Diamond Technologies
Getting data where it needs to be.

DT9000 Master
Quick Start Guide
V1.2

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i Revision History

Version	Date	Description
1.0	11/2/2014	Original Version
1.1	12/29/2014	All Sections
1.2	3/26/2015	New Application Version (v1.2)

ii Reference Documents

iii Table of Contents

1.0 General

The DT9000 Master features an Ethernet card which is able to act as a master for a number of different Industrial Ethernet networks. The DT9000 Ethernet Master can also optionally support other non-Ethernet based industrial networks. This guide provides a general overview of the DT9000 setup and configuration for use as an Ethernet master.

1.1 Front View

Front view of a DT9000 Master with Ethernet Master

1.2 Power

Power (9-40V) is applied through the *PWR* connector on the bottom left of the front panel. When power is properly applied to the device, the *STBY* (Standby) LED will turn Yellow. If the reverse polarity is applied, the *REV* LED will turn red. If this occurs, disconnect the device from the power supply and switch the positive and negative wires in the connector. Once the power is properly connected, the push button switch directly above the *PWR* connector can be used to turn the DT9000 on.

1.2 Ethernet Port

The *ETHERNET* port is used to connect the Ethernet master card to the industrial network. Depending on which network master you have configured on the Ethernet card, the two connectors can have different functions. In general (especially with a single, non-looping connection) you should use the left socket.

> *Note: For a more detailed, network specific explanation of the Ethernet port functions, see section 5 of this document.*

1.4 EXP Port

The *EXP* port has different functions depending on the features of the particular device. On *Ethernet Master Only* devices the *EXP* port can be used to connect an external display with a VGA connector. On devices with optional additional Fieldbus masters, the *EXP* port is used to connect to the optional Fieldbus master which is installed in the DT9000.

1.5 LAN Port

The *LAN* ports can be used to connect the DT9000 to a local network. Initially, the *LAN2* port is used to directly connect a PC to the DT9000 to configure and control the device. Both *LAN* ports can be configured as desired once the initial connection is made, but changing the default settings on *LAN2* is not recommended, as it could prevent you from connecting to the DT9000. Also the LAN1 port is initially setup as a pass through network port. This allows the user to connect a corporate network to the LAN1 port and devices connected to LAN2 will be connected to both the DT9000 and the corporate network.

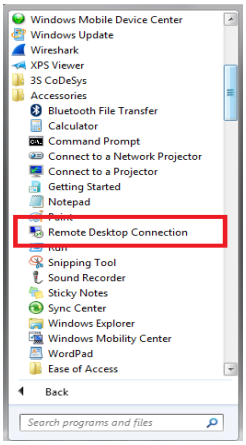
1.6 COM Ports

Depending on how many network masters are installed in the DT9000, there will be between 1 and 3 COM ports available. These ports are used by the Modbus RTU Master and can be configured as a generic serial port to attach other serial devices to the DT9000.

2.0 Getting Connected

The preferred method of connecting to the DT9000 Master is using Windows Remote Desktop. Before initiating the connection, 1) ensure that your PC's network adapter is set to receive an IP address via DHCP, and 2) make sure that LAN 2 on the DT9000 is connected to an Ethernet port on your PC through a standard Ethernet cable. The DT9000 will automatically assign an IP address to your network adapter when you connect to it.

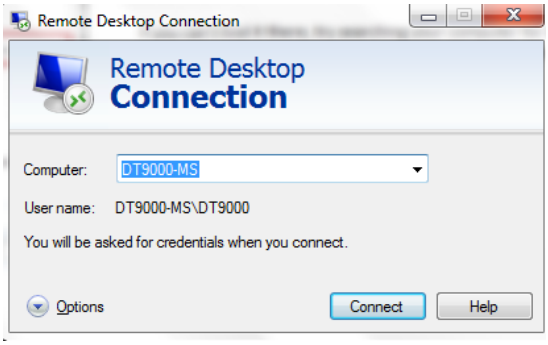
Note: With devices that do not contain a Fieldbus Master option, you can directly hook up an external VGA display (EXP port), USB mouse and USB keyboard to control the device if desired.



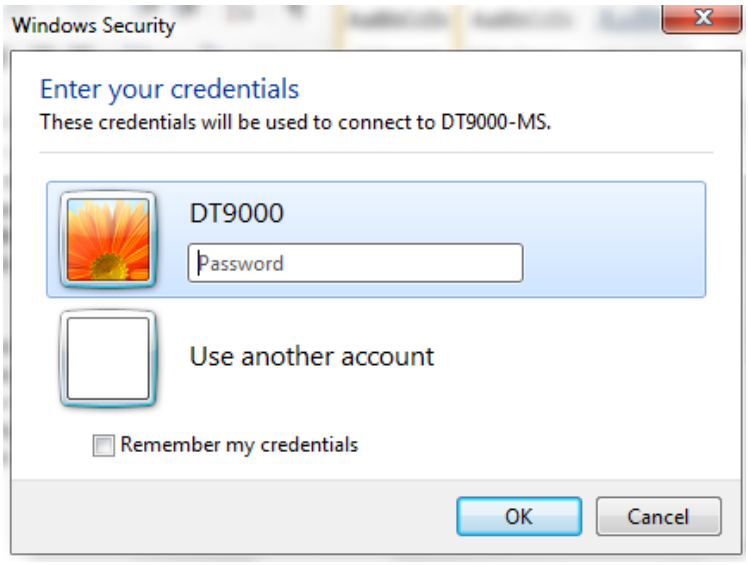
The Remote desktop tool can typically be found under "Start > Accessories > Remote Desktop Connection"

If you can't find it there, try searching your computer for it. Most Windows installations will come with the Remote Desktop tool.

When you start Remote Desktop, it will ask for the name of the computer you would like to connect to. You can either enter the name or IP address of the DT9000 to connect. The default name is **DT9000-MS.**



Note: Depending on how your Network Discovery is configured, your pc may not be able to connect using the computer name. In this case, use the IP address.



