HORNER APG

User Manual for

HECOM650/HE800COM650

&

HECOS600/HE800COS600

CANOpen Master and Slave

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Rev 2	Added OCS Interface chapter	D.Taylor	11 Sept 2008
Rev 3	Added OCS Interface chapter	D.Taylor	12 Oct 2008

PREFACE

This manual explains how to use the Horner APG HSyCon software product.

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List of Revisions

Index	Date	Version	Chapter	Revision
	20-Feb-03	01	All	Initial release.

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CHAPTER 1: INTRODUCTION

1.1 Scope

This manual is intended to give the user enough information to configure an OCS/RCS/TIU with a SmartStack COM Module correctly. It does not provide detailed information of the theory behind the fieldbus protocols. *HSyCon,* is an easy-to-use Windows™-based configuration package for use with the SmartStack COM range of fieldbus modules. The software user's guide is contained in this manual. Cscape and Cbreeze are also easy-to-use Windows™-based configuration packages for use with the OCS/RCS and TIU platforms respectively.

A basic level of understanding of Microsoft Windows technology and operation is assumed. The manual assumes that the user is familiar with Windows 95, Windows 98 or Windows NT.

1.2 Introduction

The Fieldbus Smartstack module range adds a range of Master or Slave capable fieldbus protocols to the OCS/RCS and TIU families. These modules are self-contained units which provide access to the fieldbus network via a dual port ram interface on the SmartStack backplane. They are simple install and configure, requiring only three stages to get them operational, these are :

1. Physical installation and connection.
2. Configuration of the fieldbus interface.
3. Configuration of Cscape / Cbreeze to map the fieldbus data.

The system is comprised of two separate software functions, the fieldbus interface software running independently in the COM module and the OCS/TIU firmware running in the main module. Data and commands are exchanged via a dual port ram interface. The configuration of the COM module is via the RS232 serial port on the module. For correct operation the number of registers assigned in the OCS must match the number required by the Master or Slave module configuration.

The Smartstack module should be configured with the OCS/TIU first as otherwise it will be held in reset and cannot be configured.

1.3 Installing and Removing a SmartStack Module

The following section describes how to install and remove a SmartStack Module.

Caution: To function properly and avoid possible damage, do not install more than four Smart Stack™ Modules per OCS / RCS or TIU.
Do not attempt to install or remove a SmartStack module with the power on.

Installing SmartStack Modules

1. Hook the tabs. Each SmartStack Module has two tabs that fit into slots located on the OCS. (The slots on the OCS are located on the back cover.)

2. Press the SmartStack Module into the "locked" position, making sure to align the SmartStack Module fasteners with the SmartStack receptacles on the OCS.

Removing SmartStack Modules

1. Using a flathead screwdriver, lever up the end of the SmartStack Module (opposite end to tabs) and swing the module out.
2. Lift out the tabs of the module.

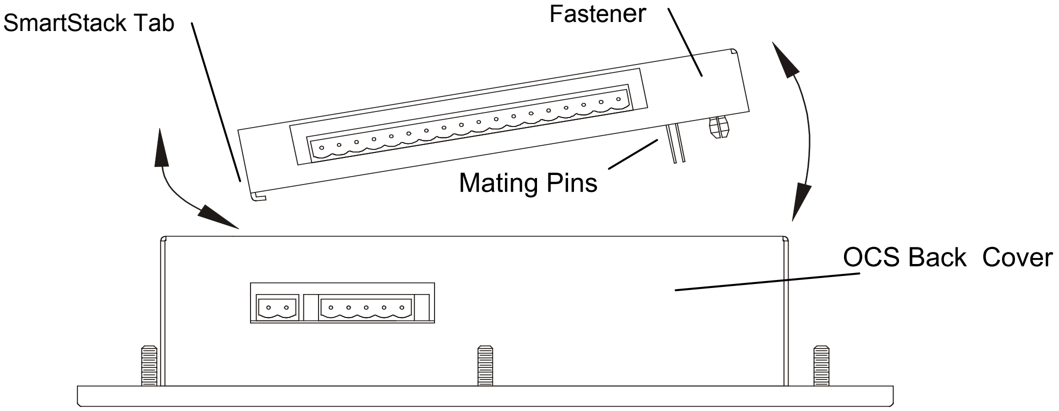
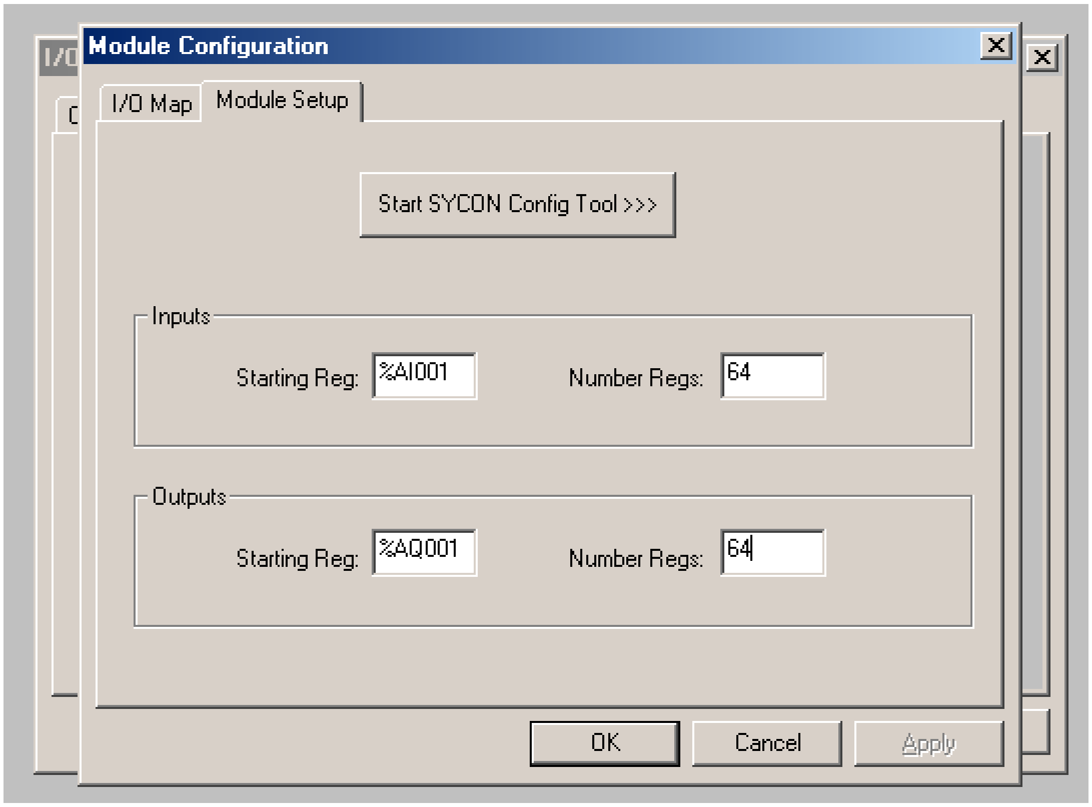


Figure 2.1 – Installing a SmartStack Module in an OCS

1.4 Installation of the COM module in an OCS/TIU

The SmartStack COM range are installed in a similar way to any other SmartStack module, however, the user should be aware that while the Auto Config function will report the presence of the module it cannot assign the amount of I/O required, the user must do this manually. To configure the amount of I/O required use the **Controller > I/O Configure** menu. If the Com module is on a base then double click the left mouse button on the relevant base and then double click again on the Module config button. The following menu allows the configuration of the module :



Inputs

Starting Reg: %AI001 Number Regs: 64

Outputs

Starting Reg: %AQ001 Number Regs: 64

Figure 1.1: SmartStack COM Module Configuration in Cscape / Cbreeze.

Select the Module Configuration tab and enter the register types and number required. Click OK to close the windows and download the configuration to the OCS /TIU. For further details of configuring OCS /TIU units please see the relevant module user manual.

1.5 CANOpen Network

CAN is an acronym for Controller Area Network. The CAN specification describes the physical interface, the telegram structure and the secure transmission of a CAN telegram. It describes the transmission and the reception of telegrams. The CAN telegram consists (simplified) of a telegram identifier and 0 to 8 bytes of data. The meaning of the telegram identifier and of the max. 8 bytes of user data is not described, e.g. it does not say anything about the application layer.

CANopen is an open standard protocol based on CAN. It specifies the meaning of the telegram identifiers and of the 0 to 8 bytes of user data. It is a standard application layer defined by the CIA (CAN In Automation) specification DS 301.
CANopen is network concept and determines what data and what services are to be transmitted the meaning of the data for the individual device classes. It provides functions for the network initialization, guarding and configuration. It is a very flexible protocol.

A CANopen device can be described generally as being composed of three components: communication, objects and application.

	Component	Description
•	Communication	The communication unit contains the mechanism for the transport of data according to the CANopen specification over CAN.
•	Object dictionary	The object dictionary is the connection between the application unit and the communication unit. It contains configuration data and device information. All entries have an object index (index) and a subindex.
•	Application	The application unit describes the function of the CANopen device.

Table 1: Components of the CANopen Device Model

1.6 Communication Profile, Device Profile and Device Type

The Communication Profile DS 301 specifies how to communicate. The Device Profiles DS 401xx specify, what is communicated :

Device Profile	Description
301	Common communication profile according to DS301
401	Device profile for I/O modules
402	Device profile for drives
406	Device profile for encoder

Table 1: Device Profile and Device Type

1.6.1 Communication Profile 301

The communication profile DS 301 is a common profile. It is the basis of CANopen communication and lays down how the devices communicate on the CANopen network.

1.6.2 NMT State Machine (State Diagram)

NMT stands for Network Management. This state machine defines and controls the CANOpen fieldbus states, the following diagram shows the possible states of a CANopen Node.

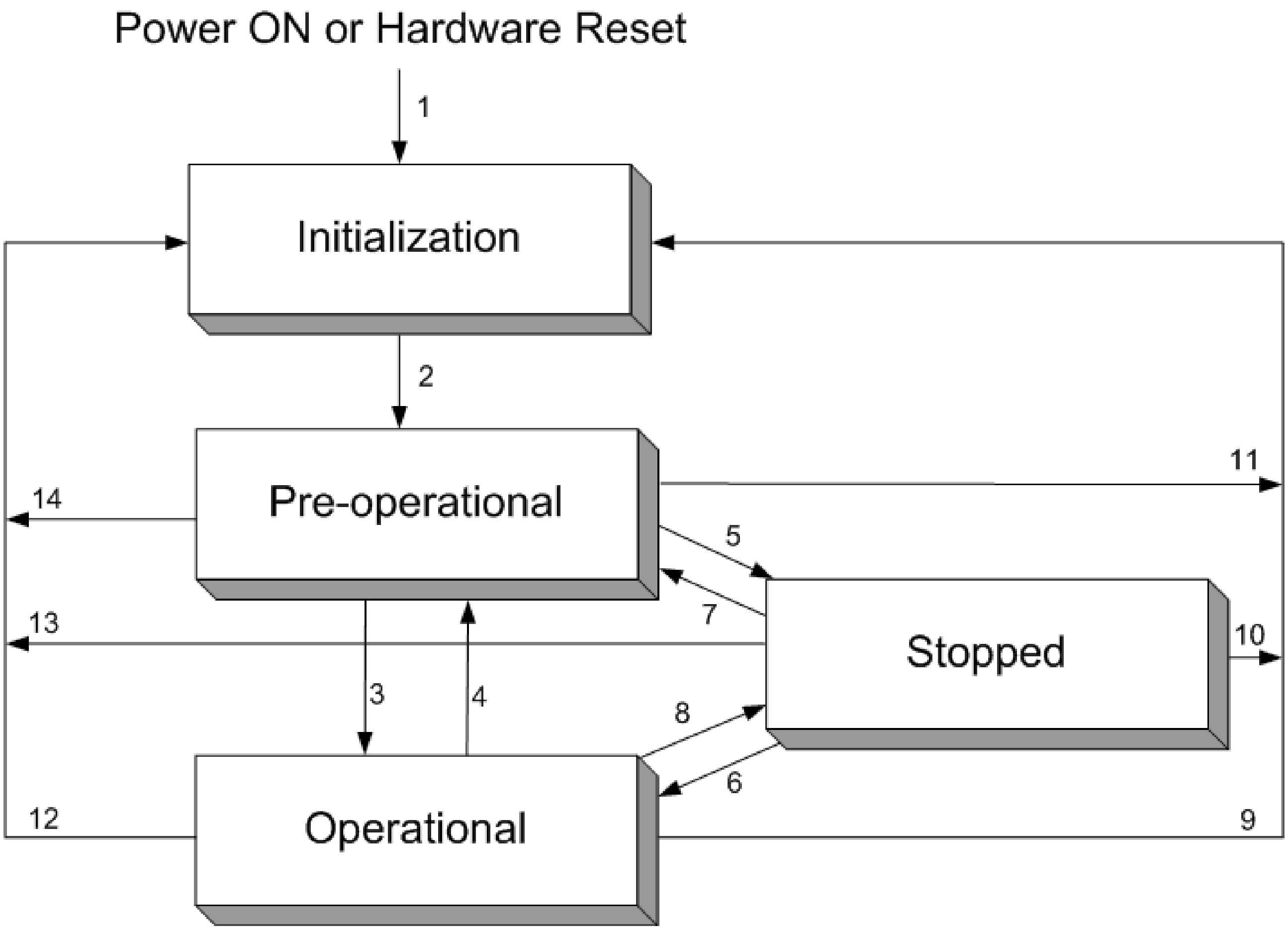


Figure 1: NMT-State Machine

Number	Meaning
1	At Power on the initialisation state is entered autonomously
2	Initialisation finished -enter PRE_OPERATIONAL automatically
3, 6	Start_Remote_Node indication
4, 7	Enter_PRE-OPERATIONAL_State indication
5, 8	Stop_Remote_Node indication
9, 10, 11	Reset_Node indication
12, 13, 14	Reset_Communication indication

Table 2: Description NMT-State Machine

1.6.3 Communication Characteristics in the different NMT States

The following table shows the possible communication in the respective NMT states.

