GE
Intelligent Platforms

Programmable Control Products

PACSystems* RX3i

CANopen Master Module

User's Manual, GFK-2831A

October 2013

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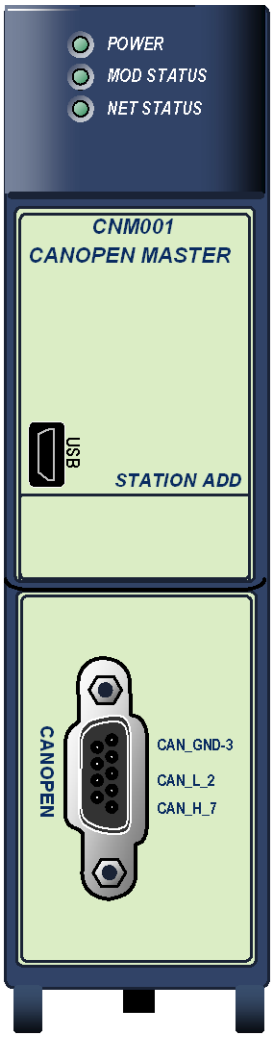
Chapter 1. Introduction

The CNM001 module allows the RX3i Controller CPU to send and receive data on a CANopen network. It can act as master for up to five devices on the CANopen network.

The module's three LEDs display its operating and communications status. A 9-pin male D-connector interfaces to the CANopen network.

A CNM001 module can be installed in any I/O slot in the main rack in an RX3i system, except slot 0 or the expansion slot.



Features

- TX PDO data scanning of up to 272 bytes (Includes 20 bytes of module status and slave status diagnostics.)
- RX PDO data scanning of up to 272 bytes
- Fault logging for loss or addition of CANopen slave devices that support Node Guarding, Heartbeat protocol, or have PDO counter health status monitoring enabled.
- Slave status bit per slave address to indicate in reference memory whether devices are healthy. (For devices that support either Node Guarding or Heartbeat protocol, or have PDO counter health status monitoring enabled.)

Note: In the CANopen protocol, “transmit” and “receive” are defined from the slave’s point of view. This means that TX PDOs are mapped to the CPU as %AI input scan data and RX PDOs are mapped as %AQ output scan data.

Firmware Upgrades

The CNM001 module receives its firmware upgrades directly from the SYCON.net software using the USB port on the module.

1.1 Module Specifications

Mounting Location	RX3i main rack: Any slot except slot 0 or expansion slot.
Backplane Current Consumption	800mA at 3.3VDC
Hot swappable	Yes
RX3i CPU requirements	RX3i CPU Firmware version 7.70 or later

For product standards, product standards, general operating specifications and installation requirements, refer to the *PACSystems RX3i System Manual* GFK-2314.

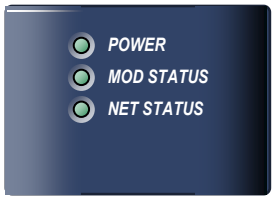
1.2 Communications Specifications

Maximum input data scanned by CPU	272 bytes (Includes 20 bytes of module status and slave status diagnostics)
Maximum output data scanned by CPU	272 bytes
Maximum number of supported slave devices	5
Maximum number of receive PDOs	15
Maximum number of transmit PDOs	30
Exchange of process data	Via Process Data Object (PDO) protocol transfer (synchronized, remotely requested and event driven (change of state))
Functions	Node guarding / life guarding Heartbeat protocol PDO mapping Synchronization Object (SYNC) protocol (producer)
Baud rates	10 kbits/s to 1 Mbits/s
Data transport layer	CAN Frames
CAN Frame type	11 Bit

1.3 Module User Features

1.3.1 Indicators

The module's three LEDs display its operating and communications status:



Power

LED State		Module State
Green		The module has backplane power.
Off		There is no backplane power to the module.

Module Status

LED State		Module State
Green		The module is operating normally.
Green/yellow, blinking		Module is waiting for firmware download.
Yellow		Firmware download in progress.
Off		Power supply for the device is missing or hardware defect.

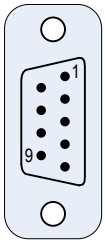
Network Status

LED State		Module State
Off		**Reset:** The module is executing a reset.
Green, single flash		**Stopped:** The device is in the stopped state.
Green, blinking		**Preoperational:** The module is in the preoperational state.
Green		**Operational:** The device is in the operational state.
Red, single flash		**Warning Limit reached:** At least one of the CANopen module's error counters has reached or exceeded the warning level (too many error frames).
Red, double flash		**Error Control Event:** A guard event (NMT Slave or NMT-master) or a heartbeat event (Heartbeat consumer) has occurred.
Red, on		**Bus Off:** The CANopen module is not active on the bus.

1.3.2 Ports

1.3.2.1 CANopen Port

The CNM001 module has a 9-pin male D-connector for connection to the CANopen network. For pin assignments and cable requirements, refer to 2.3, “Connecting the CNM001 Module to the CANopen Network.”



1.3.2.2 USB Port

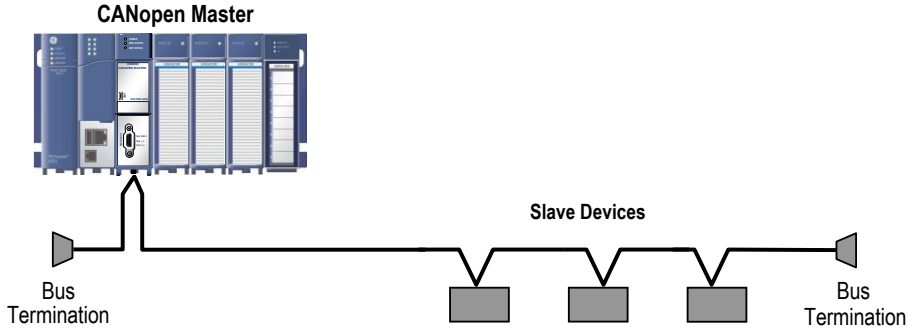
A USB Mini Type B connector is used to download the CANopen network configuration from the SYCON.NET software to the module.

1.4 CANopen Network Topology

The CNM001 module provides a balanced (differential) two-wire interface over shielded twisted pair cable to the CANopen network.

Maximum cable length is determined by the data rate used. Termination resistors are required at the end of each cable. For details, see 2.3, “Connecting the CNM001 Module to the CANopen Network.”

The CNM001 module does not support multiple masters.



Sample CANopen Network

1.5 Communications on a CANopen Network

The data exchange with CANopen devices takes place by means of data objects, which are defined in the CANopen communication profile. The CNM001 supports the following objects:

- 15 transmit PDOs
- 30 receive PDOs
- 1 synchronization object (SYNC, without time stamp)
- Node guarding
- Network Management (NMT) objects

1.5.1 Data Flow

The CNM001 Master module sends outputs to the slave devices in Receive Process Data Objects (RPDOs) and receives inputs in Transmit Process Data Objects (TPDOs). Note that "transmit" and "receive" are defined from the slave's point of view, so that TPDOs are mapped to the CPU as %AI input scan data and RPDOs are mapped as %AQ output scan data.