If you are able to successfully connect with the name or address you provided, you will be prompted to enter your account password. The username is DT9000 and the password is Diamond

Depending on your computers security settings, you may see a warning similar to this one when the Remote Desktop connection is being established.

Click yes to continue with the connection.

You should now be remotely connected to your DT9000. If you get an error while attempting to connect, please read the **Troubleshooting Remote Desktop Connections** section of this guide.

2.1 Troubleshooting Remote Desktop Connections

2.1.1 Ensure that the DT9000 is on

First, check that the *+3.3v LED* (below the *PWR* connector) is solid green. If the LED shows Yellow, the device is in "Standby Mode." If this is the case, push the button above the *PWR* connector to turn the DT9000 on. Wait a few minutes for it to boot up and attempt to connect again. If the *REV LED* (below the *PWR* connector) is solid red, this means the power is not properly connected (see section 1.2).

2.1.2 Ensure that you are connected to the proper LAN port

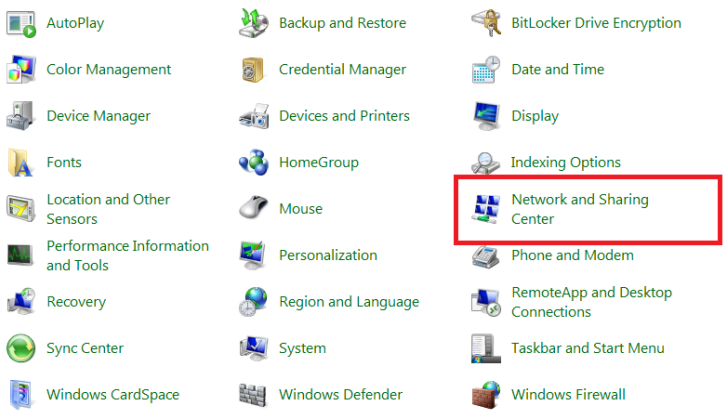
To make the initial remote desktop connection to your device, you must be using *LAN2* on the DT9000. *LAN 1* can later be configured to allow a remote desktop connection if you wish, but the initial device setup will only allow the connection to be made on the *LAN2* port. If the cable is connected properly, you should see the green and yellow LEDs above the *LAN2* port active.

2.1.3 Ensure that you have a direct connection to the device

DO NOT try to connect to the DT9000 through a router or switch when you make the initial Remote Desktop connection. The DT9000 should be plugged directly into an Ethernet port on the PC you wish to connect from. After making the initial connection you can configure the network settings to allow for different types of connections.

2.1.4 Ensure that your Ethernet port is being assigned a dynamic IP address

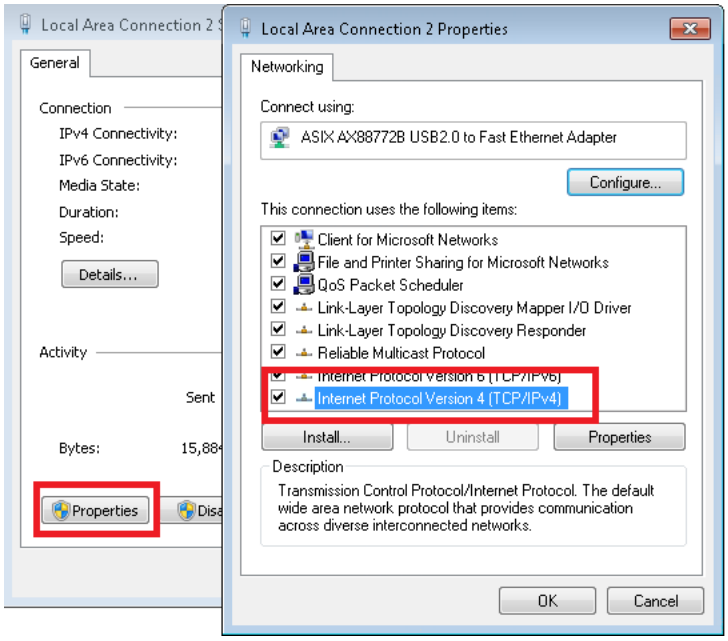
If your PC is set to a static IP address or static DNS server, you will be unable to connect to the DT9000 using Remote Desktop.



To access these settings, first Navigate to "Start > Control Panel > Network and Sharing Center"

Click the “Local Area Connection” link for the network adapter that is connected to the DT9000.

Note: If you have more than one Local Area Connection, ensure that you are selecting the correct one. You may have to have the network cable connected for this option to appear.

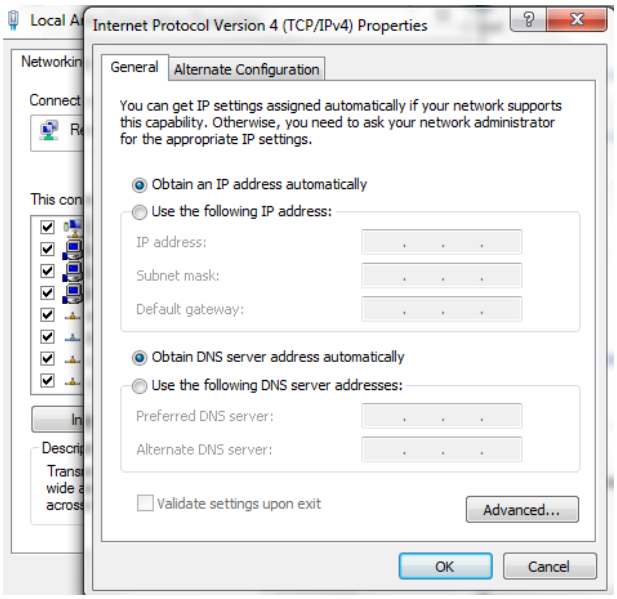


Clicking the “Properties” button will bring up the “Local Area Connection Properties” window. Scroll down until you see Internet Protocol Version 4 (TCP/IPv4). Select that option and click “Properties”

Set up your network connection so that it is the same as the window pictured to the right.