Communication	Initialization	Pre-Operational	Operational	Stopped
PDO			•	
SDO		•	•	
SYNC		•	•	
Time Stamp		•	•	
EMCY		•	•	
BootUp	•			
NMT		•	•	•

Table 3: Communication in the different NMT States

CHAPTER 2: HSYCON INSTALLATION

2.1 System Requirments

- PC with 486-, Pentium processor or higher.
- Windows 95/98/ME, Windows NT/2000/XP.
- Free disk space: 30 - 80 Mbyte.
- CD ROM drive.
- RAM: min. 16 Mbyte.
- Graphic resolution: min. 800 x 600 pixel.
- Windows 95: Service Pack 1 or higher.
- Windows NT: Service Pack 3 or higher.
- Keyboard and Mouse.

2.2 System Installation

It is recommended that all application programs on the system are closed before installation begins. Insert the CD in the local CD ROM drive. The installation program will start by itself (if Autostart is enabled). Otherwise change into the root directory on the CD and start Autorun.exe (Autostart disabled).

Note: Administrator privileges are required on Windows NT/2000/XP systems for installation!

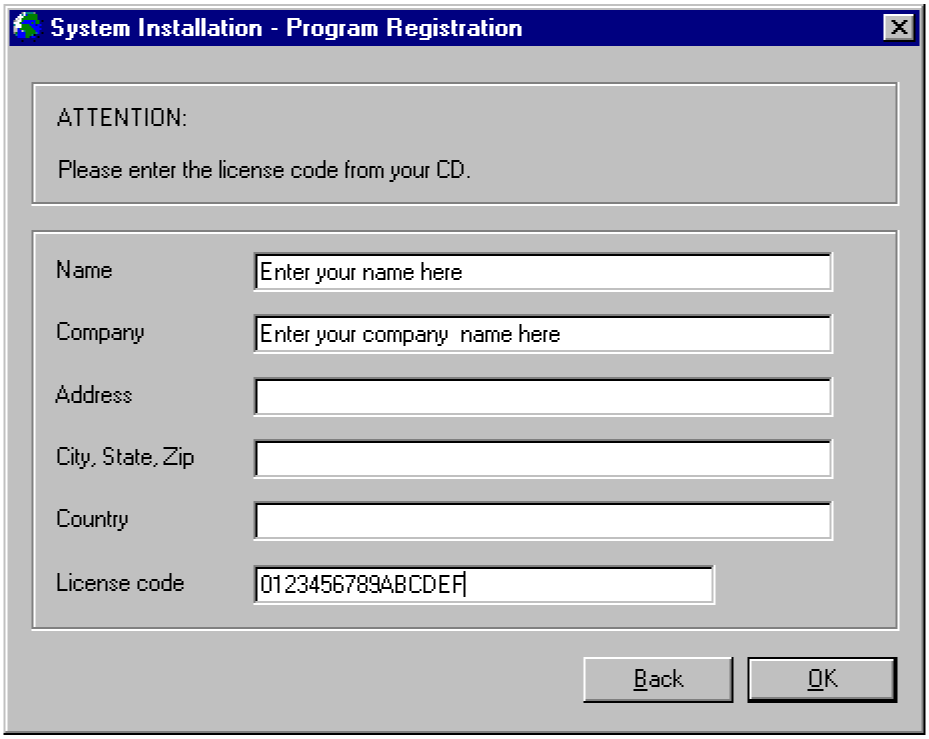
The installation program asks for the components to install. Answer these questions with **Yes** or **No**. Tick 'No' for the OPC Server function, it is not included with this installation pack.

Figure 1: Selection for the Installation of the licensed System Configurator (without OPC)

2.3 Installation of the System Configurator HSyCon

During the installation the user name, company name and license code must be entered. Otherwise the HSystem Configurator will only work in basic version mode. In this case, all functions are available, but the configuration is limited to two devices on the network, this is usually sufficient for Slave devices.

Follow the instructions of the installation program by selecting the fieldbus system to be installed and answer all the questions with **OK** or **NEXT**.



System Installation - Program Registration

ATTENTION:

Please enter the license code from your CD.

Name	Enter your name here
Company	Enter your company name here
Address	
City, State, Zip	
Country	
License code	0123456789ABCDEF

Figure 2: Enter the Name, the Company Name and the Licensecode

Note: The License code 0123456789ABCDEF is not a valid code and is only used for explanation purpose, the code is case sensitive.

It is necessary to fill in the Name,Company Name and License code fields, the rest are optional.

The installation program copies the program files, GSD or EDS files and Bitmaps to the PC. Finally the following files are entered in the system Registry.

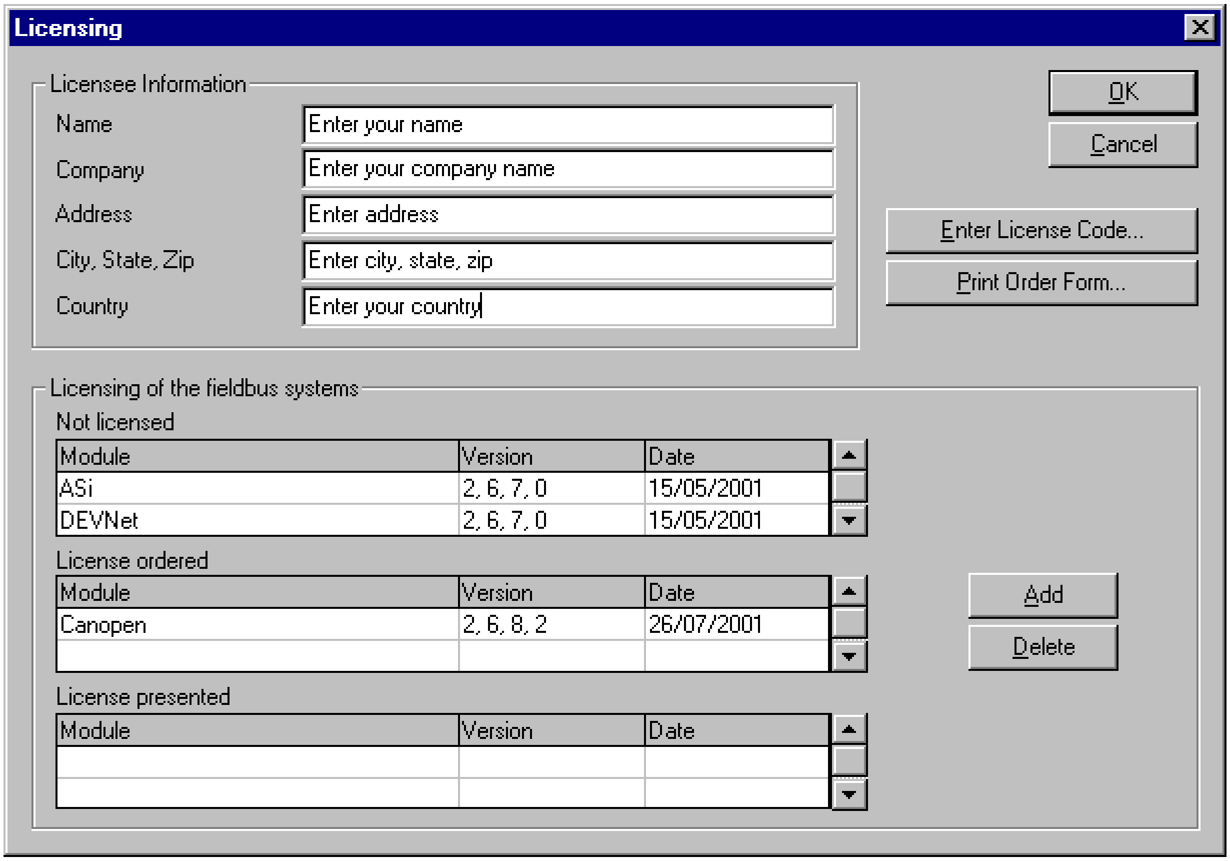
- System DLLs
- The application

2.4 Licensing

This section describes the steps required to license the System Configurator for an already installed basic version of the System Configurator. To license the System Configurator during installation was described above.

Start HsyCon. Select the menu **Help > Licensing**. The licensing window will open. Listed in the table in the middle are the fieldbus modules that were already selected during the installation. If the required fieldbus is not in the table then select it from the upper table by double clicking on it or by select and **Add**. Enter the name and the company name. Select the button **Enter License Code**. The following windows appear. Enter the 16 digits of the license code.

Note: License codes with less than 16 digits can only be entered during the installation. In this case uninstall the System Configurator first and then restart the installation and enter the code. Also the System Configurator (license code with less than 16 digits) expects a license in the device. This will already be in all Horner SmartStack Master and Slave modules.



Licensee Information

Name	Enter your name
Company	Enter your company name
Address	Enter address
City, State, Zip	Enter city, state, zip
Country	Enter your country

Licensing of the fieldbus systems

Not licensed

Module	Version	Date
ASi	2, 6, 7, 0	15/05/2001
DEVNet	2, 6, 7, 0	15/05/2001

License ordered

Module	Version	Date
Canopen	2, 6, 8, 2	26/07/2001

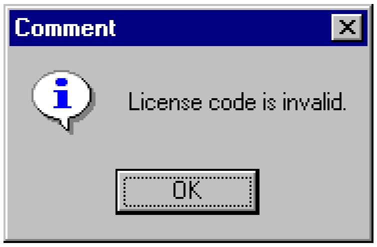
License presented

Module	Version	Date

Figure 3: Enter the License Code

Note: The license code showed above is an invalid license code and is only used for explanation.

Once the license code has been entered select the **OK** button. The code is verified. If the license code is valid HSyCon will display text stating that it requires to be restarted to activate the license. If the license code is invalid the following window appears.



License code is invalid.

Figure 4: Note license code is invalid

In this case check :

- the license code is entered properly (it is case sensitive).

2.5 Scope of functions of the basic version (unlicensed) Fieldbus Modules

The basic version and unlicensed fieldbus modules have the following functionality:

- Full functionality for configuring up to two devices (slaves). For configuration of a Horner SmartStack COM Slave device this is enough.
- All diagnostic functions

- Open and download of an existing configuration file. If the configuration file has more than two devices, a modification of this configuration is not possible.

CHAPTER 3: GETTING STARTED – CONFIGURATION

3.1 Overview of Communication Types

The CANOpen communication protocol supports several different communication objects, Table 2 below shows some of the options supported by the Horner COM/COS SmartStack modules :

Communication

- PDO (CANopen)
- SDO (CANopen)
- Send/Receive Transparent(CAN)

Table 4: Overview of CANopen Communication Types

3.2 Configuration of a SmartStack CANOpen Master PDO Telegram to any CANOpen Slave

The following describes the steps to configure a SmartStack CANOpen Master PDO Telegram to any CANOpen Slave :

	Action	**Menu in the System Configurator**
•	Create a new project	**File > New > CANopen**
•	Copy EDS file of CANopen Node, if Node is not available yet	**File > Copy EDS**
•	Select SmartStack CANopen Master	**Insert > Master**
•	Select CANopen Node and set Node address	**Insert > Node**
•	Set PDO	Left mouse click on the Node, then
•	Set Offset address **(*1)**	**Settings > Node Configuration**
•	Set Bus Parameter	Left mouse click on the Master, then **Settings > Bus Parameter**
•	Set Device Assignment, if no automatic assignment has occurred	Left mouse click on the Master, then **Settings > Device Assignment**
•	Save project	**File > Save**
•	Download	Left mouse click on the Master, then **Online > Download**
•	Live List	Left mouse click on the Master, then **Online > Live List**
•	Start Debugger	Left mouse click on the Master, then **Online > Start Debug Mode**
•	Device Diagnostic	Left mouse click on the Node, then **Online > Device Diagnostic**
•	Stop Debugger	**Online > Stop Debug Mode**
•	Global Diagnostic	Left mouse click on the Master, then **Online > Global State Field**
•	Transfer user data: Send data, Receive data	Left mouse click on the Master, then **Online > I/O Monitor**

Table 3. Configuration of SmartStack CANOpen Master PDO to any CANOpen Slave.

3.3 Configuration of a SmartStack CANOpen Slave to any CANOpen Master

The following table describes the steps to configure a PDO telegram for a SmartStack CANOpen Slave to any CANOpen Master :

Action	**Menu in the System Configurator**
• Create a new project	**File > New > CANopen**
• Select SmartStack CANopen Master **(*1)**	**Insert > Master**
• Select SmartStack CANopen Node and set Node address	**Insert > Node**
• Set Bus Parameter	Left mouse click on the Master, then **Settings > Bus Parameter**
• Set Device Assignment, if no automatic assignment has occurred	Left mouse click on the Node, then **Settings > Device Assignment**
• Save project	**File > Save**
• Download	Left mouse click on the Node, then **Online > Download**
• PDO diagnostic	Left mouse click on the Node, then **Online > Extended Device Diagnostic > COS_TASK PDO Transfer**
• Transfer user data: Send data, Receive data	Left mouse click on the Master, then **Online > I/O Monitor**

Table 4. Configuration of SmartStack CANOpen Slave PDO to any CANOpen Master.