PDOs can have the following communication types:

- **Synchronous PDOs** are sent by slave devices that support synchronous operation in response to the SYNC object, a high priority COB that does not contain user data.
- **Event-driven (asynchronous) PDOs** are sent after a trigger event, such a change in an input value.
- **Remotely requested PDOs** are sent when the slave is polled by a remote transmit request.

1.5.2 NMT (Network Management)

The CNM001 module supports the NMT error control protocols:

- **Node guarding/Life guarding:** The CNM001 acts as an NMT master, which sends a request to its slave devices to verify their operational states. The master uses this service to monitor the occurrence and resolution of errors on remote slave devices. Errors are identified by the slave's node ID.
- **Heartbeat protocol:** The CNM001 supports the Heartbeat protocol. The master produces a heartbeat signal, which is consumed by the slave devices. If a slave device does not receive the heartbeat signal within the specified heartbeat consumer time, the slave reports a heartbeat event error.

1.5.3 SYNC Object Protocol

The CNM001 module operates as a SYNC producer, periodically sending the SYNC object out on the network. Slave devices that support synchronous operation are consumers of the SYNC object and can use it to synchronize their operation.

1.5.4 PDO Counters

For each attached device, the CNM001 module can maintain a counter variable that increments when a PDO message is received from the attached device (TPDOs received by the master only.) The controller can then use these counters as indications of attached device health. If configured to use PDO counters to assess slave health, the status of the PDO counter based status will override the status of the Node guarding or Heartbeat protocol configured for that slave device.

- A device's PDO counter increments when the CNM001 module receives any PDO message from the device.
- Each input scan performed on the IC695CNM001 module will cause it to monitor the PDO counter based health of all slave devices configured to use the PDO counter mechanism to assess slave health.
- Each input scan if the PDO counter has not incremented since the previous input scan the PDO counter timeout is assessed. If the number of milliseconds configured as the PDO counter timeout length has passed since the last input scan that detected a change in the PDO counter value, then the slave device is considered lost and the corresponding slave status bit is marked as lost and also a fault is logged in the I/O fault table for that slave device.
- If on a future input scan the PDO counter changes again, the PDO counter for slave health is reset and the slave is marked as healthy and a addition of device fault is logged in the I/O fault table.
- Raw PDO counter data can be scanned with input scan data if configured, using Config Byte 6.

1.5.4.1 PDO Counter Operation for Offline Devices

If some or all configured devices are powered off or disconnected, the following symptoms will be present:

- Slave health bit for each device that is offline will be cleared. When this bit is cleared a single Loss of Device fault will be logged in the I/O fault table for each node address that is lost.
- PDO counters belonging to each device that is offline will stop incrementing.
- The PDO data received from that slave device will hold-last-state.
- All counters belonging to healthy devices will continue to be updated normally, and the slave health bit for all healthy devices will remain set.

1.6 Additional Information

PACSystems RX3i User Manuals

For additional information, refer to the manuals listed below. Manuals can be downloaded from the Support website.

PACSystems RX3i and RX7i CPU Reference Manual, GFK-2222

PACSystems RX3i System Manual, GFK-2314

Information about CANopen

For detailed information about CANopen, contact the CAN in Automation e.V. (CiA) organization: http://www.can-cia.org/

1.7 CANopen Terminology

CAN	Controller Area Network
CAN-ID	The 11-bit CAN message identifier
COB	Communication object
COB-ID	Communication object identifier: uniquely identifies a COB
EDS	Electronic datasheet. A file format defined in CiA306 that defines the operation of a device on a CANopen network.
NMT	Network management
PDO	Process data object
RPDO, RX PDO	Receive PDO
SYNC	Synchronization object: transmitted by a SYNC producer to trigger a synchronized action by the SYNC consumer nodes that receive it
TPDO, TX PDO	Transmit PDO

Chapter 2. Hardware Installation

This chapter contains information on the following procedures:

- Reviewing system power requirements
- Installing the CNM001 module in the RX3i backplane
- Connecting the module to the CANopen network

2.1 Reviewing System Power Requirements

Review the power requirements of your system to ensure that your power supply has sufficient capacity to support the CNM001 module. The Machine Edition software automatically calculates power supply load once you add the 3rd party module to your configuration and enter the power consumption of 0.800 Amps for +3.3VDC. Details on manually calculating power supply load can be found in the *PACSystems RX3i System Manual*, GFK-2314.

2.2 Installing the Module in the RX3i Backplane

A CNM001 module must be installed in the main RX3i rack, in any slot except slot 0 or the expansion slot.

A CNM001 module in an RX3i Universal Backplane can be installed or removed while power is applied to the system (hot swapped).

Warning

Inserting or removing a module with power applied to the system may cause an electrical arc. This can result in unexpected and potentially dangerous action by field devices. Arcing is an explosion risk in hazardous locations. Be sure that the area is non-hazardous or remove system power before removing or inserting a module.

For details about installing RX3i rack systems and modules, refer to the *PACSystems RX3i System Manual,* GFK-2314.

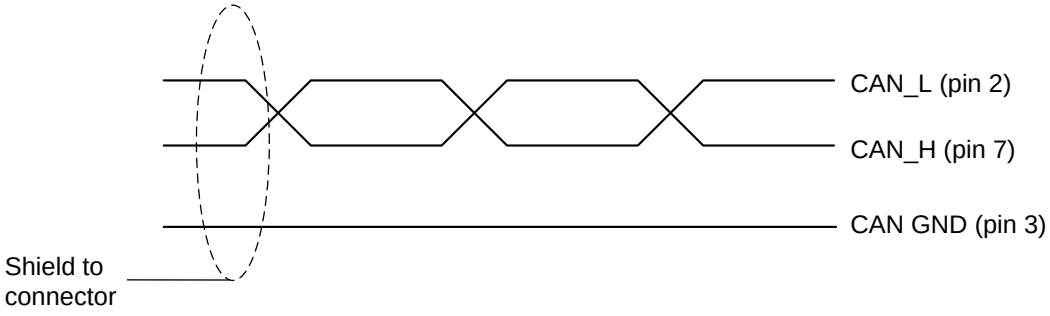
2.3 Connecting the CNM001 Module to the CANopen Network

The CNM001 module has a 9-pin male D-connector for connection to the CANopen network.

2.3.1 CANopen Port Connections

CANopen Port Pin Assignment

Pin No	Signal	Description
1	Not connected	Reserved
2	CAN_L	CAN Low bus signal
3	CAN_GND	CAN ground
4	Not connected	Reserved
5		
6		
7	CAN_H	CAN High bus signal
8	Not connected	Reserved
9		



The cable shield should be connected to each device on the network.

2.3.2 Network Data Rates and Bus Lengths

The CNM001 module supports the estimated bus lengths and data rates defined in CiA 303 version 1.8.0.