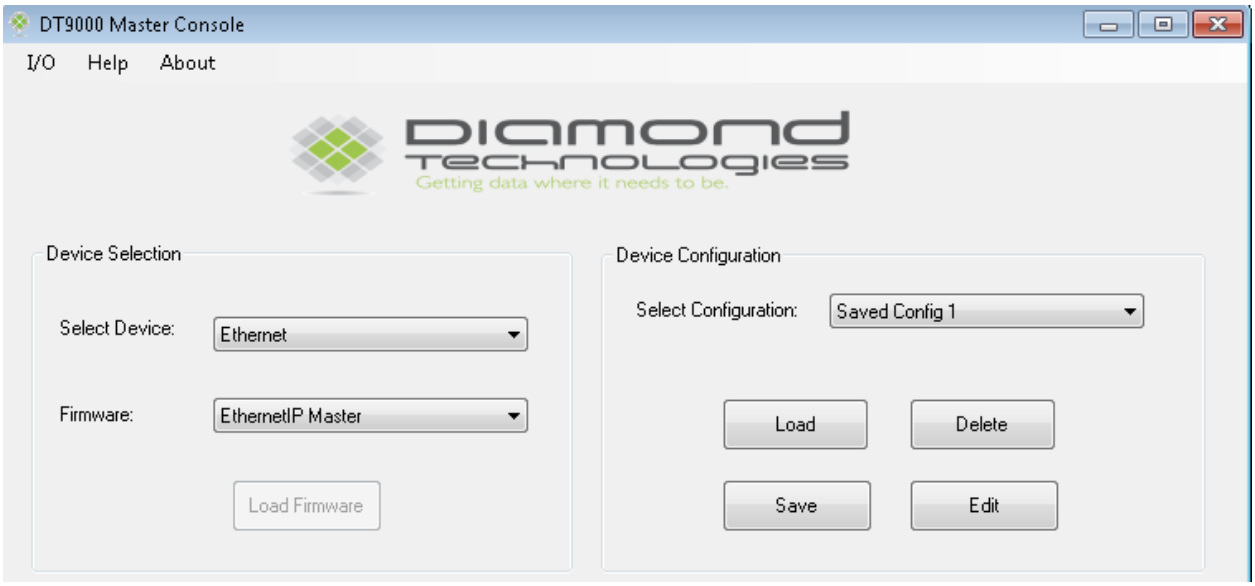
Ensure that "Obtain IP address automatically" is selected

Ensure that "Obtain DNS server address automatically" is selected



3.0 Master Setup and Configuration

The DT9000 can be configured as a master on many different industrial networks, depending on the options installed. To configure these networks, open the DT9000 Master Console application. This tool can be found under *C:\Program Files\Diamond Technologies Inc\DT9000 Master Console* and can also be found as an icon on your DT9000 desktop. The DT9000 Master Console must be run as an Administrator to function properly.



The master console can be used to select and configure Master communication channels

3.1 Master Devices and Firmware

The **Master Firmware** section of the application can be used to change the firmware on the physical communication channels in the DT9000. The **Select Device** list displays the available communication channels and the physical network connecters attached to them.

When you select a device, the **Firmware** selection box will display the currently installed firmware. If no firmware is installed, it will display *None*. To change the firmware, select the firmware you would like to install and click **Load Firmware**. If the firmware is successfully loaded the communication channel will be initialized with the new protocol stack and a success message will appear.

The firmware you are loading must be compatible with the physical hardware connected to the communication channel. Below is a list of hardware options and available network firmware.

Network Firmware	Hardware Option
EthernetIP Master	Ethernet
EtherCAT Master	Ethernet
Profinet I/O Master	Ethernet
Profibus Master	PROFIBUS
Profibus DPV2 Master	PROFIBUS2
CANopen Master	CANopen
DeviceNet Master	DevNet
Modbus RTU Master	Modbus RTU

3.2 Master Configuration

Once Firmware is downloaded to the device the next step is to build a Master Configuration. The Master Configuration defines what slave devices the Master will communicate with, the specifics about each slave, as well the specifics about the network communications. *(See Section 4.0 for more information about creating a new configuration file.)*

The **Master Configuration** section can be used to switch between commonly used master configurations. It allows you to save and load device configurations with a single click. When you select a device, the **Select Configuration** selection box will display all saved configurations for the currently loaded firmware. Loading a new firmware to the device will refresh this list. Note that the configuration displayed in the box is not necessarily the currently loaded configuration.

To save the currently downloaded configuration simply click the **Save** button. This will open a dialog window asking you to name the configuration. If the configuration is successfully saved, a success popup window will appear.

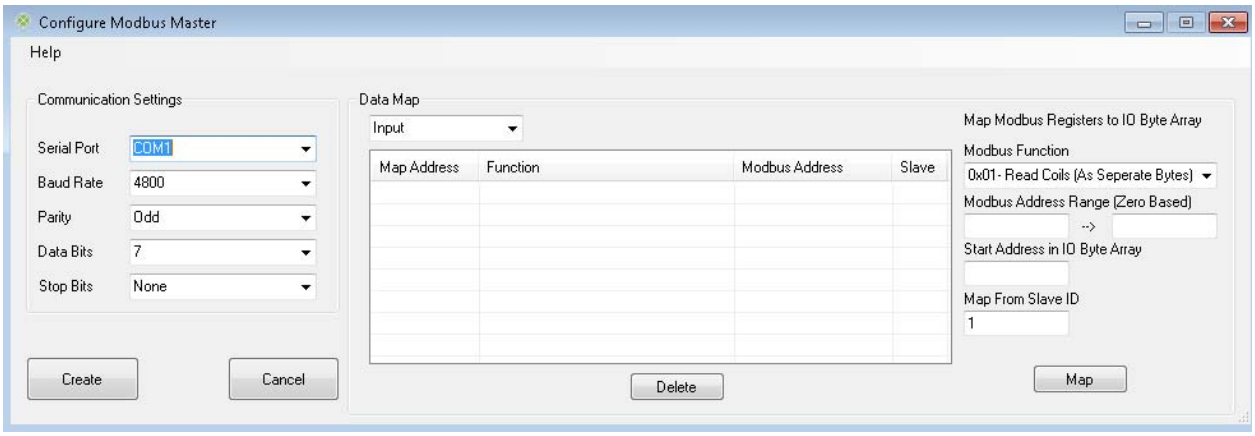
To load a configuration to the device, select the configuration you wish to load from the **Select Configuration** selection box and click the **Load** button. If the master configuration is successfully loaded the communication device will be restarted and a success popup window will appear. This operation will overwrite any existing configuration in the device.

