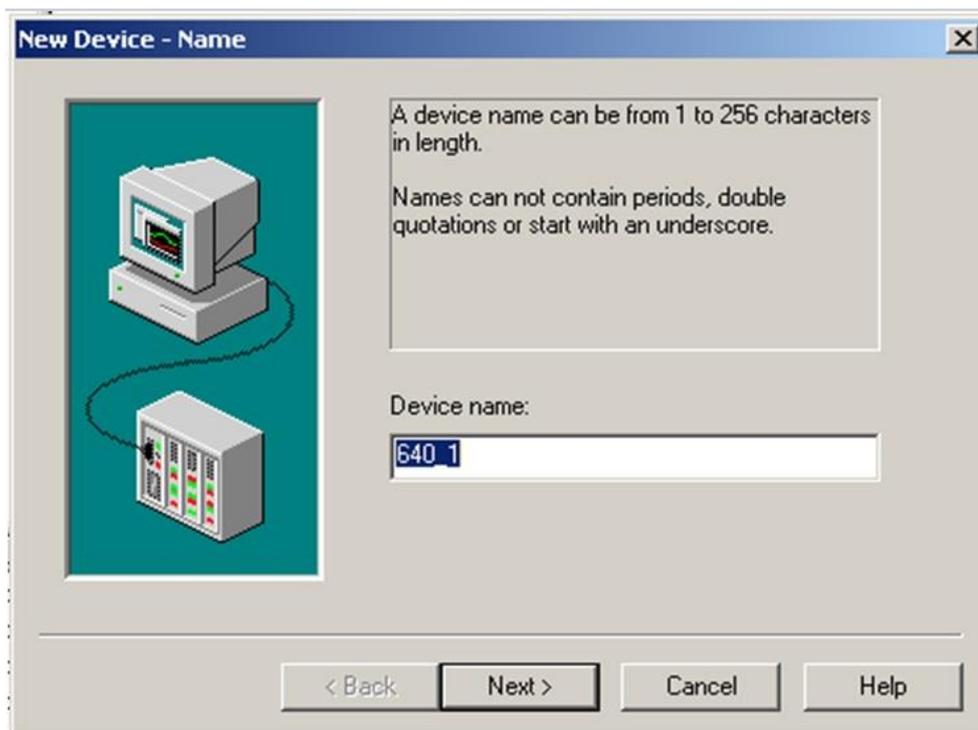
You can review the summary of the new channel you just created.



You may now add your first slave device. Click on “Click to add a device”



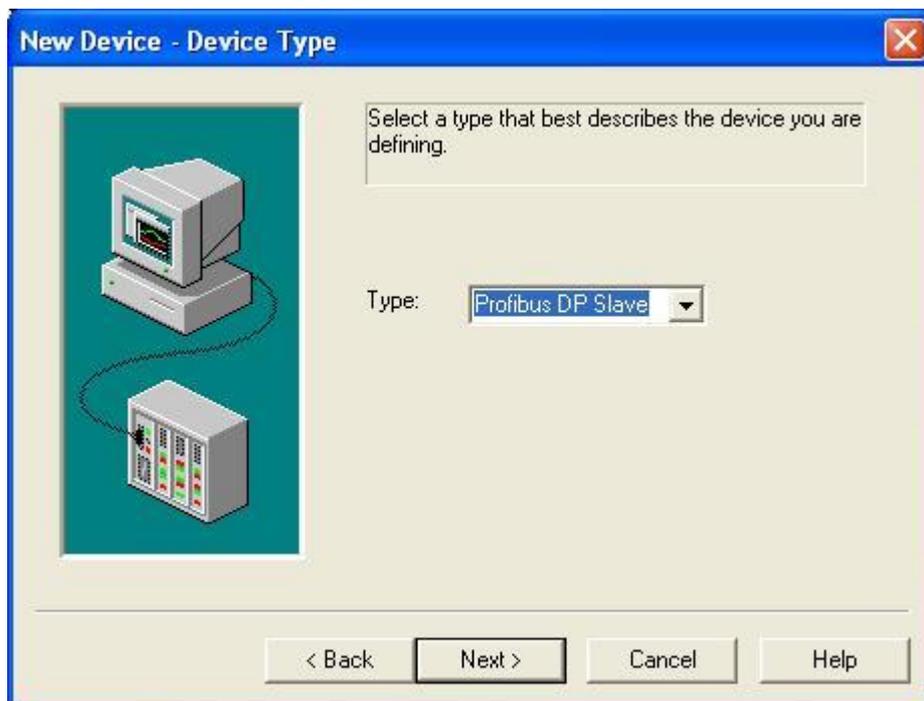
Give your new device a name.