2.3.3 Network Termination.

A 120 ohm termination resistor is required at the each end of the bus. Where termination is required, you must use a bus terminal that has built-in selectable termination

Chapter 3. Getting Started: Initial Configuration

You will need:

- PACSystems CPU Firmware 7.70 or later.
- SYCON.net configuration software, available from Hilscher. For details, refer to their website: http://www.hilscher.com. Search for "Communication Solutions DVD for cifX, comX and netJACK."
- Device driver for the CNM001 module USB connection. (Available on the "Communication Solutions DVD for cifX, comX and netJACK" DVD.)
- Mini USB cable for connecting SYCON.net to the CNM001 module.
- Proficy Machine Edition configuration and programming software from GE Intelligent Platforms, version 7.00 or later.
- Serial or Ethernet cable for connecting the Proficy Machine Edition programmer to the RX3i CPU.
- EDS files for the slave devices in your system, available from the device manufacturers.

Two steps are required to configure the IC695CNM001 module as a master on a CANopen network:

1. Configure the CANopen network using the SYCON.net software from Hilscher and download the configuration to the module through the USB port.
2. Configure the CNM001 module as a third-party module in Proficy Machine edition and download the configuration to the RX3i CPU. This part of the configuration specifies how the data from the CNM001 module is transferred to the RX3i CPU.

Note: A maximum of 272 bytes (136 words) of scanned data can be configured for input data (%I, %AI and %R in) and for output data (%Q, %AQ and %R out). If either quantity exceeds this limit, the configuration will fail to store and faults will be logged in the Controller Fault Table. For an example, 3.3, "I/O Scan Data Limits."

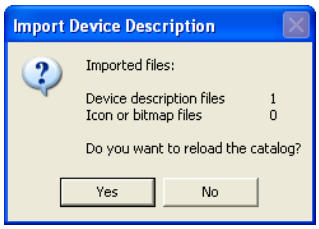
Note: By default the module is configured to scan 4 bytes of module status data and 16 bytes of slave device health data first. These bytes must be counted when checking for the maximum of 272 bytes of input scan data.

3.1 Configuring the CANopen Network using SYCON.net

The SYCON.net tool is used to create an electronic description of the CANopen network. The CNM001 master module ***must*** be configured as node 1. The slave devices are configured as nodes under the master module.

Step 1. Install the slave device drivers.

a. Open SYCON.net
b. Select: Network → Import Device Descriptions…
c. Change Files of type drop down to CANopen EDS (*.eds, *.dcf)
d. Browse to and select the EDS files for the slave devices in your system.
e. Select Open.
f. In the Import Device Description dialog box, click Yes.

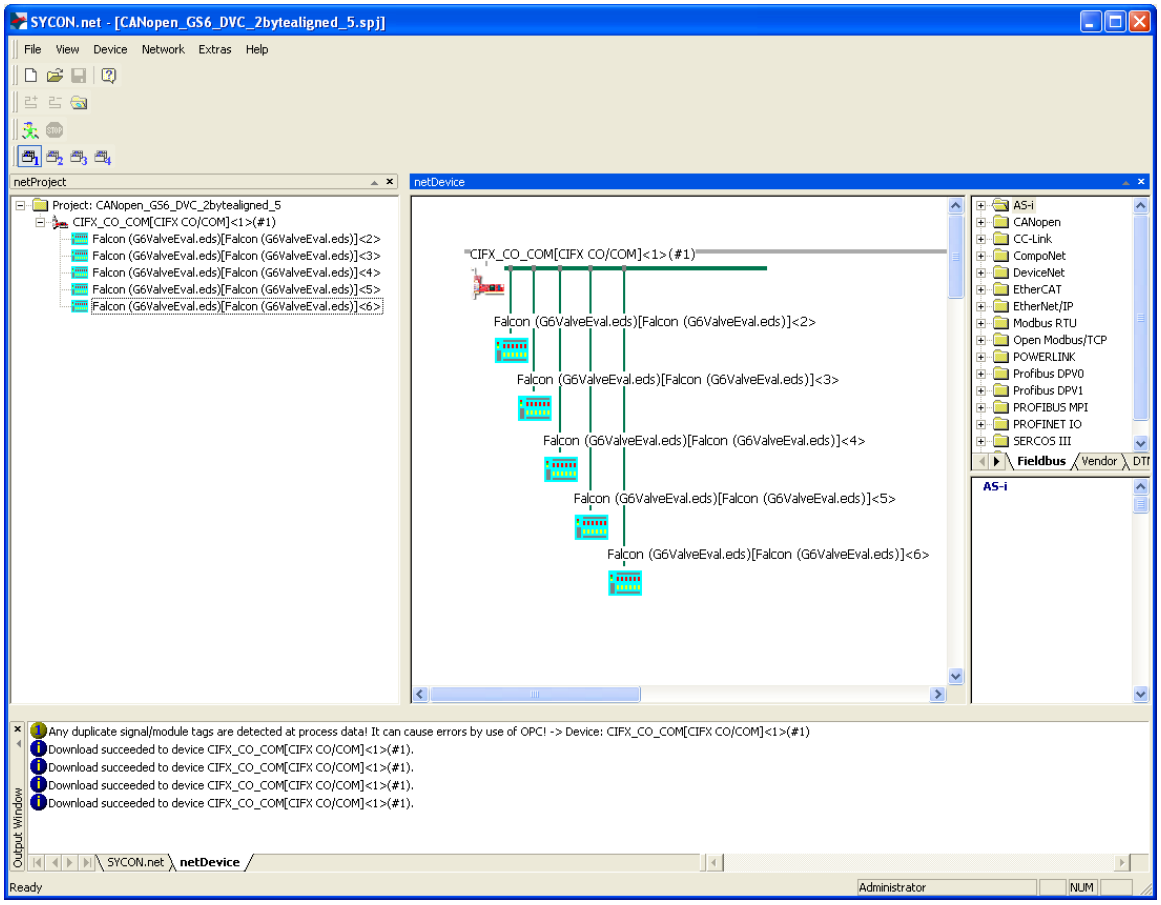


g. Wait until the device catalog is reloaded (may take several minutes).

Step 2. Create a project and download it to the CANopen module

For information on using the SYCON.net tool to configure a network, refer to the user documentation provided by Hilscher. The following figure shows a sample project in SYCON.net.