Note: The SmartStack CANopen Node is configured via the CANopen Bus by means of an SDO download from a configuration master. Without a configuration master the SmartStack CANopen Node provides two send and two receive-PDOs with a default mapping for the communication.

Note (*1): Insert a SmartStack CANopen Master to the configuration. It serves as a dummy and does not have to agree with the connected Master.

3.4 Configuration for SDO Communication

The following table describes the steps to configure a Smartstack CANopen Master to any CANopen Node for SDO communication:

	Action	Menu in the System Configurator
•	Create a new project	**File > New > CANopen**
•	Copy EDS file of CANopen Node, if Node is not available yet	**File > Copy EDS**
•	Select SmartStack CANopen Master	**Insert > Master**
•	Select CANopen Node and set Node address	**Insert > Node**
•	Set Bus Parameter	Left mouse click on the Master, then **Settings > Bus Parameter**
•	Set Device Assignment, if no automatic assignment has occurred	Left mouse click on the Master, then **Settings > Device Assignment**
•	Save project	**File > Save**
•	Download	Left mouse click on the Master, then **Online > Download**
•	Live List	Left mouse click on the Master, then **Online > Live List**
•	Transfer user data:	Left mouse click on the Node, then
	Read objects	**Online > Read Objects**
	Write objects	**Online > Write Objects**

Table 5: Smartstack master to slave SDO Configuration steps

Note (*1): If connecting to anything other than a Horner Slave then see the Slave manual for configuration help.

3.5 Configuration of a SmartStack CANopen Node to any CANopen Master (SDO)

The following table describes the steps to configure a SmartStack CANopen Node to any CANopen Master for SDO communication :

	Action	**Menu in the System Configurator**
•	Create a new project	**File > New > CANopen**
•	Select SmartStack CANopen Master **(*1)**	**Insert > Master**
•	Select SmartStack CANopen Node and set Node address	**Insert > Node**
•	Set Bus Parameter	Left mouse click on the Master, then
		Settings > Bus Parameter
•	Set Device Assignment, if no automatic assignment has occurred	Left mouse click on the Node, then **Settings > Device Assignment**
•	Save project	**File > Save**
•	Download	Left mouse click on the Node, then
		Online > Download
•	SDO Diagnostic	Left mouse click on the Node, then
		Online > Extended Device Diagnostic
•	Transfer user data:	Left mouse click on the Node, then
	Read objects	**Online > Message Monitor**
	Write objects	

Table 5: Configuration of a SmartStack CANopen Node to any CANopen Master (SDO)

Note (*1): Insert a SmartStack CANopen Master to the configuration. It serves as a dummy and does not have to agree with the connected Master.

3.6 Configuration of a SmartStack CANopen Master to any CAN Device for Send/Receive transparent (CAN)

The following table describes the steps to configure a Smartstack CANopen Master for send/receive CAN telegrams (Layer 2) transparently:

Action	Menu in the System Configurator
• Create a new project	**File > New > CANopen**
• Select Smartstack CANopen Master	**Insert > Master**
• Set Bus Parameter	Left mouse click on the Master, then **Settings > Bus Parameter**
• Set Device Assignment for the Master, if no automatic assignment has occurred	Left mouse click on the Master, then **Settings > Device Assignment**
• Save project	**File > Save**
• Download on the Master	Left mouse click on the Master, then **Online > Download**
• Transfer user data: Send CAN Telegrams Receive CAN Telegrams **(*1)**	Left mouse click on the Master, then **Online > Message Monitor**

Table 6 : **Configuration of a SmartStack CANopen Master to any CAN Device.**

Note (*1): The CAN Telegram receive Identifiers are activated per message.

3.7 Configuration of a SmartStack CANopen Node to any CAN Device for Send/Receive transparent (CAN)

The following table describes the steps to configure a SmartStack CANopen Node for send/receive CAN telegrams (Layer 2) transparently:

	Action	**Menu in the System Configurator**
•	Create a new project	**File > New > CANopen**
•	Select Smartstack CANopen Master **(*1)**	**Insert > Master**
•	Select SmartStack CANopen Node	**Insert > Node**
•	Set Bus Parameter	Left mouse click on the Master, then **Settings > Bus Parameter**
•	Set Device Assignment for the Node, if no automatic assignment has occurred	Left mouse click on the Node, then **Settings > Device Assignment**
•	Save project	**File > Save**
•	Download on the Node	Left mouse click on the Node, then **Online > Download**
•	Transfer user data: Send CAN Telegrams Receive CAN Telegrams	Left mouse click on the Node, then **Online > Message Monitor**

Table 9: Configuration of a Smartstack node for transparent mode.

Note (*1): Insert a Smartstack CANopen Master to the configuration. It serves as a dummy and need not agree with the connected Master.

Signal	LED Colour	State	Definition
RDY	Yellow	On	COM Ready
		Cyclical flashing	Bootstrap loader active
		Non cyclical flashing	Hardware or system error.
		Off	Hardware error.
RUN	Green	On	Communication running.
		Non cyclical flashing	Parameter error.
		Off	Communications stopped.
ERR	Red	On	Error on communications line.
		Off	No error.
STA	Yellow	On	
		Off	

CHAPTER 4: CONFIGURATION OF CANOPEN WITH HSYCON

4.1 Setting up the CANOpen Configuration

To create a new configuration, choose the **File > New** menu. This offers a selection list of fieldbus systems. Select **CANopen**. If only the CANopen fieldbus system is installed, the configuration window will open directly. The name of the configuration file can be allocated when the configuration is finished or with **File > Save As**.

4.2 EDS files

Each CANopen device manufacturer defines the CANopen characteristics of its device in a so called Electronic Data Sheet, (EDS file). This description files form the basis of the configuration.

Devices	EDS files
Horner devices	The EDS files for Horner devices are already included in the delivery of the System Configurator HSyCon.
Devices from other manufacturers	For other devices these have to be delivered by the device manufacturer.

Table 5: EDS files - Source of Supply

During startup the System Configurator automatically reads in all the EDS files that are in the EDS directory. This puts the device names in an internal list. The device-specific data is read directly from the EDS file during configuration.
If a CANopen Node (Slave) is needed, which does not appear in the selection list, then the appropriate EDS file can be copied to the EDS directory with the menu **File > Copy EDS**. Another method is to copy the EDS file into the SyCon EDS directory with Windows Explorer and then read the EDS files in the EDS directory with the menu **Settings > Path**.

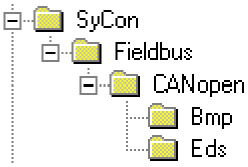


Figure 5: EDS files and bitmaps directory

The EDS path is selectable. The standard setting can be changed with the menu **Settings > Path**.

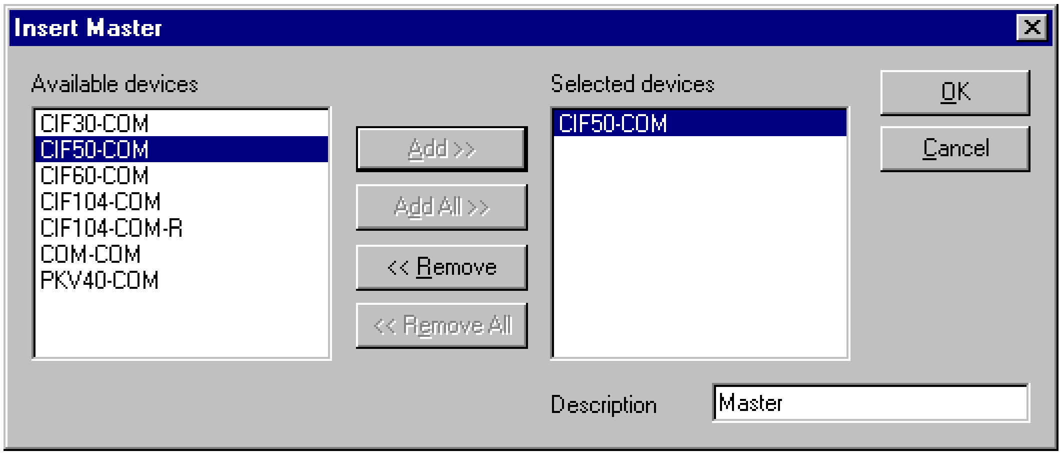
4.3 Insert Master

To insert a Smartstack Master in the configuration, choose the **Insert > Master** menu. Open the selection window, or click on the symbol:

Insert > Master

Figure 6: Insert > Master Symbol

A window appears where one master device can be selected.



Available devices: CIF30-COM, CIF50-COM, CIF60-COM, CIF104-COM, CIF104-COM-R, COM-COM, PKV40-COM

Selected devices: CIF50-COM

Description: Master

Figure 11: Insert > Master

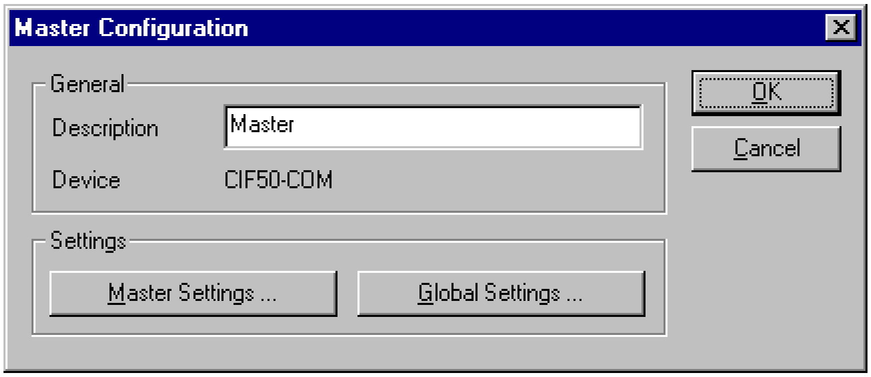
For the Horner Smartstack CanOpen Master select COM-COM.

In this window select the required Master by clicking on it in the **Available devices** list and then click the **Add** button or double click to put the Master in the **Selected devices** list. Confirm the selection with **OK** and the Master will be inserted.

This example shows a CIF 50-COM with the **Description** Master. The description may be changed by typing in this field.

4.4 Master Configuration

The Master specific configuration is carried out in the following window and subwindow.
Set the focus on the Master (left mouse click) and then select the **Settings > Master Configuration** menu or double clicking on the symbol of the Master to be configured will open the following window:



Description: Master

Device: CIF50-COM

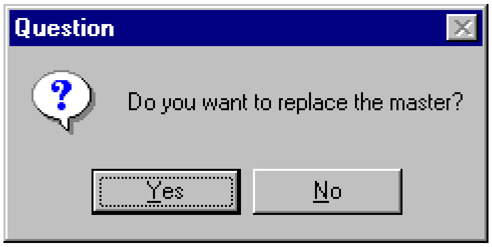
Figure 7: Settings > Master Configuration

The following can be set in this Master Configuration window:

- A (symbolic) **Description** of the Master
- The window **Master Settings** can be opened
- The window **Global Settings** can be opened

4.5 Replace Master

If a Master already exists in the configuration and should be replaced for another Master, first set the focus on the Master (left mouse click) and then select the menu **Edit > Replace**. Or right mouse click on the Master and select **Replace** in the window that appears:

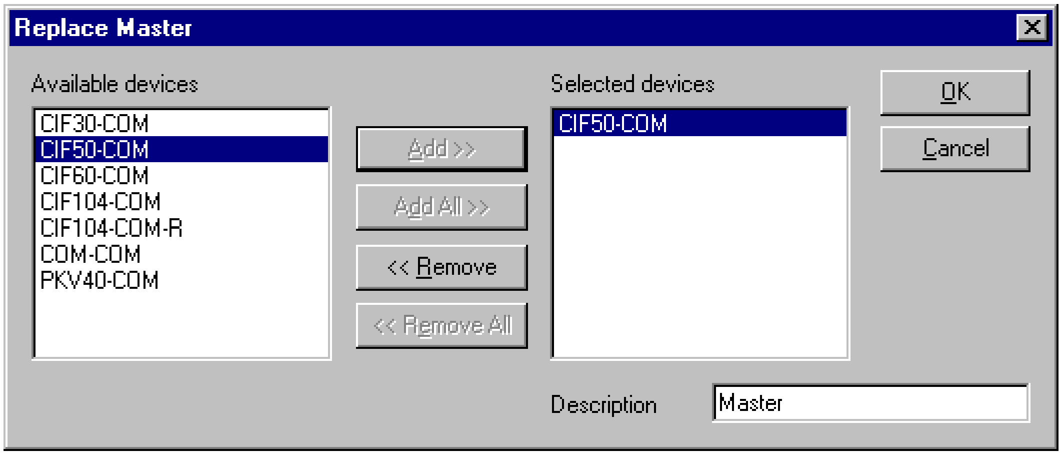


Question

Do you want to replace the master?

Figure 8: Security question Replace Master

If **Yes** is selected a new window opens, where the existing Master may be replaced with the required Master.