The **Delete** button will delete the currently selected configuration file. This operation cannot be undone.

4.0 Creating a Master Configuration

Depending on which communication device you have selected, the “New” button will either open a configuration creation form, or start a second application to assist with configuring the master for network communication.

4.1 Configuring a Modbus RTU Master



The configuration screen for the Modbus RTU Master Device

Before you can see the Network IO data from your Modbus RTU Master device, you must configure some basic communication parameters and map the Modbus data to the Network IO Array.

The communication settings allow you to select the Serial Port that the Master will use to communicate, as well as some basic serial parameters. Ensure that the parameters here reflect the settings and capabilities of your slave device(s). The Serial Port numbers are labeled on the front of the DT9000. Not all listed serial ports will be available, depending on your DT9000s installed hardware options.

The Data Map section allows you to associate any Modbus coil, input or register with a section of the Network IO Array for both inputs and outputs. The dropdown menu at the top allows you to select between the “Input” and “Output” data mappings. Depending on your selection, the list below will display all input or output maps already defined.

The fields on the right of the screen allow you to create a new data mapping. “Modbus Function” box will show either read or write functions depending if you have “Input” or “Output” data selected. This is the Modbus function that will be used to read or write your data from the slave.

Note: When mapping Coils or Discrete Inputs, there are two options for each read and write function. You can map them as ‘bytes’ or as ‘bits.’

*Mapping them as **bytes** means that each Coil will be mapped to a byte in the Network IO Array. This is useful for viewing flags. Any output mapped with this option will set a 1 for any entered value above 0.*

*Mapping them as **bits** means that all of the coils in your map will be read and packed into a byte (8 bits). If the number of coils mapped are not a multiple of 8, the high bits of the last byte will be padded with zeros. This option is useful for viewing larger data fields stored in the Modbus Coils (integers, etc.).*

The fields labeled “Modbus Address Range” indicate the Modbus address to perform the operation at on the slave device. Entering an invalid address could cause errors when viewing the Network IO. Note that the addresses are absolute (zero based, not Modicon) and are inclusive. This means that if you read addresses 0 through 5 you are reading 6 registers.

Next, enter the starting byte address in the Network IO array you want to map the data to. The ending address and data length will be calculated based on the Modbus function and Modbus address range you have selected and displayed in the data map list to the left.

Note: No two data maps can intersect each other in the Input and Output Network IO Arrays. If you attempt to add a Data Map that conflicts with an existing mapping, you will get an error.

Once you have completed your configuration hit the “Create” button on the bottom left. This will automatically load your new configuration into the Modbus RTU Master. Be sure to save the configuration if you wish to keep it!

4.2 Configuring Network Masters with SYCON.NET

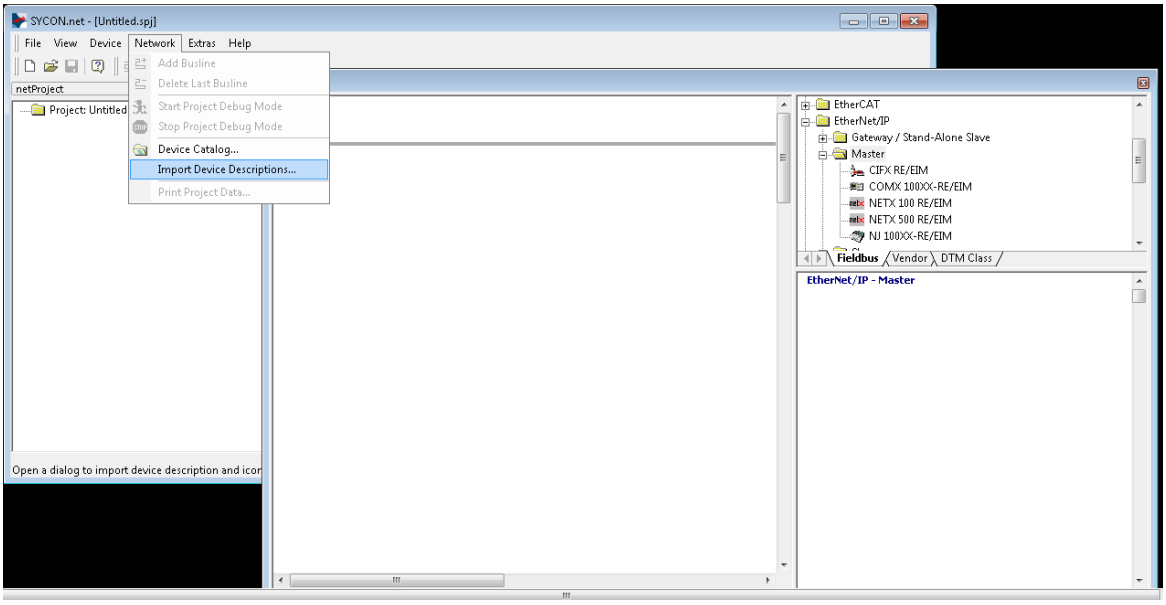
Some of the network devices must be configured using a second program called SYCON.NET. When you hit the “New” button with one of these masters selected, SYCON.NET will automatically open.

When SYCON.NET is opening, it will ask for a username and password. The default is:

Username	Administrator
Password	[blank]

For most of the network types, you will be required to upload a datasheet to Sycon.net for each type of slave device that will be included in the network configuration. The exact file format and content for this datasheet is network specific and vendor specific, and it should be available from the slave device manufacturer.