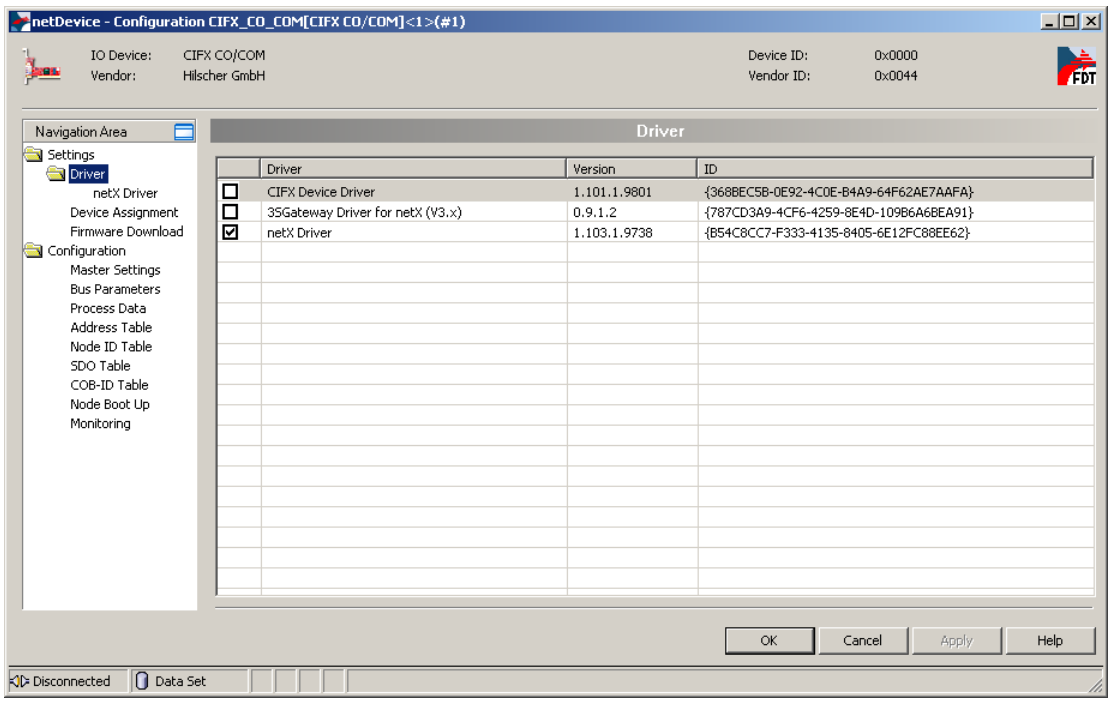
a. To configure a network for the RX3i CNM001 module, use Master device type CIFX CO/COM.



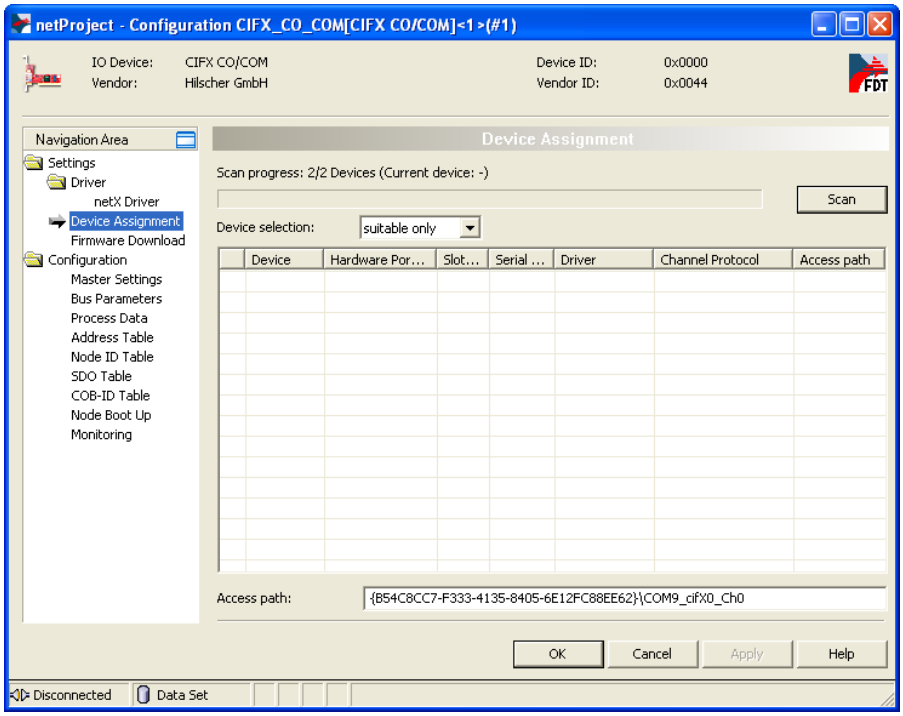
b. In the netDevice window, right click the CIFX_CO_COM[CIFX CO/COM}<1>(#1) node and select Configuration…

Note: If the Configuration command is unavailable when you right click the node containing the CANopen Master, you must first select Disconnect, and then select Configuration.

c. In the Settings folder select Driver. Select the ***netXDriver*** device driver. Clear all other driver selections.



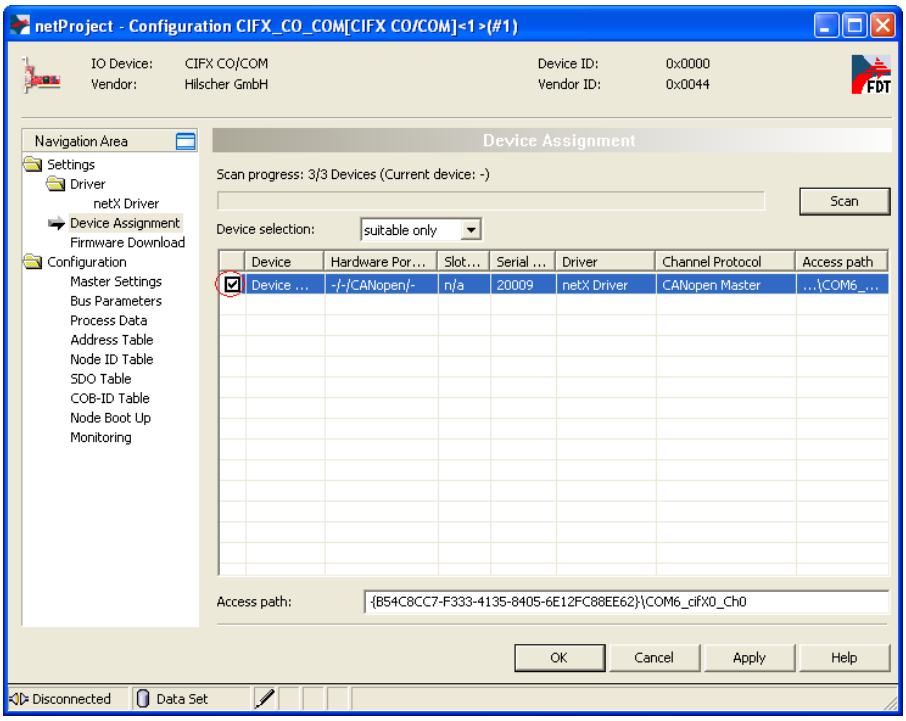
d. Select the Device Assignment screen:



e. Install the IC695CNM001 module in an RX3i backplane and power on the backplane. (See 2.2, “Installing the Module in the RX3i Backplane.”)

f. Connect a mini USB cable from the computer running SYCON.net to the USB port on the CNM001.

g. Click the Scan button. SYCON.net should find the CNM001 module. Click the box next to the CANopen master and click OK.