Replace Master

Available devices

CIF30-COM
CIF50-COM
CIF60-COM
CIF104-COM
CIF104-COM-R
COM-COM
PKV40-COM

Selected devices

CIF50-COM

Description: Master

Figure 9: Edit > Replace Master

In this window select the Master required by clicking on it. By clicking the **Add** button this Master is shown in the first position of the **Selected devices** list. With **OK** confirm the selection and the Master will be replaced.

4.6 Insert Node

To insert a CANopen Node in the configuration, select the **Insert > Node** menu to open the selection window, or click on the symbol:

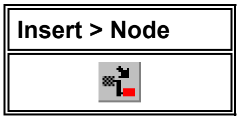


Figure 10: Insert > Node

The mouse cursor changes automatically to the insert Node cursor. Click on the required position to insert the new Node. A dialogue box appears where one or more Nodes may be selected for insertion.

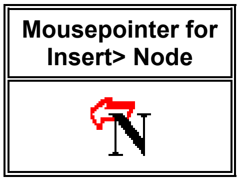
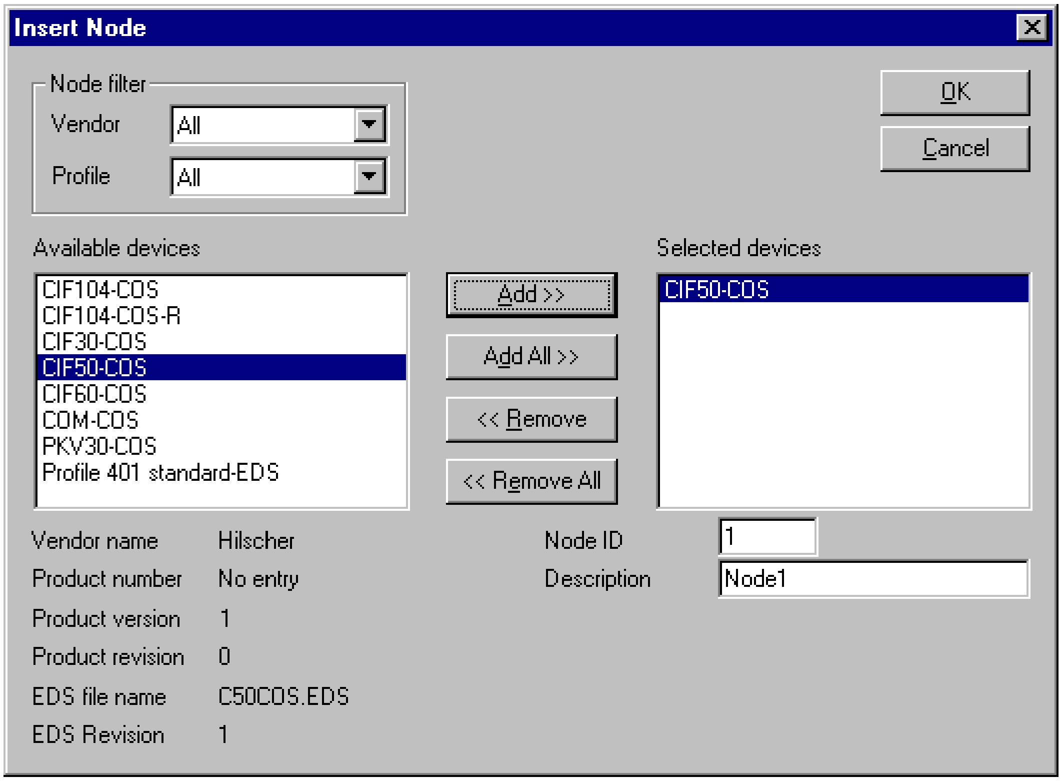


Figure 11: Mousepointer for Insert > Node



Insert Node

Node filter

Vendor: All

Profile: All

Available devices

- CIF104-COS
- CIF104-COS-R
- CIF30-COS
- CIF50-COS
- CIF60-COS
- COM-COS
- PKV30-COS
- Profile 401 standard-EDS

Selected devices

- CIF50-COS

Vendor name	Hilscher
Product number	No entry
Product version	1
Product revision	0
EDS file name	C50COS.EDS
EDS Revision	1

Node ID: 1

Description: Node1

Figure 12: Insert > Node

The left list shows all the Node devices that are present in the EDS directory. A filter can be used to limit the selection list via the **Vendor** and the **Profile**. If a Node is selected then some additional information about the Node is shown below the list box.

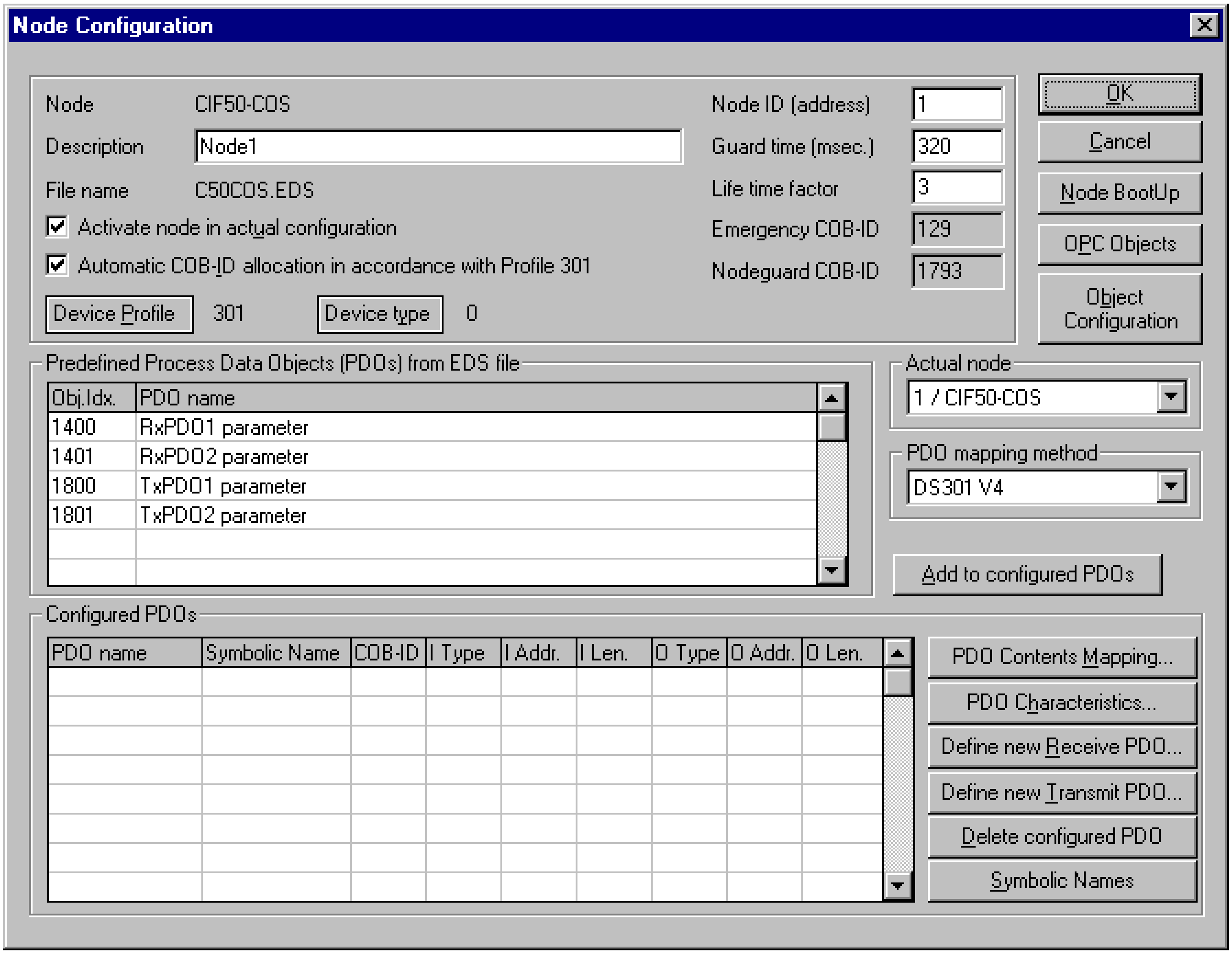
Double click or with the **Add** button, the selected Node appears in the **Selected devices** list. When a new Node is chosen HSyCon always looks for the next free Node ID value and proposes it. By selecting each Node the ID may be changed and it may be assigned a short description in the **Description** field which will accept up to 32 characters of text.
It is possible to configure an available Node multiple times with different **Node IDs**. In CANopen the Node address is called Node ID. The Node ID distinguishes the different Nodes from each other in the network. It's a unique number that must not be assigned twice. Therefore the entry in the field **Node ID** must be equivalent to the real Node ID itself, otherwise the master will not be able to communicate with the Node later when it tries to establish communication.

4.7 Node Configuration

Left mouse click on the Node symbol and select the menu **Settings > Node Configuration**. Or double click on the CANopen Node to open the Node Configuration window.
The Node specific configuration is carried out in this window. Here the PDO (Process Data Objects) and their addresses in the process data image are assigned in the Smartstack Master. Please note, that the addresses have to agree with the addresses in the PC application program.

Note 1 (Hilscher Master): The information about the Offset addresses relate to the addressing of the data in the Master! The addresses don't relate to the addressing of the data in the Node. The Node organizes its data addressing itself.

Note 2 (Hilscher Node): In case of a Hilscher Node (Slave) the In and Output bus data is taken directly to and from the Dual-port memory. The Offset addresses relate to the Master.



Node Configuration

Node	CIF50-COS	Node ID (address)	1
Description	Node1	Guard time (msec.)	320
File name	C50COS.EDS	Life time factor	3
		Emergency COB-ID	129
		Nodeguard COB-ID	1793

☑ Activate node in actual configuration

☑ Automatic COB-ID allocation in accordance with Profile 301

Device Profile 301 Device type 0

Predefined Process Data Objects (PDOs) from EDS file

Obj.Idx.	PDO name
1400	RxPDO1 parameter
1401	RxPDO2 parameter
1800	TxPDO1 parameter
1801	TxPDO2 parameter

Actual node: 1 / CIF50-COS

PDO mapping method: DS301 V4

Configured PDOs

PDO name	Symbolic Name	COB-ID	I Type	I Addr.	I Len.	O Type	O Addr.	O Len.

Figure 13: Settings > Node Configuration

The following table shows the fields and elements of the Node Configuration window.

- **Node -** The EDS file device name is shown in this field.
- **Description -** contains a symbolic name for the Node.
- **File name -** EDS file name.

- **Activate Node in actual configuration –** Reserves process memory in the Master for this Node and the Master makes a data exchange on the bus to this Node. If this setting is deactivated, the Master reserves memory in the process data image for the Node, but no data exchange to this takes place.
- **Automatic COB-ID allocation in accordance with Profile 301 –** Active in the basic setting. The COB-ID is preset for a PDO depending upon the Node address and the PDO used. If this field is deactivated, manual assignment of the COB-ID may be made. In order to reduce configuration effort for simple networks a mandatory default identifier allocation scheme is defined, which is described later. These identifiers are available in the Pre-operational state of a Node which works in accordance with the Communication Profile 301 directly after initialization. These pre-defined connection sets are used by HSyCon if automatic allocation is enabled. Then the COB-IDs in the already configured PDO COB-ID column are not editable. If the automatic allocation is disabled the COB-IDs may be edited in the range from 0 –2047.

Note: If the Automatic COB-ID allocation in accordance with Profile 301 is deactivated, HSyCon does not check if a COB-ID was assigned more than once. The user must verify this before downloading the configuration.

- **Device Profile and Device Type –** Using the information of the Device Profile and the Device Type the Master can read out the Object 1000H from the Node and compare it with this information when it starts communication. If the Device Profile and the Device Type do not agree the Master reports a parameterization error. Further information about the Device Profile and the Device Type may be found in the section *Device Profile and Device Type*.
- **NodeID –** The NodeID (address) is necessary for the addressing of the device on the bus and must be unique. The COB-Id is determined from the NodeID.
- **Guard time –** The Guard time is the supervision time of the Master related to the Node. Further information about the Guard Time may be found in the section ***Node supervision - Nodeguarding and*** Lifeguarding.
- **Life time factor –** The Life time factor is information for the Node for the supervision of the Master. Further information about the Life time factor may be found in the section ***Node supervision - Nodeguarding and*** Lifeguarding
- **Emergency COB-ID –** Information about the COB-ID of the Emergency telegram.
- **Nodeguard COB-ID -** Information about the COB-ID of the Nodeguard telegram.
- **OK -** Close the Node Configuration window and to accept the settings.
- **Cancel -** Close the Node Configuration window and reject the settings.
- **Node BootUp -** The NodeBootUp defines the start up behaviour of the Master with regard to each individual Node and is described in section ***Node BootUp***
- **OPC Objects -** Information in the OPC Objects field relate to the symbols of the OPC server and the SDO communication. Further information may be found in the manual for the OPC server.
- **Object Configuration -** The object directory may be read from the EDS file and if necessary added to the Node configuration.
- **Actual Node –** Allows Changes to the Node configuration of another Node without leaving the window.
- **PDO mapping method -** Defines the procedure of the PDO mapping. Selection may be made between DS301 V3 and DS301 V4. The difference between the methods are described.