To add a datasheet simply select the Network drop down list in SYCON.NET and then click on Import Device Descriptions. This will allow you to select the specific slave configuration file. To do this first select the correct file type in the Files of Type box, next navigate to and select the specific configuration you would like to import. Note that you can easily drag and drop the Device Description files from your PC onto the DT9000 using Windows File Explorer or transfer them via USB disk.

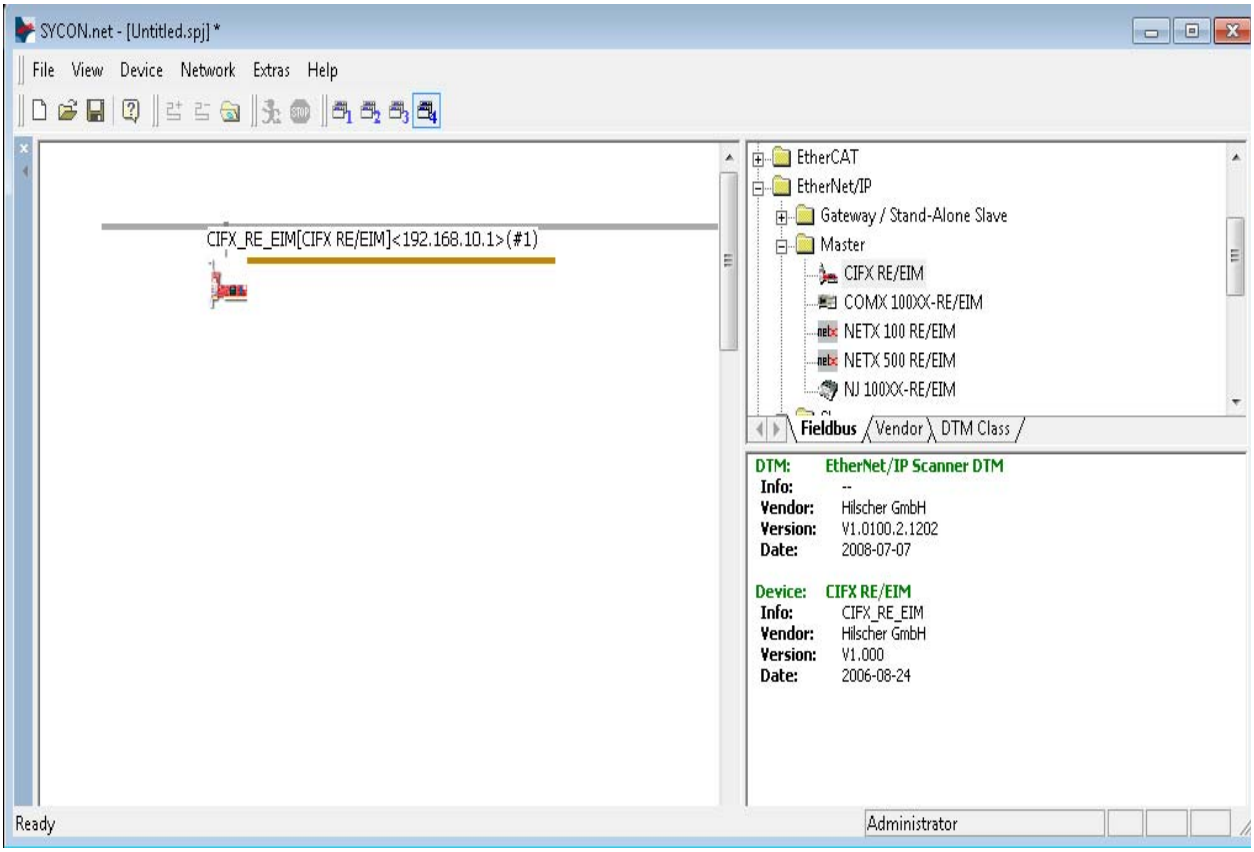


After you have imported your device description file(s) your devices will show up in the available devices list in the NetDevice window on the right side of the SYCON.NET screen. You will need to look under the specific network and then the specific type of device you have, for example Profibus and then Slave to locate a Profibus Slave device description. If the device did not show up you may have to restart SYCON.NET.

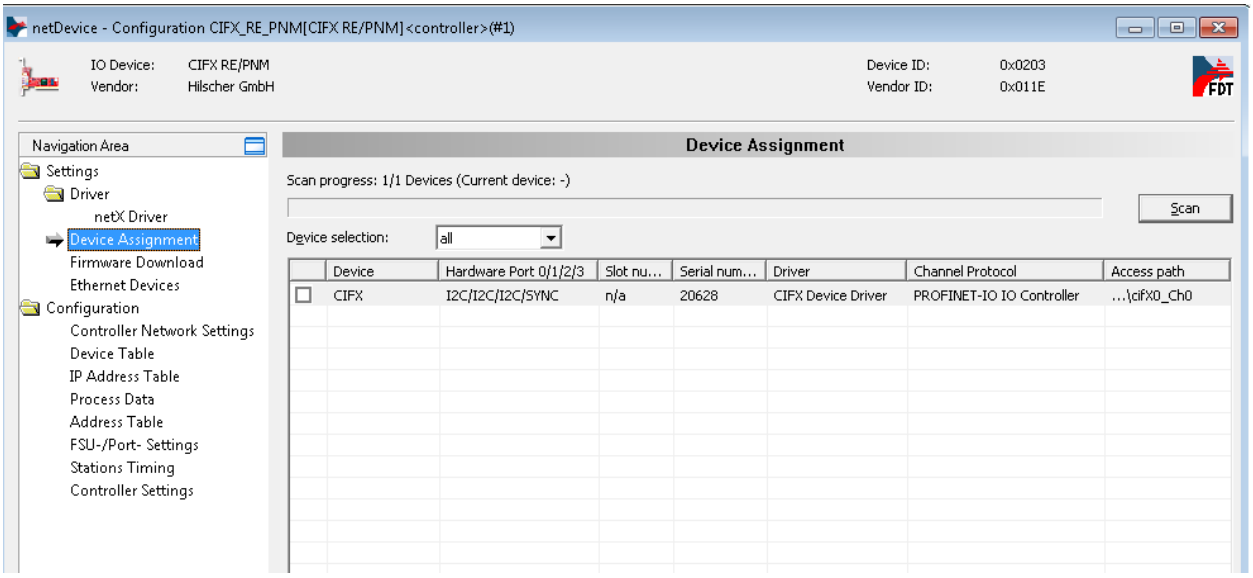
Once you have all the slave device datasheets you will need loaded into the SYCON.NET catalog, you can begin to build your configuration. Start by finding the folder on the right hand side of the NetDevice window that corresponds with the industrial network you have configured on your cifX card. Find the CIFX Master device in that folder and drag it into the blank area to the left (*see image below, The DT9000 utilizes the CIFX RE/EIM modules for Ethernet networks)*.