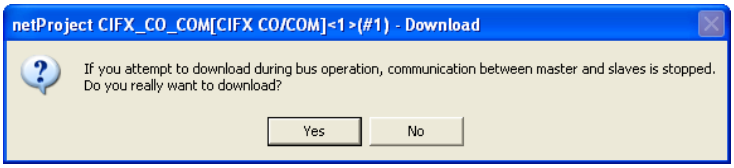


h. If no device is listed after selecting the Scan button, go to your computer's "Device Manager" window and check for errors with the "Hilscher cifX" device. If installed correctly it should be listed under "Ports" and the device's Properties dialog box should show a Device Status of "This device is working properly." If the "Hilscher cifX" device is listed with a yellow "?" icon then the USB driver needs to be manually installed from the "Communication Solutions DVD for cifX, comX and netJACK" DVD by clicking on "Update Driver" in the device's Properties dialog box and browsing to the driver on the DVD.

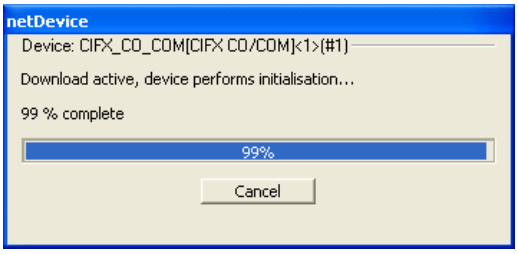
i. Put the RX3i Controller in ***Stop/Disabled*** mode.

Note: The RX3i Controller ***must*** be in Stop/Disabled mode before downloading the configuration from SYCON.net. If the configuration is downloaded to the module when the Controller is in Run or Outputs Enabled mode, the module will be lost and a hot swap, SVC_REQ 24 reset or power cycle will be required to recover the module.

j. Select Device → Download, and click Yes in the Download dialog box.



k. After approximately 30 seconds, SYCON.net programs the configuration into the CNM001 module and the configuration data is saved internally to a solid state storage. This means that you can power cycle and move the CNM001 module and it retains the configuration. You may see the following screen for about 30 seconds:



l. After the new configuration is stored, perform a power cycle, SVC_REQ 24 reset, or hot swap of the IC695CNM001 module to restart the module with the new configuration.

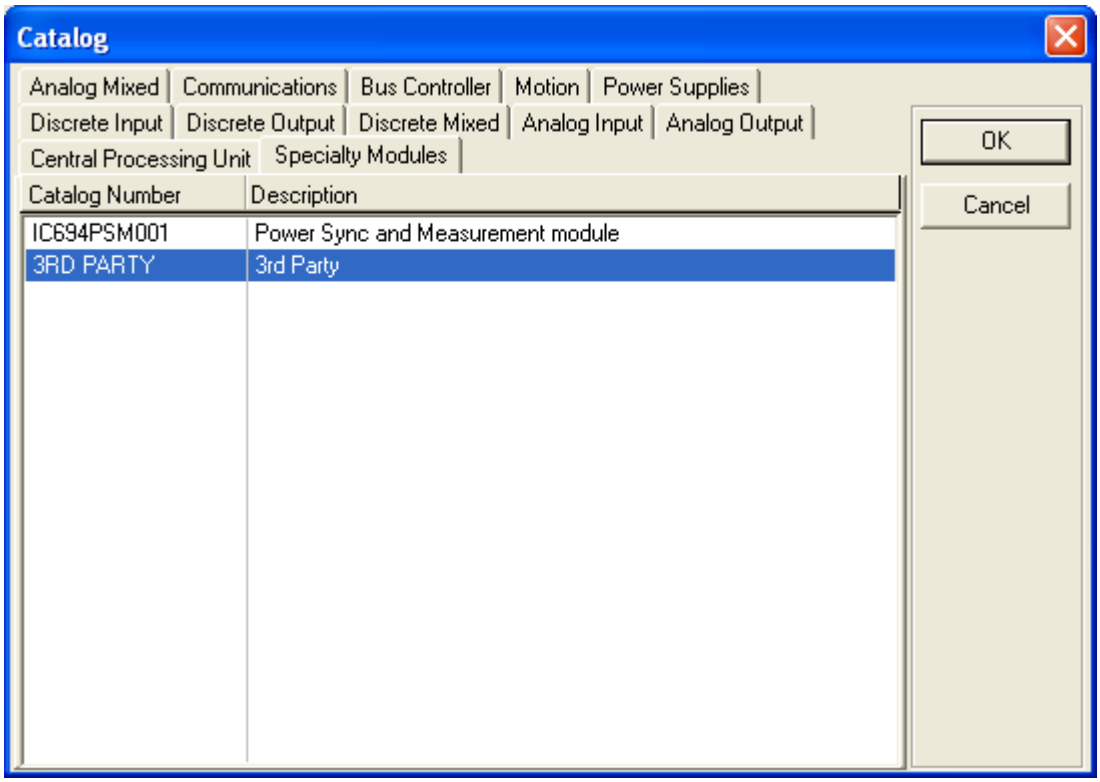
m. Close SYCON.net. You must now configure the module in Proficy Machine Edition to get the data from the module to the RX3i CPU.

3.2 Configuring the CNM001 CANopen Master in Proficy Machine Edition

The CNM001 module is configured as a 3rd Party module in the Proficy Machine Edition software.

Step 1. Configure the CNM001 module as a 3rd Party module.

a. In the module Catalog, select 3rd Party from the Specialty Modules tab.



b. Open the Parameter Editor for the 3rd Party module.

Step 2. Configure the reference data addresses and lengths for input and output scan data.

The CNM001 module scans 32 bits (2 words) of module status data, followed by 128 bits (8 words) of node status data, followed by a maximum of 252 bytes (126 words) of TPDO data as mapped by SYCON.net.

%AI Words (Input Scan Data)

Word	Function
1	Module status data. For details, see 5.2.1, “Module Status Data (32 bits).”
2	
3	Node status data. For details, see 5.2.2, “Node Status Data (128 bits).”
4	
5	
6	
7	
8	
9	
10	
11 through xx (126 maximum)	This data field is the TPDO data (from the point of view of the slave device). Its layout is assigned by the mapping created using SYCON.net configuration software. To determine the contents of each slave’s transmitted data, refer to the documentation supplied by the device manufacturer.

%AQ Words (Output Scan Data)

Word	Description
1 through xx (136 maximum)	This data field is the RPDO data (from the point of view of the slave device). The layout of this data is assigned by the mapping SYCON.net. To determine the contents of each slave’s received data, refer to the documentation supplied by the device manufacturer.

Step 3. Configure the CNM001 module interface to the RX3i CPU.

Bytes 2 through 6 are used to configure the status data that the RX3i CPU will scan from the CNM001 module.