- **Predefined Process Data Objects (PDOs) from the EDS file -** Shows the list of the PDOs which are given in the EDS file and which may be used in the configuration. Further information may be found in the section *Process Data Configuration - Selection of PDO.*
- **Configured PDOs –** Shows the PDOs which are used for the data exchange between Master and Node. As well as the Offsets in the process data image the length of the PDO's is indicated. Further information may be found in the section *Process Data Configuration - Selection of PDO.*
- **Add to configured PDOs –** Allows addition of a configured PDO to the **Configured PDO** list.
- **PDO Contents Mapping –** With a PDO in the **Configured PDOs** list selected. Double click or click on the **PDO Contents Mapping** button and the PDO transferred user data is shown, the combination may be changed if necessary.
- **PDO Characteristics –** Shows the transmission settings of the PDO. These may be adjusted if necessary.
- **Define new Receive PDO –** Allows a new Receive PDO to be added to the **Configured PDOs** list. This is described in the section *Creating Receive PDOs.*
- **Define new Transmit PDO -** Allows a new Transmit PDO to be added to the **Configured PDOs** list. This is described in the section *Creating Transmit PDOs*
- Delete configured PDO – Allows the deletion of a Configured PDO from the configured PDO list.
- **Symbolic Names –** Relates to the symbols for the OPC server, for further information see the OPC server manual.

4.8 Overview of Node Configuration

For the Node Configuration to transfer PDO data the following typical steps must be made.

Configuration step	Description
• Device Profile and Device Type	Set or take over the value which is read from the EDS file.
• Process Data Configuration	Select the PDO.
• Process Data Configuration	Set the PDO transmission characteristics.
• PDO Mapping	Take over the basic setting or adjust the PDO combination.
• Node Bootup	Set startup behaviour.
• Node supervision	Set Nodeguarding and/or Lifeguarding.

Table 6: Overview of Node Configuration

4.9 Device Profile and Device Type

Each CANopen Node has a mantatory Object 1000H, which must exist in the object directory. This object is named Device Type. The Device Type also includes information about the Device Profile. The Master reads the Object 1000H from the Node when starting up the CANopen bus and compares the entries, which are made in the two available fields **Device Profile** and **Device Type**. If the Device Profile and the Device Type do not agree, the Master reports a parameterization error and does not establish a process data transfer to the Node. To get the real values of the Node, use the online function **Online > Read Object** or click on the Node in Debug mode.

4.10 Process Data Configuration - Selection of PDO

The process data is transmitted via process data objects(PDOs), and assigned to the process data image. CANopen distinguishes between receive and send PDOs.

Receive PDOs	**Send PDOs**
Data from the Master to the Node	Data from the Node (Slave) to the Master
Output data is processed by the Node.	Input data is generated by the Node (Slave).

Table 7: PDO - Send and Receive PDO

The data of the Node in the process data image of the Master are serviced for the application with the configuration of the PDOs. The configuration window contains two tables. The upper table **Predefined Process Data Objects (PDOs) from EDS file** shows all configurable PDOs, which are predefined in the EDS file of the device. By double clicking on a table entry or via the **Add to configured PDOs** button the entry is taken over to the **Configured PDOs** table. The columns of the **Configured PDOs** table have the following meaning:

- **PDO name –** The Rx and Tx PDO parameters are shown.
- **Symbolic Name -** Here the symbolic name, which is used in case of OPC communication, is given. PDO_1400 and PDO_1800 and continuous names are used as pre-set value. This may be overwritten by the user.
- **COB-ID -** In this column the CAN telegram identifier is shown. In the case of manual assignment the telegram identifier of the CAN telegram which is transmitted with the PDO may be edited in the range from 0 to 2047.
- I Type and O Type – The specification IB stands for Input Byte and QB for Output Byte.
- I Addr. and O Addr – The **I Addr.** (Input Address) and the **O Addr.** (Output Address) define the address of the PDO data in the process data image, which is held in the Dual-port memory of the Master. The range can be between 0 and 3583. The number of data bytes is shown under **I Number** and **O Number**. The addresses may be assigned automatically by SyCon or manually by the user. This is set in the menu **Settings > Global Settings** in the field **Process Data Auto Addressing**, which is described in the section ***Global Settings***. A screening for double addresses takes place before the Download of Configuration and when the window **Address Table** is opened.
- I Len. and O Len - Gives the length of the PDO in bytes and can be a max of eight. If the value 0 is shown, the PDO does not include user data. The user data for this PDO may be set by the PDO Mapping menu.

4.11 PDO Communication Parameter (PDO Characteristic)

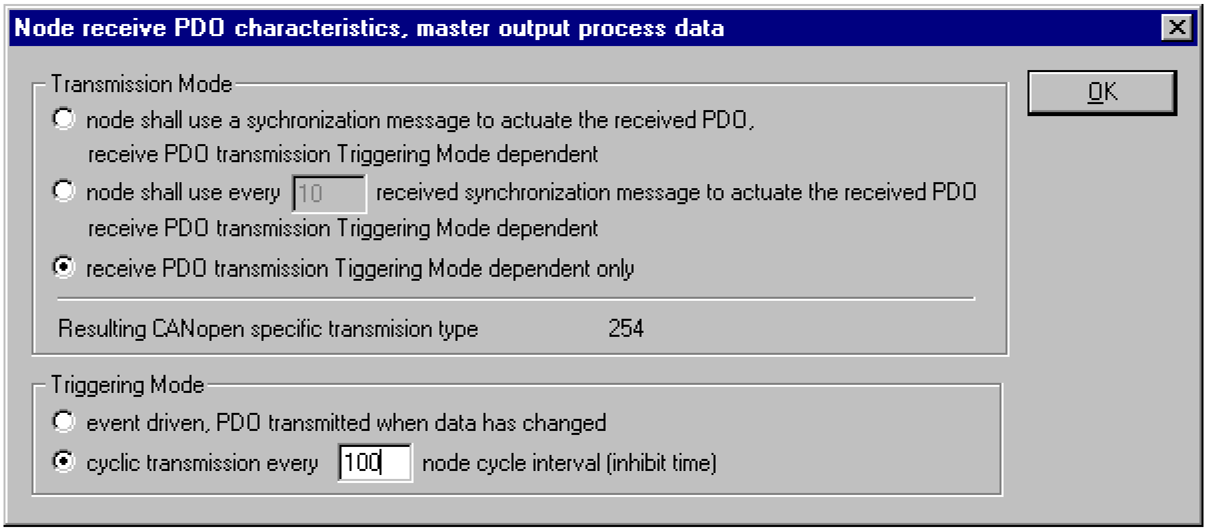
Before a chosen PDO is moved into the lower window, the **PDO characteristics** window is opened automatically. A PDO in CANopen can be configured such that it is transmitted in Event Driven mode or Cyclic Transmission. Both kinds of transmission types can be synchronised to a special sychronization message which is sent by the master in defined time intervals. Because of the different behaviour of a transmit and receive PDO, two different windows will be open during the PDO insertion. The different transmissions are distinguished in the so-called **Transmission type** value.

Synchronous means that the transmission of the PDO shall be related to the SYNC message that is sent cyclically by the Master. Preferably the Nodes use the SYNC message as a trigger to output or actuate based on the previous synchronous Receive-PDO respectively to update the data transmitted at the following synchronous Transmit-PDO. Details of this mechanism depend on the device type and are defined in the device profile.

Asynchronous means that the transmission of the PDO is not related to the SYNC message and can happen at any time.

4.12 Receive PDO characteristics

Receive PDO are output data of the Master and are received by the Node.



Node receive PDO characteristics, master output process data

Transmission Mode

○ node shall use a sychronization message to actuate the received PDO,
receive PDO transmission Triggering Mode dependent

○ node shall use every 10 received synchronization message to actuate the received PDO
receive PDO transmission Triggering Mode dependent

● receive PDO transmission Triggering Mode dependent only

Resulting CANopen specific transmision type 254

Triggering Mode

○ event driven, PDO transmitted when data has changed

● cyclic transmission every 100 node cycle interval (inhibit time)

Figure 14: Receive PDO Parameter

Transmission Type	cycl.	acycl.	syn-chronous	asyn-chronous	RTR	Description
0		•	•			The telegram is transferred related to the SYNC, but not periodically.
1..240	•		•			A value between 1 and 240 means that the PDO is transferred synchronously and periodically and that the value of the type of transmission shows the number of SYNC telegrams between the two transferring PDOs.
241..251			res.			reserved
254				•		Type of transmission 254 means that the application event is manufacturer dependent.

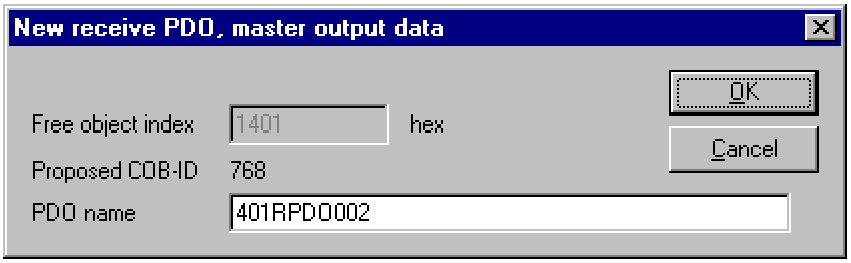
Table 8: PDO Communication Parameter > Transmission Types (Receive PDO)

The event control selection menu has two way to configure a Receive PDO for its transmission event.

- Event-controlled, which configures the Master in such a way that the Master sends the Receive PDO only if data has changed. This kind of the event control keeps the bus load low.
- Cyclic transmission. Where the time is indicated in Node cycle intervals. A Node cycle interval is the time the Master needs to test all configured PDOs in their states and to process them once. The smallest cycle interval is about 300µsec.

4.13 Creating Receive PDOs

If further PDOs shall be used, which are not predefined in the table **Predefined Process Data Objects (PDOs) from EDS file**, then they can be added with the function **Define new Receive PDO**.



New receive PDO, master output data

Free object index 1401 hex

Proposed COB-ID 768

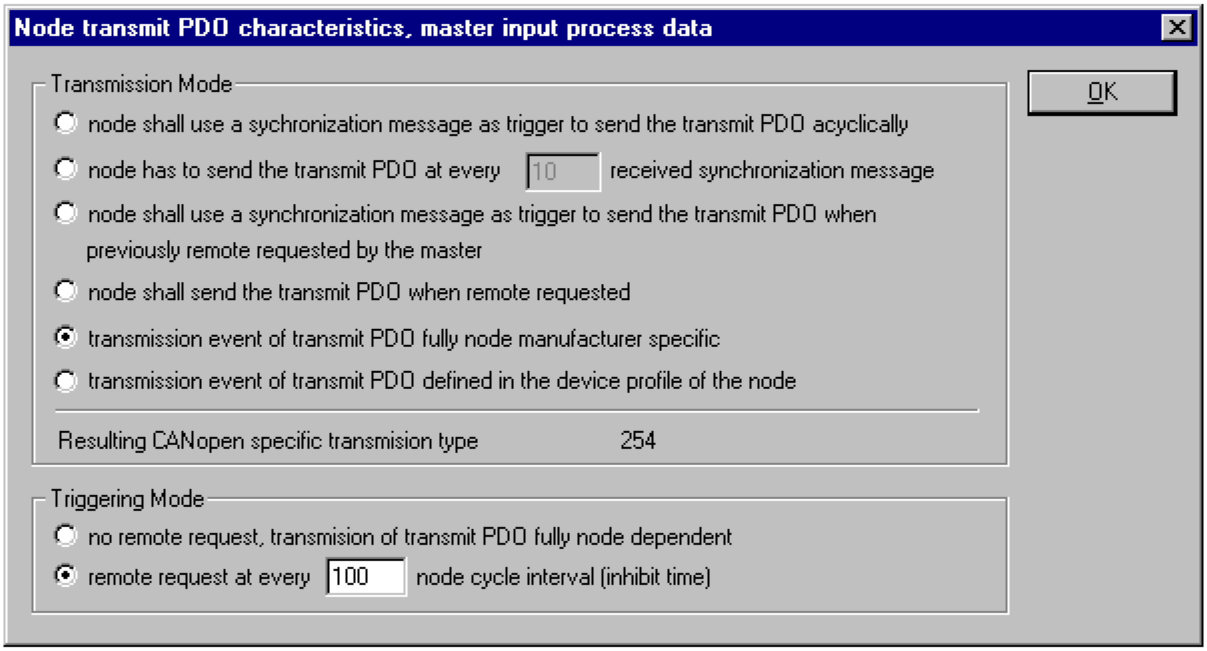
PDO name 401RPDO002

Figure 15: Definite a new receive PDO

HSyCon suggests a free message number, which can be edited later in the PDO configuration window, if the PDO was taken over.

4.14 Transmit PDO characteristics

Transmit PDOs are input data tot he Master and they are sent by the Node.