Note: The screenshots in this section show the configuration of an Ethernet IP master and slave. Depending on the network, the screens may look slightly different, but the basic procedure for configuration will be the same.

Drag and drop device descriptors from the catalog on the right into the Network window. Note that your cursor must be on the network (grey bar) to be able to drop the master into the configuration.

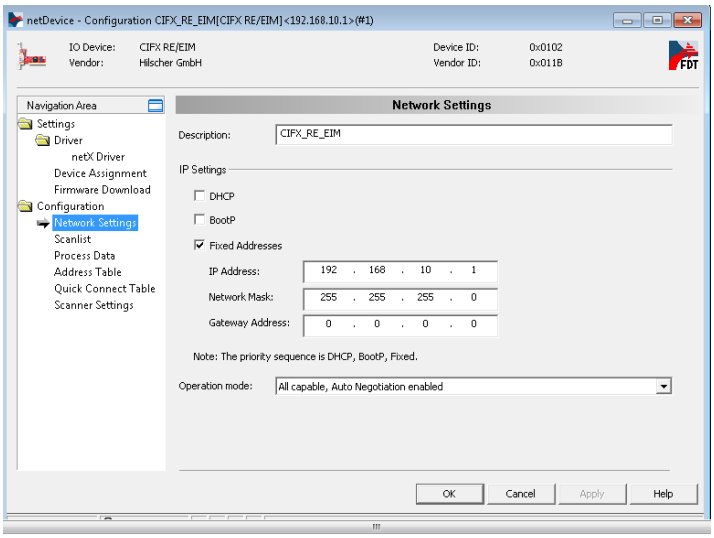


Next, we have to assign the device descriptor you have just selected to your actual cifX hardware. Right-click on the master in the network window and select **"Configuration…"**

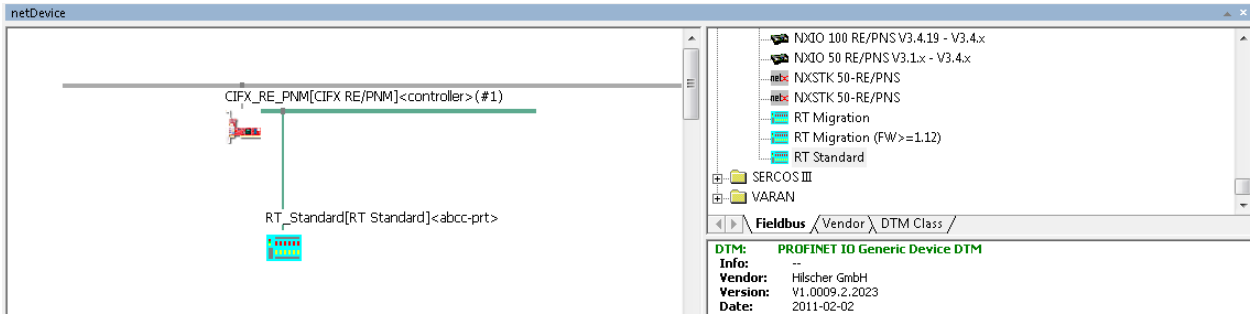


In the “Navigation Area” on the left of the configuration window, find “Device Assignment.” Set the **Device Selection** pull-down menu (to the right) to “all” and hit the **Scan** button. If your cifX firmware was properly installed, you should see the card come up in the list. Check the box next to the cifX card that represents the network master you are looking to utilize and click **Apply** at the bottom of the screen then select OK. The Channel Protocol column will show the firmware of each card installed in your DT9000. If the **Channel Protocol** section does not indicate the protocol you are attempting to use this means you have the wrong device firmware loaded (*see section 3.1).*

Next, you can use the options in the NetDevice Window to set other parameters specific to your network. In the case of Ethernet IP you will need to set your IP address as well as subnet mask as shown below.



Once the Master is setup you can setup your network slave devices. Drag any slave devices that you want to connect to the Master from the catalog into the network window so they attach to the network coming out of the master (see image below).



Right-click on the slave device in the network window and select **"Configuration…"** This will bring up the slave configuration window. This window is going to be slightly different depending on the type of network you are using. You need to set up the slave configuration so the master knows exactly what data is being communicated over the network by the slave (input and output size, for example).

Note:
If the Datasheet you imported came directly from the device manufacturer (usually means it will contain the exact name of the device in it) then you may not have to do any configuration in the slave configuration window.