Softswitch Configuration Byte Parameters

Parameter	Definition	Valid Values
Byte 1	Reserved	Must be 0
Byte 2	Reserved	Must be 0
Byte 3	PDO Counter Timeout Time (ms) **Note:** If enabled, the PDO Counter Timeout feature overrides the results from node guarding or heartbeat from the module.	0 – FF hex (0 – 255 decimal)
Byte 4	Highest Slave Address for PDO Counter Status This is the highest slave address on the CANopen bus that will use the PDO counter timeout feature. Any slave addresses above this value will either use Node Guarding or Heartbeat for slave health monitoring.	0 – 7F hex (0 – 127 decimal) **Note:** The interval between input scans on the system must not match the PDO counter roll-over time, otherwise the PDO Counter could timeout. (See 3.2.1, “PDO Counter Rollover Concerns.”)
Byte 5	Reserved	Must be 0
Byte 6	Config Flags Used to select CPU scanning of module and slave status data.	Refer to “Config Flags Definitions”
Byte 7	Reserved	Must be 0
Byte 8		
Byte 9		
Byte 10		
Byte 11		
Byte 12		
Byte 13		
Byte 14		
Byte 15		
Byte 16		

Config Flags Definitions

Bit	Values
1 (LSB)	0 = Scan 32 module status bits 1 = Do ***not*** scan 32 module status bits
2	Reserved. Must be 0.
3	Reserved. Must be 0.
4	0 = Scan 128 slave healthy bits 1 = Do ***not*** scan 128 slave healthy bits
5	0 = Do ***not*** scan 128 PDO counter bytes 1 = Scan 128 PDO counter bytes **Note**: Only up to highest SlaveAddress+1 will be incremented without bit 6 set.
6	0 = Only read highest SlaveAddress+1 PDO counter bytes if scanning PDO counters 1 = Read all 128 PDO counter bytes when scanning
7	Reserved. Must be 0
8	

Note: If you attempt to download a configuration with an invalid value for a softswitch configuration byte, the download fails and logs a System Config Mismatch fault.

To find out which byte is invalid, select the fault in the Controller fault table and display the ASCII value. (If more than one byte is incorrect, only the first one is displayed.)

Config Flags Examples

Byte 6 = 0x30

A value of 0x30 turns on the reporting of all PDO counters via the input scan data.

0	0	1	1	0	0	0	0
MSB (bit 8)							LSB (bit 1)

Byte 6 = 0x08

A value of 0x08 turns off the scanning of slave status bits.

0	0	0	0	1	0	0	0
MSB (bit 8)							LSB (bit 1)

Step 4. Provide Power Consumption Values

On the Power Consumption tab, enter the values for the CNM001 module (see 1.1, “Module Specifications.”) This allows Proficy Machine Edition to accurately calculate the current usage for the rack power supply.

3.2.1 PDO Counter Rollover Concerns

The PDO counter is stored in a one-byte field and will roll over every time the 256th PDO is received from a given slave device. Because of this rollover, if the input scan period and rollover period are the same, the system could time out a slave device using the PDO counter timeout feature even though the slave device is still healthy. This happens because the PDO counter appears to be frozen to the controller even though it is actually incrementing 256 times between scans. To avoid this scenario, make sure the system is configured in such a way that the input scans occur either significantly more or significantly less frequently than the time it takes the PDO counter to roll over.

Example: When using the GS6 valve driver and a CANopen Master cycle time set to 5ms, the PDO counter normally increments every 5ms, for a rollover time of about (5×256=1280) 1280ms. This means that to avoid a problem with the PDO counter rolling over you would need to scan inputs faster than once every 1280ms. In the typical system configuration using the GS6 valve driver, a constant sweep time of 10ms is used, which is well below the 1280ms rollover time.

3.2.2 Proficy Machine Edition Configuration Examples

3.2.2.1 Five Slave Devices

The following sample configuration is for a CNM001 master module that has five slave devices with 40 bytes of PDO TX data and 20 bytes of PDO RX data per device.

Settings | Wiring | Power Consumption

Parameters	Values
Module Details	CANopen Master
Module ID	3
Reference Address	%I00081
Length	0
Reference Address	%Q00001
Length	0
Reference Address	%AI00001
Length	110
Reference Address	%AQ00001
Length	50
Reference Address (in)	%R00001
Length (in)	0
Reference Address (out)	%R00001
Length (out)	0
Byte 1	0h
Byte 2	0h
Byte 3	28h
Byte 4	6h
Byte 5	0h
Byte 6	0h
Byte 7	0h
Byte 8	0h
Byte 9	0h
Byte 10	0h
Byte 11	0h
Byte 12	0h
Byte 13	0h
Byte 14	0h
Byte 15	0h
Byte 16	0h
I/O Scan Set	1

- Reference data lengths for I/O scan data:

110 words of %AI input data:	2 words module status data + 8 words node status data + 100 words (40 bytes x 5 devices) of PDO TX data from the slave devices as mapped by SYCON.net
50 words of %AQ output data:	20 bytes x five devices as mapped by SYCON.net (PDO RX data)

- PDO Counter Timeout (byte 3) is 40ms (0x28)
- Highest Slave Address (byte 4) is 6 (0x6) for highest slave to use for PDO Counter Timeout.

- Config Flag (byte 6) is 0x00:

Bit No.	*Value*	*Definition*
1 (LSB)	0	Scan 32 module status bits
2	0	Do not scan 384 slave status bits
3	0	Do not scan 128 lost slaves bits
4	0	Scan 128 slave healthy bits
5	0	Do not scan 128 PDO counter bytes
6	0	Do not read all 128 PDO counter bytes when scanning.
7	0	Must be 0
8	0	Must be 0

Input Data Calculations for this Configuration

Module Status		4 bytes
Slave Status	(1 bit per slave)	16 bytes
PDO TX data	(Five devices × 40 bytes)	200 bytes
Total	Valid, <272 bytes	220 bytes

3.2.2.2 Three Slave Devices and 128 Input Scan Bits

The following sample configuration is for a CNM001 master module that has three slave devices with 40 bytes of PDO TX data and 20 bytes of PDO RX data per device.

Settings | Wiring | Power Consumption

Parameters	Values
Module Details	CANopen Master
Module ID	3
Reference Address	%I00001
Length	0
Reference Address	%Q00001
Length	0
Reference Address	%AI00111
Length	70
Reference Address	%AQ00051
Length	30
Reference Address (in)	%R00001
Length (in)	0
Reference Address (out)	%R00001
Length (out)	0
Byte 1	0h
Byte 2	0h
Byte 3	28h
Byte 4	4h
Byte 5	0h
Byte 6	30h
Byte 7	0h
Byte 8	0h
Byte 9	0h
Byte 10	0h
Byte 11	0h
Byte 12	0h
Byte 13	0h
Byte 14	0h
Byte 15	0h
Byte 16	0h
I/O Scan Set	1

- Reference data lengths for I/O scan data:

134 words of %AI input data:	2 words module status data + 8 words node status data + 64 words raw PDO counter data 60 words (40 bytes x 3 devices) of PDO TX data from the slave devices as mapped by SYCON.net
30 words of %AQ output data:	20 bytes x three devices as mapped by SYCON.net

- PDO Counter Timeout (byte 3) is 40ms (0x28)
- Highest Slave Address (byte 4) is 4 (0x4) for highest slave to use for PDO Counter Timeout.