Node transmit PDO characteristics, master input process data

Transmission Mode

○ node shall use a sychronization message as trigger to send the transmit PDO acyclically

○ node has to send the transmit PDO at every 10 received synchronization message

○ node shall use a synchronization message as trigger to send the transmit PDO when previously remote requested by the master

○ node shall send the transmit PDO when remote requested

● transmission event of transmit PDO fully node manufacturer specific

○ transmission event of transmit PDO defined in the device profile of the node

Resulting CANopen specific transmision type 254

Triggering Mode

○ no remote request, transmision of transmit PDO fully node dependent

● remote request at every 100 node cycle interval (inhibit time)

Figure 16: Transmit PDO Parameter

Transmission Type	cycl.	acycl.	syn-chronous	asyn-chronous	RTR	Description
0		X	X			The telegram is transferred related to the SYNC, but not periodically.
1..240	X		X			A value between 1 and 240 means that the PDO is transferred synchronously and periodically and that the value of the type of transmission indicates the number of SYNC telegrams between the two transferring PDOs.
241..251			res.			reserved
252			X		X	The transmission types 252 and 253 mean that the PDO is an event without immediate notification and it is only transferred with remote transmission requirement. With the type of transmission 252 the data are immediately updated after receiving the SYNC Telegram (however not sent).
253				X	X	The transmission types 252 and 253 mean that the PDO is an event without immediate notification and it is only transferred with remote transmission requirement. With the type of transmission 253 the data are immediately updated after receiving the SYNC Telegram
254				X		The Transmission type 254 means that the application event is manufacturer dependent.
255				X		The Transmission type 255 means that the application event is defined in the respectively supported equipment profile. The exact transmission mode whether cyclically, event-controlled etc. can reread there.

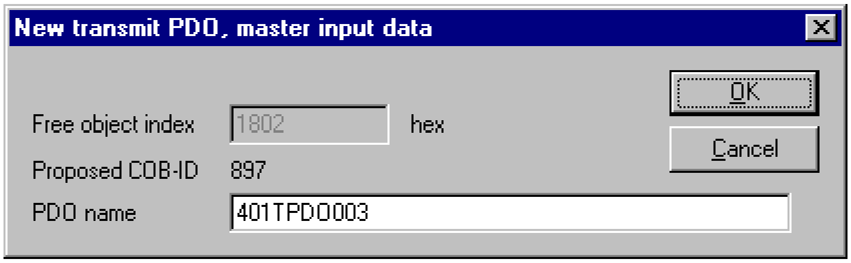
Table 9: PDO Communication Parameter > Transmission Types (Transmit PDO)

The event control selection menu has to two ways to configure a transmit PDO for its transmission event.

- No remote request. The Master behaves completely passively to the PDO and is programmed only for receiving. When the PDO is received is completely Node dependent here.
- Remote request. Here the Master sends Remote-Telegrams in settable Node cycle intervals, which instructs the Node to send its Transmit PDO to the Master upon receiving it.

4.15 Creating Transmit PDOs

If further PDOs shall be used, which are not predefined in the table **Predefined Process Data Objects (PDOs) from EDS file**, this can be done with the function **Define new Transmit PDO**.



New transmit PDO, master input data

Free object index 1802 hex

Proposed COB-ID 897

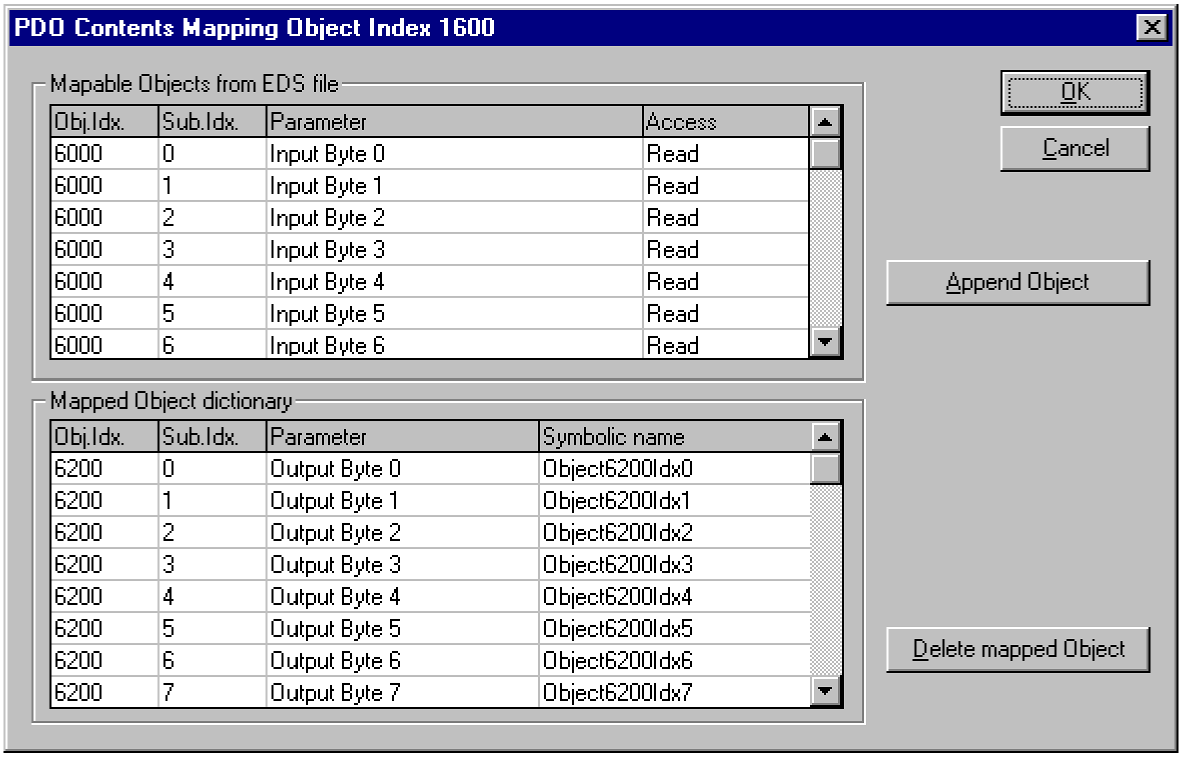
PDO name 401TPDO003

Figure 17: Definite a new Transmit PDO

HSyCon suggests a free message number, which can be edited later in the PDO configuration window, if the PDO was taken over.

4.16 PDO Contents Mapping - Arrange a PDO

Some CANopen Nodes support PDO data mapping and dynamic distribution. This allows the user to define the mapping of objects into a PDO. The mapping itself is always done by the Node internally after is has received new RX-PDO or has to send new TX-PDO, so that the master can handle the input and output PDOs from the Node completely transparently. This guarantees high speed data transfer and execution in the view of the master. The Node’s mapping dictionary is only configured once during its configuration phase.
A PDO can contain up to 8 bytes of process data. The combination of these individual process data elements can be changed when the button **Append Object** is used. When a PDO was transferred from the upper table to the **Configured PDOs** table, HSyCon automatically maps all found mappable process data from the Nodes EDS file into this PDO.



PDO Contents Mapping Object Index 1600

Mapable Objects from EDS file

Obj.Idx.	Sub.Idx.	Parameter	Access
6000	0	Input Byte 0	Read
6000	1	Input Byte 1	Read
6000	2	Input Byte 2	Read
6000	3	Input Byte 3	Read
6000	4	Input Byte 4	Read
6000	5	Input Byte 5	Read
6000	6	Input Byte 6	Read

Mapped Object dictionary

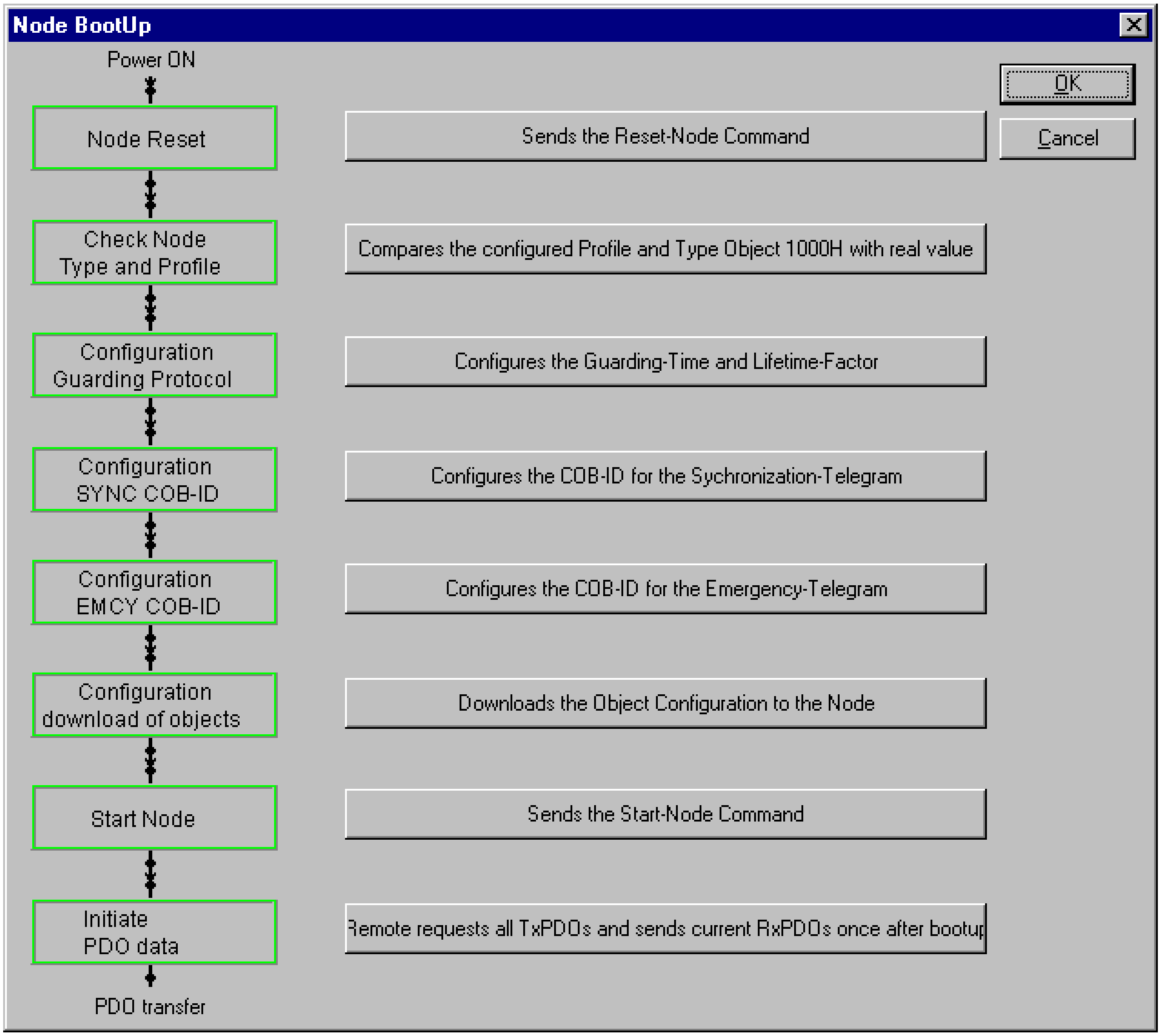
Obj.Idx.	Sub.Idx.	Parameter	Symbolic name
6200	0	Output Byte 0	Object6200Idx0
6200	1	Output Byte 1	Object6200Idx1
6200	2	Output Byte 2	Object6200Idx2
6200	3	Output Byte 3	Object6200Idx3
6200	4	Output Byte 4	Object6200Idx4
6200	5	Output Byte 5	Object6200Idx5
6200	6	Output Byte 6	Object6200Idx6
6200	7	Output Byte 7	Object6200Idx7

Figure 18: PDO Contents Mapping

The picture above is an example for a TX-PDO mapping. The upper table shows all available objects with their access rights which are declared in the node’s EDS file. A double click on one of these transfers it into the lower table. This table contains the real mapped objects that shall be the content of the PDO later in the process data exchange phase.
Note: Not all CANopen Nodes supports the PDO mapping feature!

4.17 Node BootUp

The Node BootUp defines the network startup behaviour of the Master to get a Node operative. There are different states a Master can run through per Node. Each state is configurable and can be enabled (activated) or disabled (deactivated) here. In the basic setting all states are activated.



Node Reset — Sends the Reset-Node Command

Check Node Type and Profile — Compares the configured Profile and Type Object 1000H with real value

Configuration Guarding Protocol — Configures the Guarding-Time and Lifetime-Factor

Configuration SYNC COB-ID — Configures the COB-ID for the Sychronization-Telegram

Configuration EMCY COB-ID — Configures the COB-ID for the Emergency-Telegram

Configuration download of objects — Downloads the Object Configuration to the Node

Start Node — Sends the Start-Node Command

Initiate PDO data — Remote requests all TxPDOs and sends current RxPDOs once after bootup

Figure 19: Online > Node Configuration > Node BootUp

Node Reset - If enabled, the master sends the CANopen specific Node Reset Communication command.

Check Node Type and Profile - If enabled, the master will compare the contents of the mandatory Node Object 1000H (device type) with the values configured within HSyCon. If the values are different, the master will report a parameterisation error.

Configuration Guarding Protocol - A CANopen Master has two specific registers responsible for the Node guarding protocol. If the item is enabled, the master will write the Guard Time and Life-Time factor of the Node configuration into the corresponding objects of the Node during startup.

Configuration SYNC COB-ID - If the item is enabled, the master will write the SYNC COB-ID of the configuration into the corresponding objects of the Node during startup.

Configuration EMCY COB-ID - If the item is enabled, the master will write the EMCY COB-ID of the configuration into the corresponding objects of the Node during startup.