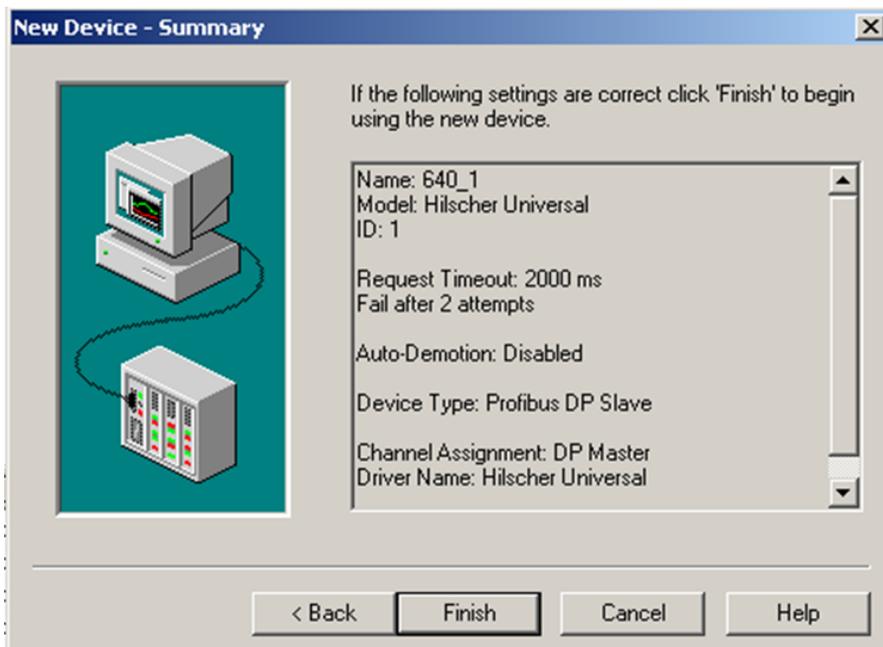
Set the device ID. ID# 0 was already used for the master, so chose #1.



The next 2 screens will be fine as default, click next. Choose the device type. Click next.

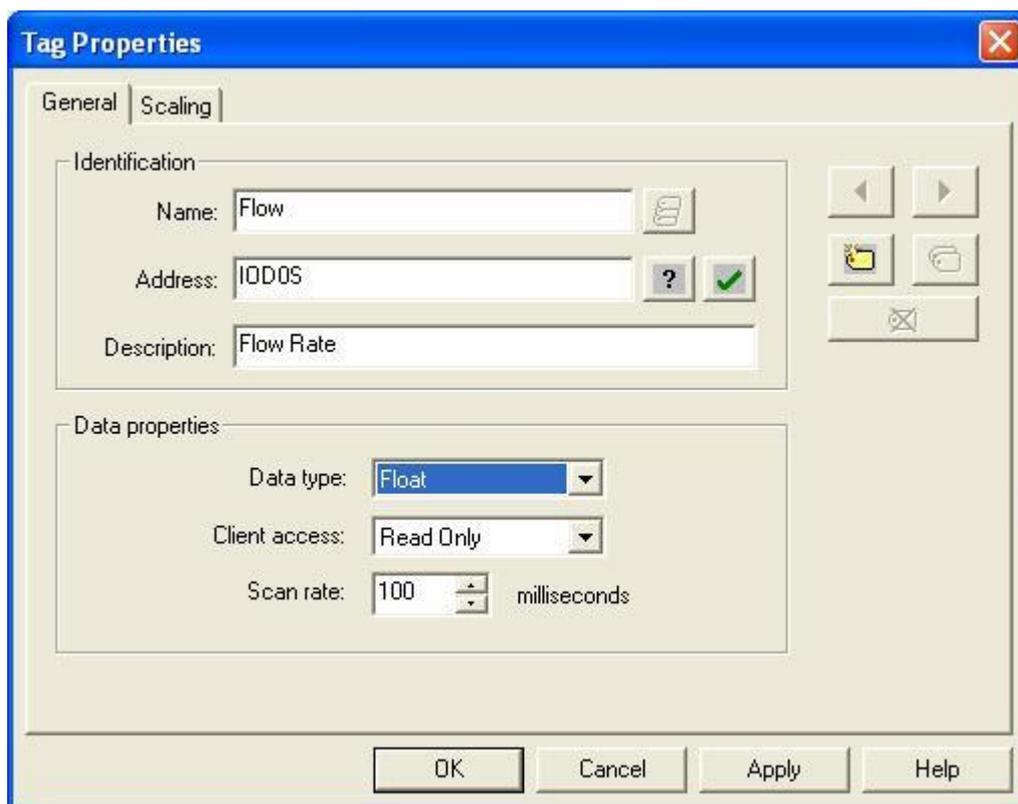


Review the new device summary, click next.



Click Finish, you have now created a new device for your network.

You will now need create a Tag to access each piece of Cyclic data, as specified in chapter 3.2. Click on “Click to add a static tag” and fill in the boxes as above.



The example above is for the flow:

**Flow (R):**

Data type: 32 bit floating point (MSB – LSB) Should this be LSB-MSB?

Description: The actual flow as measured by the instrument

Because you only have one device on your network, and the Flow is “Instance ID1”, the Data Address would be 0. If there were other save devices in your network you would need to add the last Address of the previous device to the starting address of the new device.