- Config Flag (byte 6) is 0x30:

Bit No.	*Value*	*Definition*
1 (LSB)	0	Scan 32 module status bits
2	0	Do not scan 384 slave status bits
3	0	Do not scan 128 lost slaves bits
4	0	Scan 128 slave healthy bits
5	1	Scan 128 PDO counter bytes
6	1	Read all 128 PDO counter bytes when scanning
7	0	Must be 0
8	0	Must be 0

Input Data Calculations for this Configuration

Module Status		4 bytes
Slave Status	(1 bit per slave)	16 bytes
PDO Counters	(1 byte per slave)	128 bytes
PDO TX data	(Three devices × 40 bytes)	120 bytes
Total	Valid, <272 bytes	268 bytes

3.3 I/O Scan Data Limits

If the amount of input or output scan data exceeds 272 bytes (136 words), the configuration download from Proficy Machine Edition will fail

Example

The following configuration contains 1184 input bits (%I), 100 input words (%AI) and 0 input words (%R) for a total of (1184/8) + (100*2) + (0*2) = (148) + (200) + (0) = 348 input bytes. Since this is greater than 272 you will get faults and the configuration will fail to store.

The amount of output data is not a problem, with 0 output bits (%Q), 50 output words (%AQ) and 0 output words (%R), which totals to (0/8) + (50*2) + (0*2) = (0) + (100) + (0) = 100 output bytes.

%R is valid for both input and output, which is why it is noted as (in) and (out) in the 3rd party configuration in Proficy Machine Edition.

InfoViewer | (0.5) 3RD PARTY | tempCheck | _MAIN

Settings | Wiring | Power Consumption

Parameters	
Module Details	
Module ID	3
Reference Address	%I00081
Length	1184
Reference Address	%Q00001
Length	0
Reference Address	%AI00001
Length	100
Reference Address	%AQ00001
Length	50
Reference Address (in)	%R00001
Length (in)	0
Reference Address (out)	%R00001
Length (out)	0
Byte 1	0h
Byte 2	0h

Attempting to download this configuration will generate the following faults.

Controller Date/Time: 01-01-2000 00:10:50
Last Cleared: 01-01-2000 00:00:00

Fault Table Viewer

Status: Online

Controller Fault Table (Displaying 7 of 7 faults, 0 Overflowed)

Loc	Fault Description	Date/Time
0.2	Controller sequence store failure	01-01-2000 00:06:44
	Error Code: 0 | Group: 137 | Action: 3:Fatal | Task Num: 0	
	Fault Extra Data: 00 3c 03 9d 80 3b 00 1e 00 3c 01 ce 00 03 40 32 00 00 00 00 00 00 00 00	
0.2	Non-critical CPU software event	01-01-2000 00:06:44
	Error Code: 213 | Group: 140 | Action: 1:Informational | Task Num: 3	
	Fault Extra Data: 00 3c 01 c9 80 22 00 0f 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	
0.2	Non-critical CPU software event	01-01-2000 00:06:44
	Error Code: 404 | Group: 140 | Action: 1:Informational | Task Num: 3	
	Fault Extra Data: 00 18 02 5d 80 22 00 0f 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	

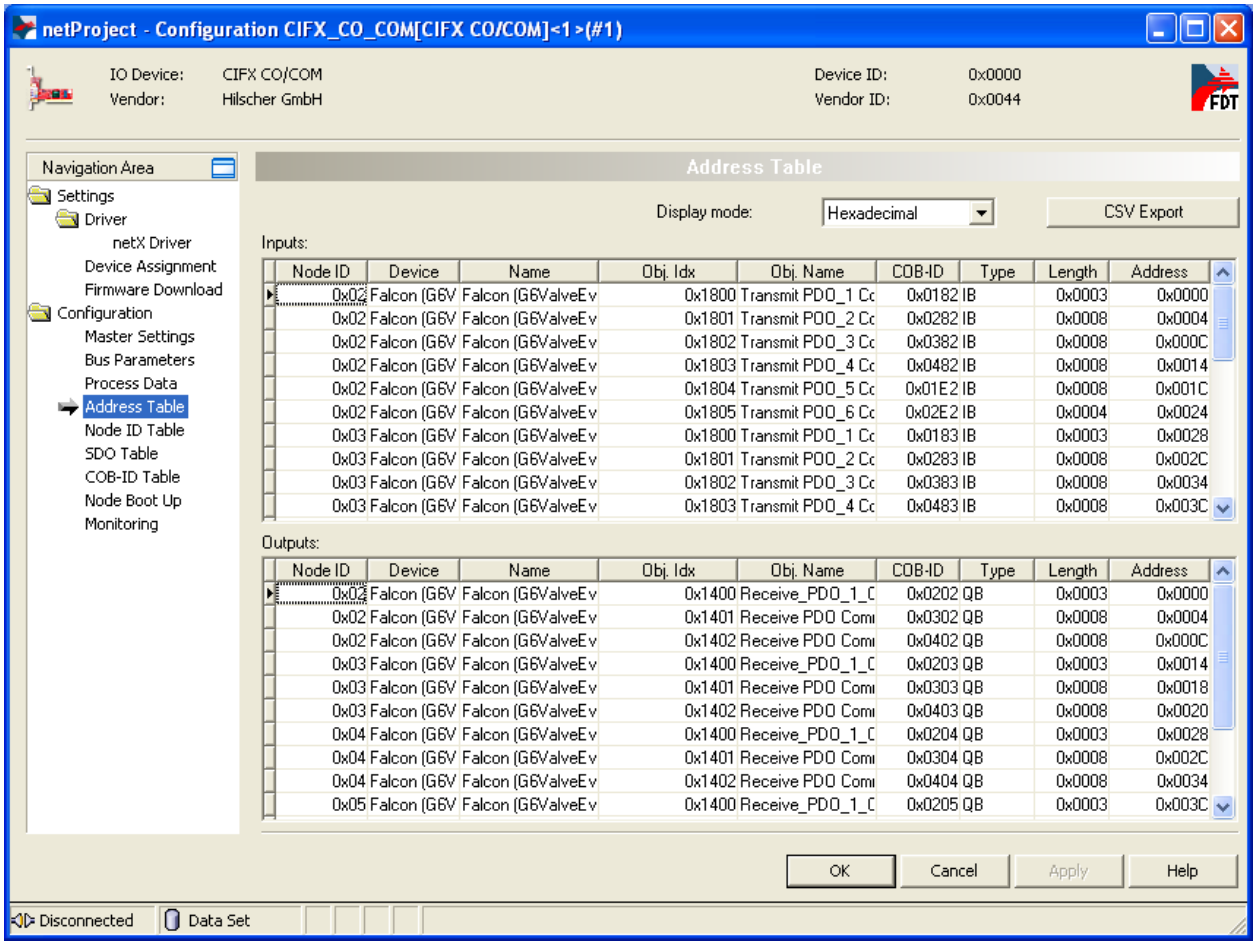
Note: For additional examples, see 3.2.2, “Proficy Machine Edition Configuration Examples.”