Configuration download of objects - To get a PDO communication to a Node working, the master has to send all relevant configuration objects to the Node. For example the mapping table, the COB-ID a PDO shall be sent through are covered here. If enabled, all these parameters and also the user specific objects which are added manually in the Node object configuration window are written down to the Node by the master.

Start Node - To reach the operational state in CANopen a Node has to get the CANopen specific Start Node command. If enabled, the master will send the Start Node command to the Node at the end of the boot-up procedure.

Initiate PDO data - This item selects if the installed PDOs shall be automatically written and read by the master directly after the startup. This ensures that the latest data is exchanged between the Master and Slave.

4.18 Node supervision - Nodeguarding and Lifeguarding

The **Guard time** and **Life time factor** settings serve the supervision of the Node and the supervision of the Master in the view of the Node. Once communication is established to the Node, the Master will poll the Node in **Guard time** multiplied by **Life time factor** time intervals with special guard telegrams to check if it is still present in the network or not. The Node supervises if the Master has done a guard polling during the configured time interval to check if the Master is still present. If one of these values is configured to **0**, then the supervision is disabled in the Master as well as in the Node. The Node itself will start with the Node guarding when the first remote-transmit-request from the Master for its guarding identifier is received. The Master will start the Node guarding after it has initialized all the communication objects necessary for the Node. If the Node guarding fails during runtime, the Master will reset the communication to the specific Node and restarts its initialization.

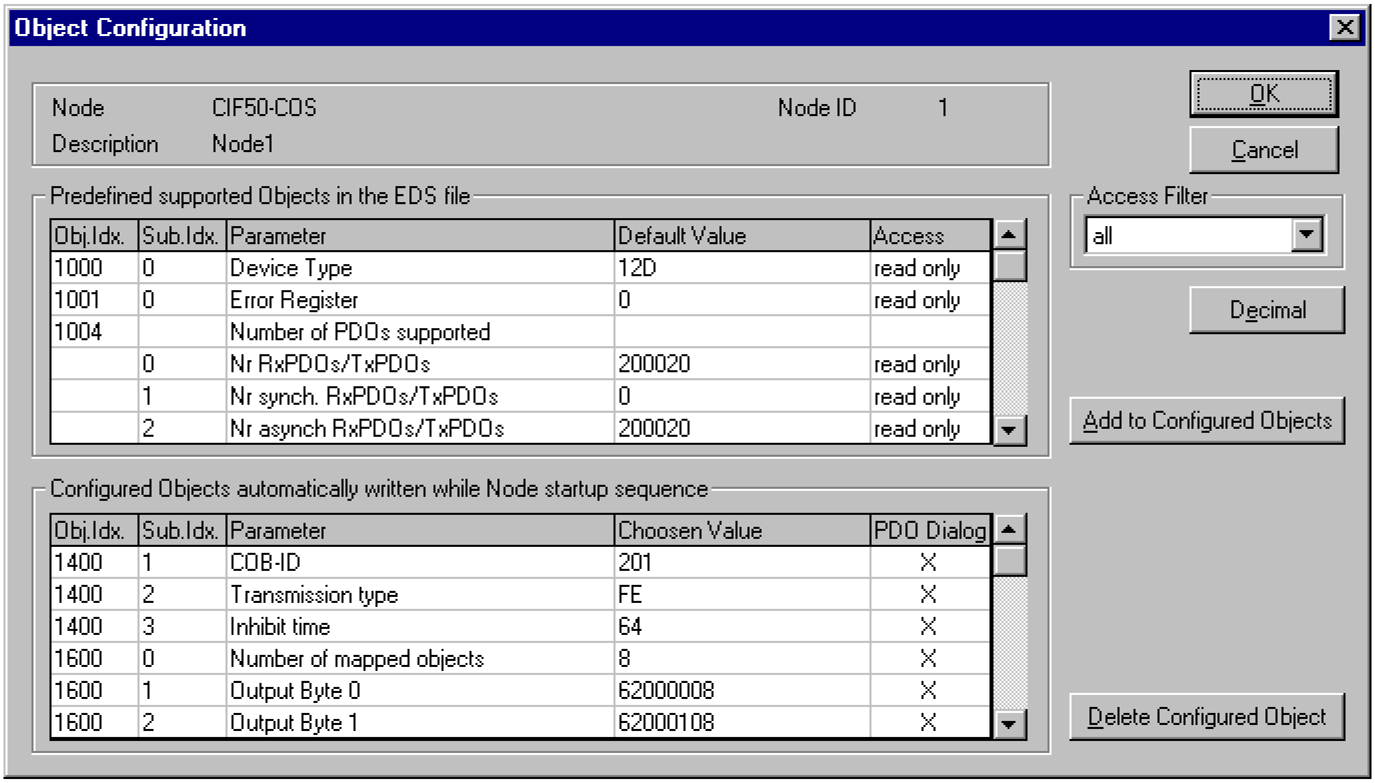
Note: If the Node does not support the Nodeguarding, the Master cannot recognize that the Node failed.

4.19 Object Configuration

The most important part of a CANopen device is its object directory. The object directory is essentially a grouping of objects accessible via the network in an ordered predefined fashion. Each object within the directory is addressed using a 16-bit index. The Device profiles of CANopen define the name, the meaning, the value range and data type of the Service Data Objects (SDO). With Service Data Messages the contents of an object and its subindex can be changed. This is necessary to set up the behaviour of a CANopen Node in the required manner.

To get access to the SDO configuration press the **Object Configuration** button. The window shown below will appear and shows all supported objects read from the EDS file of the Node in the upper table. If some PDOs have already been inserted they will be shown in the lower table too.

HSyCon places some objects in this table automatically when a PDO in the **Node Configuration** window is inserted. These values can not be edited.



Node CIF50-COS Node ID 1
Description Node1

Predefined supported Objects in the EDS file

Obj.Idx.	Sub.Idx.	Parameter	Default Value	Access
1000	0	Device Type	12D	read only
1001	0	Error Register	0	read only
1004		Number of PDOs supported		
	0	Nr RxPDOs/TxPDOs	200020	read only
	1	Nr synch. RxPDOs/TxPDOs	0	read only
	2	Nr asynch RxPDOs/TxPDOs	200020	read only

Access Filter: all

Configured Objects automatically written while Node startup sequence

Obj.Idx.	Sub.Idx.	Parameter	Choosen Value	PDO Dialog
1400	1	COB-ID	201	X
1400	2	Transmission type	FE	X
1400	3	Inhibit time	64	X
1600	0	Number of mapped objects	8	X
1600	1	Output Byte 0	62000008	X
1600	2	Output Byte 1	62000108	X

Figure 20: Online > Node Configuration > Object Configuration

4.20 OPC Objects

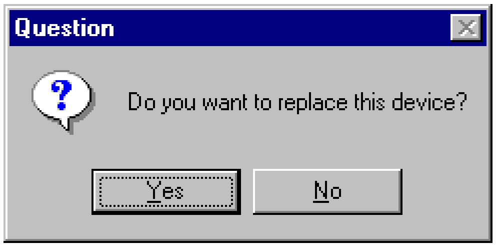
Symbols for the OPC communication can be entered via SDO telegrams from this window. Objects may be selected from the list provided. Further information may be found in the OPC Server manual.

4.21 OPC User Defined Objects

Symbols for the OPC communication can be entered via SDO telegrams from this window. Objects can be entered by the user. Further information may be found in the OPC Server manual.

4.22 Replace Node

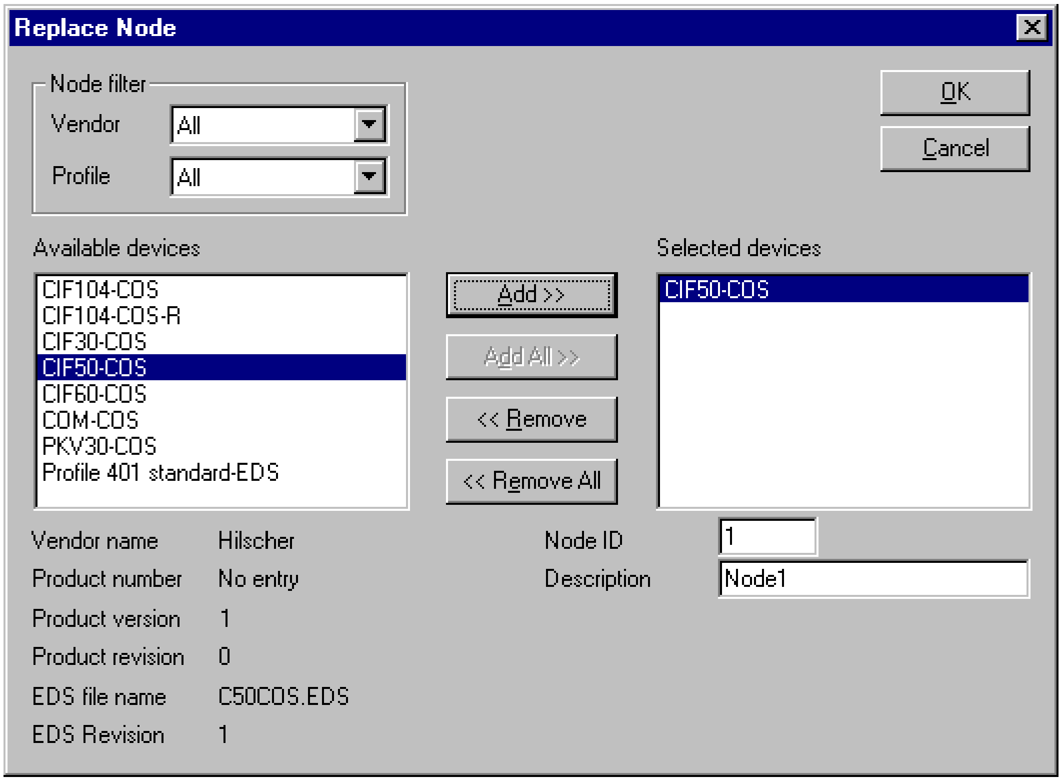
If a Node already exists in the configuration and should be replaced with another Node, first set the focus on the Node (left mouse click) and then choose the menu **Edit > Replace**. Or right mouse click on the Node and select **Replace** in the menu that opens. In the opened window the question appears asking if the Node should be replaced.



Do you want to replace this device?

Figure 21: Security question Replace Device

The **Yes** button opens a new window, where the new Node may be selected.



Replace Node

Node filter

Vendor All

Profile All

Available devices

CIF104-COS
CIF104-COS-R
CIF30-COS
CIF50-COS
CIF60-COS
COM-COS
PKV30-COS
Profile 401 standard-EDS

Selected devices

CIF50-COS

Vendor name	Hilscher
Product number	No entry
Product version	1
Product revision	0
EDS file name	C50COS.EDS
EDS Revision	1

Node ID 1

Description Node1

Figure 22: Edit > Replace Node

In this window select the required Node by clicking on it. By clicking the **Add** button the Node is shown in the **Selected devices** list. With **OK** confirm the selection and the Node will be replaced.

CHAPTER 5: SETTINGS

5.1 Device Assignment

The Device Assignment setting determines how the System Configurator communicates with the device. This is set in the device arrangement via the menu **Settings > Device Assignment**. The following possibilities are available:

CIF Device Driver	**CIF Serial Driver**	**CIF TCP/IP Driver**

CIF Device Driver:

- Not supported do not choose this driver.

CIF Serial Driver:

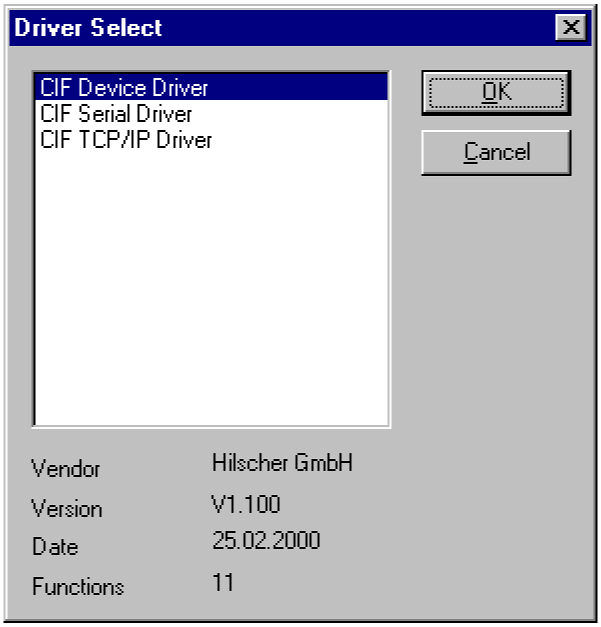
- CIF Serial Driver: The HSystem Configurator communicates with the SmartStack device over a serial connection. In this case a COM interface of the PC must be connected via a cable (straight) with the diagnostic interface of the SmartStack device. The cable is standard Horner Programming cable.

CIF TCP/IP Driver:

- Not supported do not choose this driver.