Add a tag name. Address 0 with the data type, in this case IO D 0 S. (32 bit float, byte swapped). Add a description. Set the Client access to Read Only. Click OK.

Keptserver has a very simple Quick Client that can be used to read and write to device tags. Click the Hammer icon to start the quick client. When you highlight the profibus master.C100\_1 tag, you can read the flow data (4.756) and quality of the communications.

## GSD File

### GSD File Text:

```
#Profibus_DP
;
; Sierra Instruments Inc.
;
; Version 1.0
;
; This GSD-File is intended for the Smart Meter 640S
; This Unit supports DPV0
;
; Outgoing Cyclic data (slave to master)
;
; Instance ID   | Description           | Size (bytes) | Format
;-----+-----+-----+-----
; 1            | Flow                 | 4            | REAL
; 2            | Totalizer            | 4            | REAL
; 3            | User full scale | 4            | REAL
; 4            | Factory full scale  | 4            | REAL
; 5            | K-factor             | 4            | REAL
; 6            | Serial Number       | 12           | ASCII
; 7            | Flow unit            | 5            | ASCII
; 8            | Totalizer unit | 3            | ASCII
; 9            | Status              | 2            | INT
;
; Incoming Cyclic data (master to slave)
;
; Instance ID   | Description           | Size (bytes) | Format
;-----+-----+-----+-----
; 10           | Reset totalizer | 4            | REAL
; 11           | User full scale | 4            | REAL
; 12           | K-factor         | 4            | REAL
;
GSD_Revision    = 4
;
Vendor_Name     = "Sierra Instruments, Inc."
Model_Name      = "Smart Meter 640S - Profibus"
Revision        = "V1.0"
Ident_Number    = 0x0e13
Protocol_Ident  = 0
Station_Type    = 0
FMS_supp       = 0
Hardware_Release = "Revision H"
Software_Release = "V6.0"
;
9.6_supp       = 1
19.2_supp      = 1
45.45_supp     = 1
93.75_supp     = 1
187.5_supp     = 1
500_supp       = 1
1.5M_supp      = 1
3M_supp        = 1
6M_supp        = 1
12M_supp       = 1
;
```

```

MaxTsdr_9.6      = 60
MaxTsdr_19.2    = 60
MaxTsdr_45.45   = 60
MaxTsdr_93.75   = 60
MaxTsdr_187.5   = 60
MaxTsdr_500     = 100
MaxTsdr_1.5M    = 150
MaxTsdr_3M      = 250
MaxTsdr_6M      = 450
MaxTsdr_12M     = 800
;
Redundancy      = 0
Implementation_Type = "VPC3+C"
Bitmap_Device   = "640S_De"
Bitmap_Diag     = "640S_Di"
Bitmap_SF       = "640S_Sf"
;
Freeze_Mode_supp = 1
Sync_Mode_supp   = 1
Auto_Baud_supp   = 1
Set_Slave_Add_supp = 1
Min_Slave_Intervall = 1
;
Modular_Station = 0
;
Fail_Safe       = 0
Slave_Family    = 0           ; General
Max_Diag_Data_Len = 6
;
DPV1_Slave     = 1

C1_Read_Write_supp = 0

Max_Initiate_PDU_Length = 52

C2_Read_Write_supp = 1
C2_Max_Data_Len    = 80
C2_Response_Timeout = 300
C2_Read_Write_required = 1
C2_Max_Count_Channels = 2
;
DPV1_Data_Types    = 0
;
Max_User_Prm_Data_Len = 0
;
<Module-Definition-List>
Module              = "42 bytes in, 12 bytes out" 0xc0,0x8b,0xa9
1
EndModule

```

**GSD File Cert:**

PROFIBUS Nutzerorganisation e.V.  
Haid-und-Neu-Str. 7  
D-78131 Karlsruhe  
Tel.: +49-721-96 58-590  
Fax: +49-721-96 58 589  
E-mail: info@profibus.com  
http://www.profibus.com



**Confirmation**  
Registration of a PROFIBUS Device

**Model name :** 640 Compod Profibus DP  
**Release :** 1  
**Manufacturer :** Sierra Instruments Inc.

The following details have been registered by PNO for the device mentioned above:

**Device type:**  Master  Slave  
**Protocol type:**  DP-V0  DP-V1  DP-V2

**ID Number :** 0E13 HEX  
**GSD file :** SIER0E13.GSD

**Contact person:**  
Sierra Instruments Inc.  
Mr. Evaristo Westplate  
Engineering  
Bijlmansweid 2  
1934RE Egmond aan den Hoef  
NIEDERLANDE  
Tel.: 31 7250 71400  
Fax: 31 7250 71401  
E-Mail: e\_westplate@sierrainstruments.nl

**Karlsruhe, 2012-08-14**  
Place, Date

Business office of the PROFIBUS Nutzerorganisation e.V.

SIER0E13