3.4 Viewing TX/RX PDO Mapping using SYCON.net

To view the CNM001 module's TX/RX PDO mapping within the Input and Output scan data in SYCON.net, go to the CIFX_CO_COM configuration and select the Address Table.

The tool displays rows of Input PDOs (TX PDOs from the slave device perspective) and Output PDOs (RX PDOs from the slave device perspective) which define their node address, PDO name, Length, and Offset within the data. In this data the Address is the offset within the corresponding input scan and output scan data areas as configured in the Proficy Machine Edition configuration (see page 21).

Note: To determine the specific contents of each PDO, refer to the documentation provided by the device manufacturer.



Chapter 4. Recommended Settings for Use with GS6 Valve Drivers

4.1 Recommended 3rd Party Config Bytes

Byte 3 = >0x05 (5ms) and <0x32 (50ms) NOTE: For use with the GS6 the system takes two controller sweeps + one cycle period to begin the timeout period so the best case timeout length from loss of slave to timeout of PDO counter timeout is 15ms + the timeout time set in byte 3 and the worst case is 25ms + the timeout time set in byte 3. So for example if byte 3 is set to 0x0F (15ms) the best case timeout time from loss of slave device until it is reported would be about 30ms, while the worst case would be 40ms. If Byte 3 is set to 0x19 (25ms) the best case would be 40ms and worst case would be 50ms.

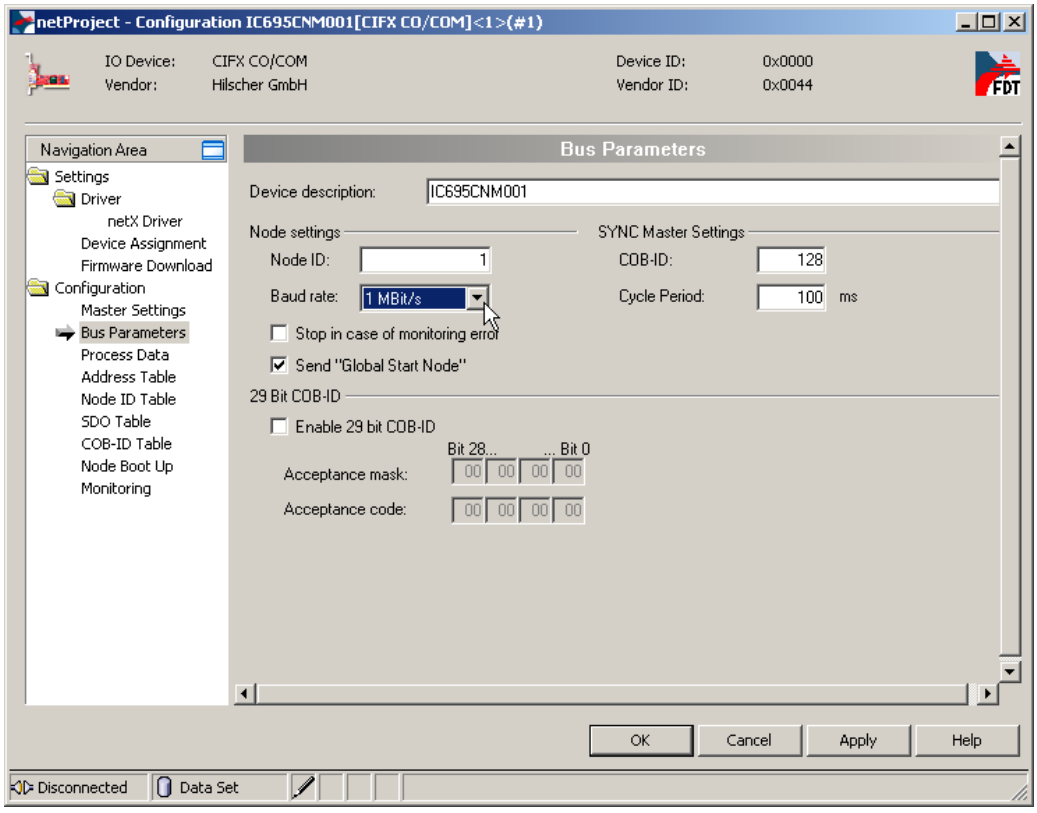
Byte 4 = 0x06 (use PDO counters for slave addresses 2, 3, 4, 5, and 6 to asses slave health.)

Byte 6 = 0x00.

4.2 Setting the Network Baud Rate

In SYCON.net open the Master module configuration and select Bus Parameters.

Note: Baud rate must be the same for all nodes on the network.



- Node ID ***must*** be set to 1.
- Only baud rates of 125K, 250K, and 500K are supported.
- COB-ID ***must*** be set to 128.
- Cycle Period ***must*** be set to 5ms.

4.3 CNM001 Master Module Communication Capabilities with GS6 Valve Devices

No. of Slave Nodes Connected	Cycle Period (ms)	baud rate (kbps)	Total Data exchanged RX (bytes)	Total Data exchanged TX (bytes)	Distance Tested (Meters)
1	5	500	20	42	100
	5	250	20	42	225
	5	125	20	42	500
2	5	500	40	84	100
	5	250	40	84	225
	5	125	40	84	500
3	5	500	60	126	100
	5	250	60	126	225
	5	125	60	126	500
4	5	500	80	168	100
	5	250	80	168	225
5	5	500	100	210	100
	5	250	100	210	225

Note: The network baud rate is selected in the configuration for the CNM001 module, using the SYCON.net software. All nodes on the network must use the same rate.

Chapter 5. Diagnostics

5.1 Slave Health

The following tools can be used to diagnose bus communications problems.

- Fault logging to the I/O fault table in Proficy Machine Edition for loss or addition of CANopen slave device (that support either Node Guarding or Heartbeat protocol)
- Node status data: One status bit per slave address in reference memory to identify devices that are lost (that support either Node Guarding or Heartbeat protocol)
- Module status data: All slaves healthy bit.

5.2 Status Data

5.2.1 Module Status Data (32 bits)

Bit Number	Definition
0	Module OK 1 = CNM001 module is present and available 0 = CNM001 module is not powered up or not available (not configured or faulted)
1	All slaves healthy 1 = All configured slaves are OK 0 = At least one slave is faulted
2	PDO Counters enabled 1 = PDO counters are enabled 0 = PDO counters are not enabled
3 – 31	*Reserved*

5.2.2 Node Status Data (128 bits)

This data consists of one bit per device, with bit position indicating the address. For example slave address 2 is indicated by bit 1 (first bit is bit 0).

Node Status Bit =	Definition
0	▪ The device is either not configured, or configured and not exchanging data. Loss of or inactive communication between the master and the slave device. ▪ Failed data path. ▪ PDO Counter Timeout parameter has been exceeded. **Note:** If any slave node status bit is 0, the all slaves healthy module status bit will also be 0.
1	The slave is configured and is exchanging data.

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