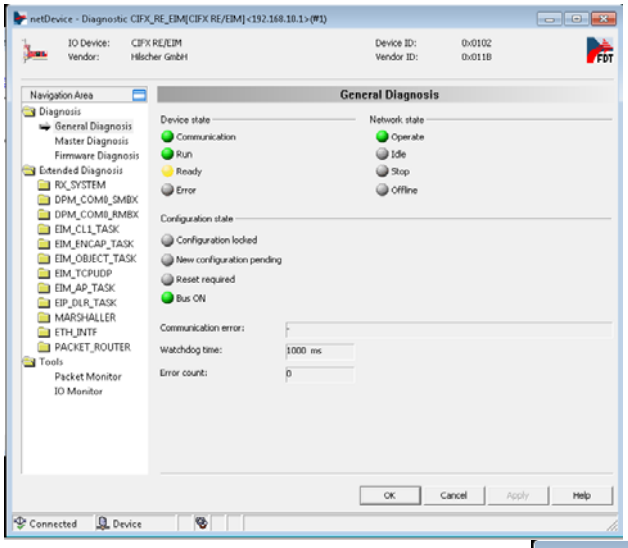
There are some situations when a manufacturer will provide you with the datasheet for the 3rd party hardware they use for network integration, so it does not contain the specific I/O configuration of the device. If this is the case, the device manufacturer will need to provide additional instruction on how the slave device is configured so you can set it up with your master.

Once you have completed the configuration for all of your slave devices, you need to send the configuration to the cifX master. Right-click on the master icon in the network window and select **"Download."** Once the download is complete communication should automatically start between the master and the slaves.

Be sure to download the configuration every time you make a change. The changes in SYCON.NET will not be reflected in the actual master hardware until you download the configuration. This new configuration will now be accessible through the DT9000 Master Console application.

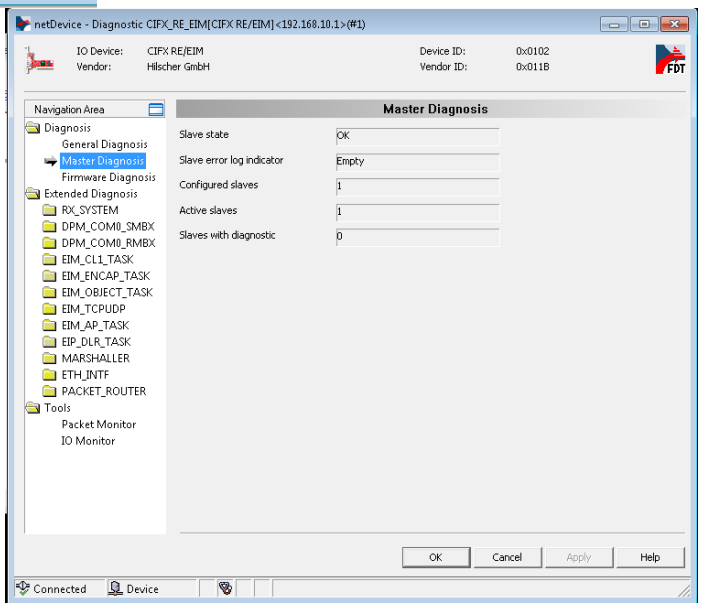
Note: Make sure to save the generated configuration file in the DT9000 Master application. If you wish to edit the configuration in the future, make sure that you also save the SYCON.net project.

After downloading the configuration you can view the status of the network and troubleshoot any communication issues, right click on the master icon in the network window and click “**Diagnostic…**” This will bring up the master configuration menu. To access the “General Diagnosis” and “Master Diagnosis” select them from the navigation area on the left.

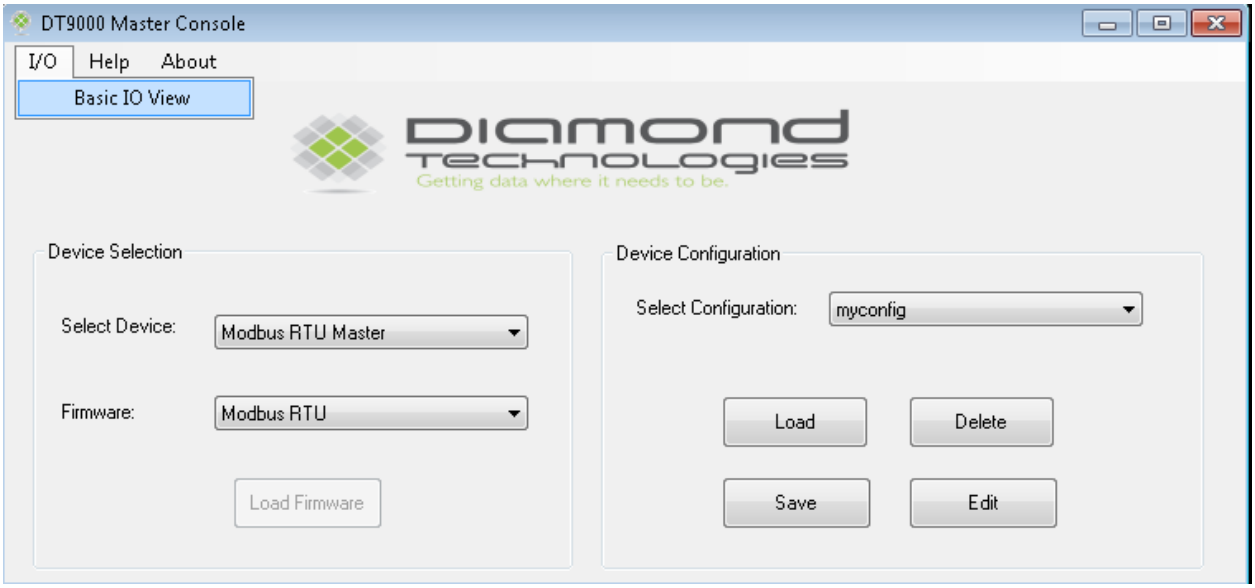


This “General Diagnosis” screen is indicating that there are no errors on the network and the network is in a run state.

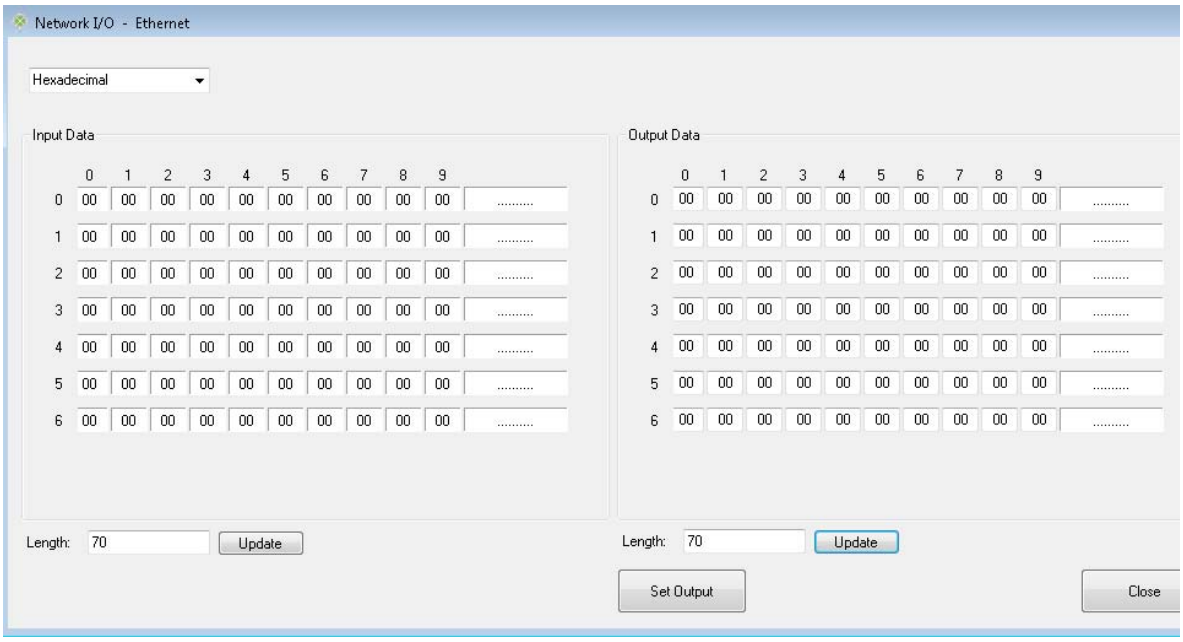
The “Master Diagnosis” tab can also give some useful information about the current state of the network. This screen is showing the number of configured slaves and their status.



5.0 Network IO Monitor



To view the network IO data you must first select a device and a configuration. Once the configuration has been loaded you can select the “Basic IO View” from the I/O Menu Item.



The network IO Monitor displays the real-time input and output data over the selected network. Each row of data contains 10 bytes, and the ASCII value of that row is displayed next to it, with a ‘.’

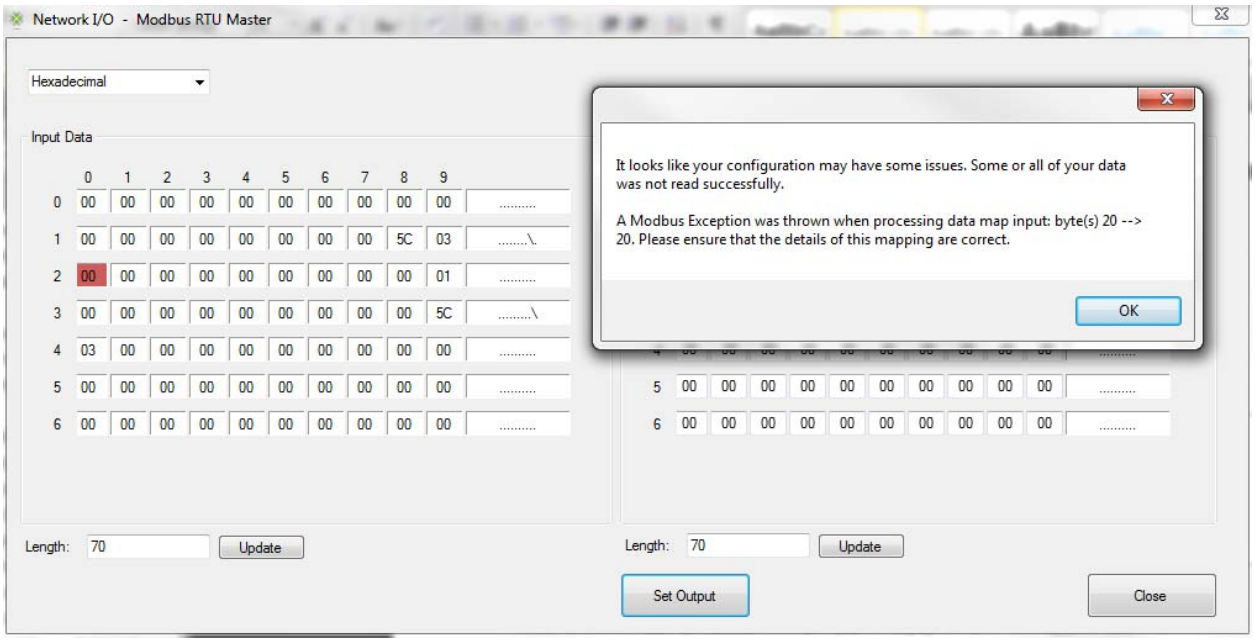
symbolizing an unprintable character. The dropdown menu at the top allows you to switch between hexadecimal and decimal data.

To write to the output data, simply enter the values you wish to write into the corresponding bytes in the output array and hit “set output.” You will get a popup confirmation if the write was successful.

5.1 Troubleshooting Network Data

Many Industrial Networks will not show any of the data if there is an error in the configuration. If you are seeing all zeros on your IO window, review the configuration file and ensure that it is correct.

Other networks (Such as Modbus RTU) are able to display some of the mapped data when a minor configuration error is present. The network IO Monitor will pop up an error to indicate the mappings that are not correct, and those bytes will change red on the IO Screen. Any other data mappings will continue to function, though for large data maps, these errors could cause a significant slowdown in communication between master and slaves.



Here is an example with one byte of incorrectly mapped data. Only the affected byte(s) will turn red and the rest of the data will be read as usual.