5.2 COM Serial Driver

The serial driver supports COM1 to COM 4, in order to communicate via the diagnostic interface with the device. The Device is selected via **Settings > Device Assignment.**



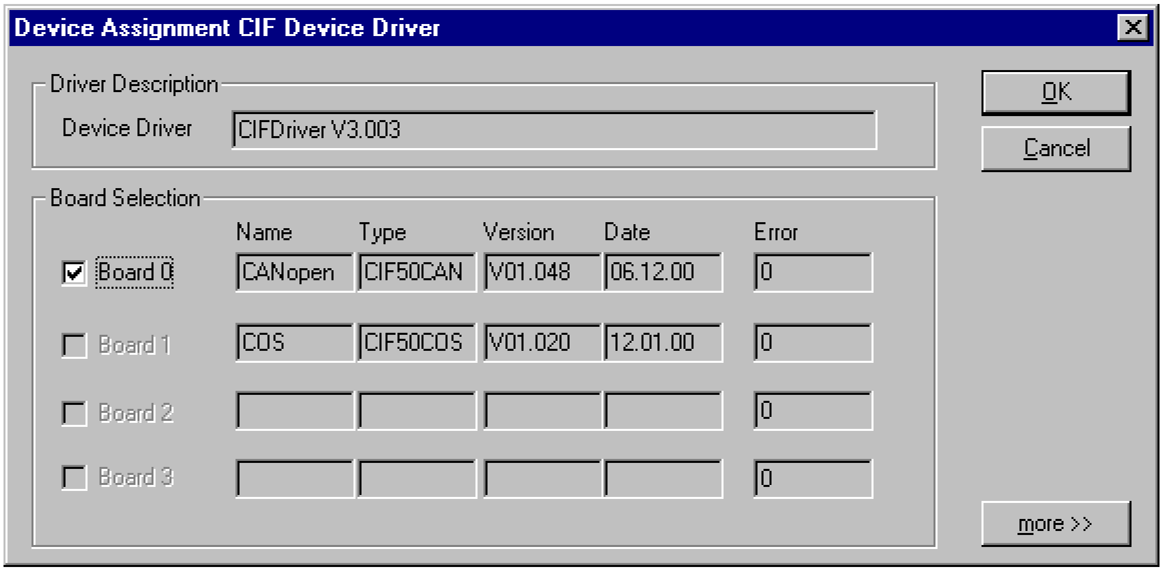
CIF Device Driver
CIF Serial Driver
CIF TCP/IP Driver

Vendor Hilscher GmbH
Version V1.100
Date 25.02.2000
Functions 11

Figure 23: Driver selection – CIF Serial Driver

Choose the **CIF Serial Driver** and then **OK**, in order to select the CIF Serial Driver. The connection must first be established using the switching surface **Connect COM1** or **Connect COM2** or **Connect COM3** or **Connect COM4**. They can be used depending on which COM interfaces are installed and free on the PC.

The System Configurator sends a request to the corresponding COM interface and polls the Firmware of the device. A display of the Firmware will indicate when a device is connected. In the other case, a Timeout error (-51) appears, which will state that no device is connected.



Device Assignment CIF Device Driver

Driver Description

Device Driver: CIFDriver V3.003

Board Selection

	Name	Type	Version	Date	Error
☑ Board 0	CANopen	CIF50CAN	V01.048	06.12.00	0
□ Board 1	COS	CIF50COS	V01.020	12.01.00	0
□ Board 2					0
□ Board 3					0

Figure 24: CIF Serial Driver – Device Assignment

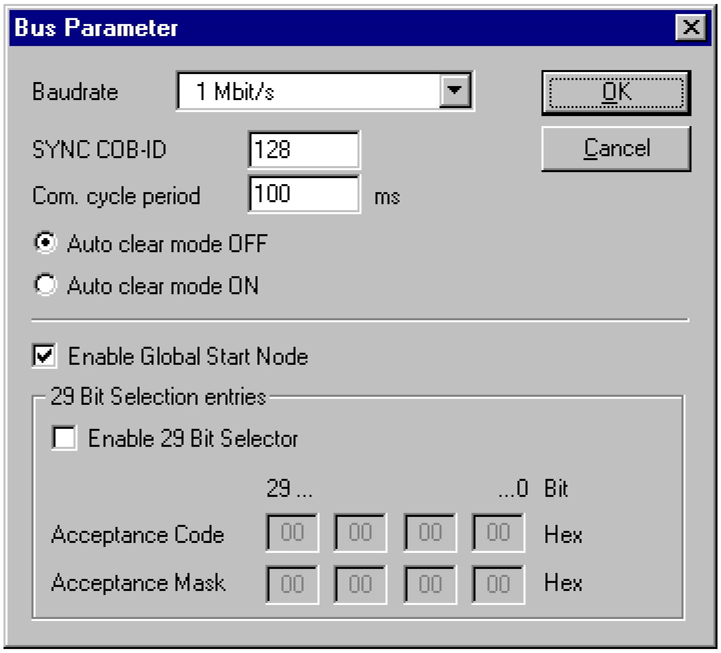
The error number – 20 indicates that this COM interface is not available or already in use.

5.3 Bus Parameters

The Bus Parameters are the foundations of a functioning data exchange. This section contains information for setting the Bus Parameters as well as the descriptions of the individual parameters.
In these windows the basic settings for the CANopen network are done. Mainly, this concerns the setting of the **Baudrate**.

Attention: Check that all CANopen Nodes support the selected Baud rate.

Basic rule: The Baud rate must be the same for all devices. The Node address on the other hand must differ from Node to Node. The Master itself does not have a Node address.



Bus Parameter

Baudrate: 1 Mbit/s

SYNC COB-ID: 128

Com. cycle period: 100 ms

● Auto clear mode OFF

○ Auto clear mode ON

☑ Enable Global Start Node

29 Bit Selection entries

□ Enable 29 Bit Selector

	29 ...			...0	Bit
Acceptance Code	00	00	00	00	Hex
Acceptance Mask	00	00	00	00	Hex

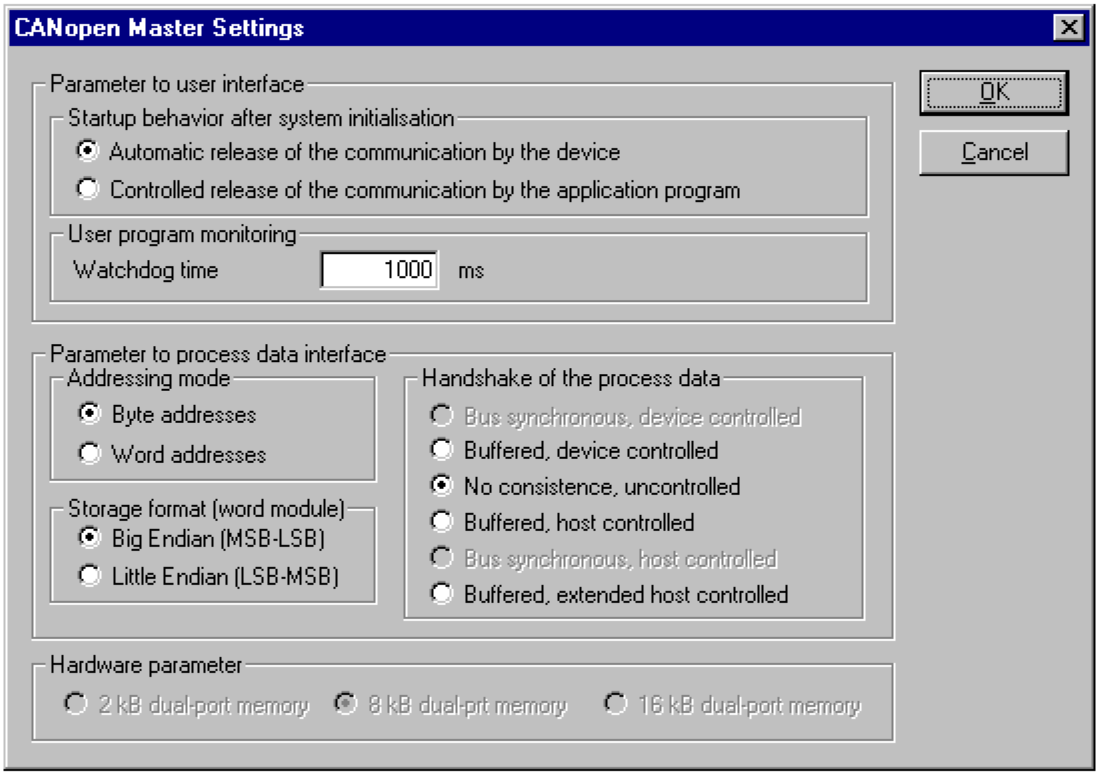
Figure 25: Settings > Bus Parameter

- SYNC COB-ID and SYNC-Message – The cycle time of the SYNC-Message and its message number COB-ID must to be set. The default value is 128. As soon as a participant with synchronized PDO transfer is configured, the SYNC message is sent in the configured cycle period frame from the Master.
- Auto clear mode OFF – The Auto Clear feature defines the behaviour of the Master if the communication is interrupted to a Node. If the flag Auto clear mode ON is activated, the Master will also stop the communication to all further Nodes which were still responding and active. If the flag Auto clear mode OFF is activated, then a lost communication contact to one Node has no influence on the communication channel of the still present ones. For all the error affected Nodes the master tries to re-establish communication.
- Enable Global Start Node – Once all the desired nodes have been configured the Master sends a Global Start Node command to start all the nodes synchronously.
-

5.4 CANopen Master

5.5 Master Settings

To enter the CANopen Master settings, select the menu **Settings > Master Settings** or right mouse button click on the corresponding Master symbol and select **Master Settings** from the list which opens up.
The CANopen **Master Settings** contain parameters that determine the behaviour of the Master device as well as the user interface. These settings are only valid for SmartStack devices and are included in the download of the configuration.



CANopen Master Settings

Parameter to user interface

Startup behavior after system initialisation

● Automatic release of the communication by the device

○ Controlled release of the communication by the application program

User program monitoring

Watchdog time 1000 ms

Parameter to process data interface

Addressing mode

● Byte addresses

○ Word addresses

Storage format (word module)

● Big Endian (MSB-LSB)

○ Little Endian (LSB-MSB)

Handshake of the process data

○ Bus synchronous, device controlled

○ Buffered, device controlled

● No consistence, uncontrolled

○ Buffered, host controlled

○ Bus synchronous, host controlled

○ Buffered, extended host controlled

Hardware parameter

○ 2 kB dual-port memory ● 8 kB dual-prt memory ○ 16 kB dual-port memory

Figure 26: Settings > CANopen Master Settings

- Startup behaviour after system initialisation **– Always select** Automatic release of the communication by the device, **this allows the Master device to start the data exchange on the Bus once the initialization is complete. If** Controlled release of communication by the application program **has been set, the application program must activate the data exchange at the Bus.**
- User program monitoring - The Watchdog time determines how long the device waits for a triggering of the software watchdog by the application program until it sets the outputs of the Slave devices to 0. This behaviour must be activated by the user program and does not start automatically, always set this to 0mS.

Note: The Watchdog is not a special CANopen function, but an often needed feature in interaction with a SoftPLC.

- Addressing mode – The addressing mode of the process data image determines how the addresses (Offsets) of the process data are interpreted. Either of the addressing modes Byte addresses or Word addresses are possible.
- Storage format (word module) – The storage format determines how the data is interpreted and stored in the process image. This allows the connection of nodes with different Endian data.
- Handshake of the process data – Always use Buffered, host controlled. This parameter defines how data is exchanged with the OCS / TIU and is fixed in these systems.
- Hardware parameter – The size of the dual-port memory of the hardware can be selected. The parameter will enlarge or reduce the possible value ranges for the I/O offsets. In the CANopen Master the dual-port memory size is 8K, whereby 7K is process data.

5.6 Addressing Mode

The addresses in the configuration of the Nodes define the starting point of the data in the process image. This can work in a Word or Byte oriented method by means of the **Addressing mode** parameter.

Addresses	Meaning
Byte addresses	The process image has a Byte structure and each Byte has its own address.
Word addresses	The process image has a Word structure and each Word has its own address.

Table 10: Addressing Mode

The following table is meant to clarify the method of addressing:

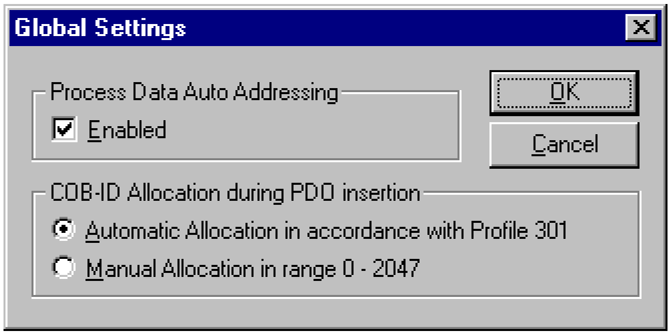
Byte addressing		
Byte 0	I/QB 0	I/QW 0
Byte 1	I/QB 1	
Byte 2	I/QB 2	I/QW 2
Byte 3	I/QB 3	
Byte 4	I/QB 4	I/QW 4
Byte 5	I/QB 5	

Word addressing		
Word 0	I/QB 0	I/QW 0
	-	
Word 1	I/QB 1	I/QW 1
	-	
Word 2	I/QB 2	I/QW 2
	-	

Table 11: Image of the method of addressing for input and Output.

5.7 Global Settings

Set the focus on the Master (left mouse click) and select the menu **Settings > Global Settings**. Or click on the symbol of the Master device with the right mouse key to select the menu **Master Configuration** and then click the button **Global Settings**.



Global Settings

Process Data Auto Addressing

☑ Enabled

COB-ID Allocation during PDO insertion

● Automatic Allocation in accordance with Profile 301

○ Manual Allocation in range 0 - 2047

Figure 27: Settings > Global Settings

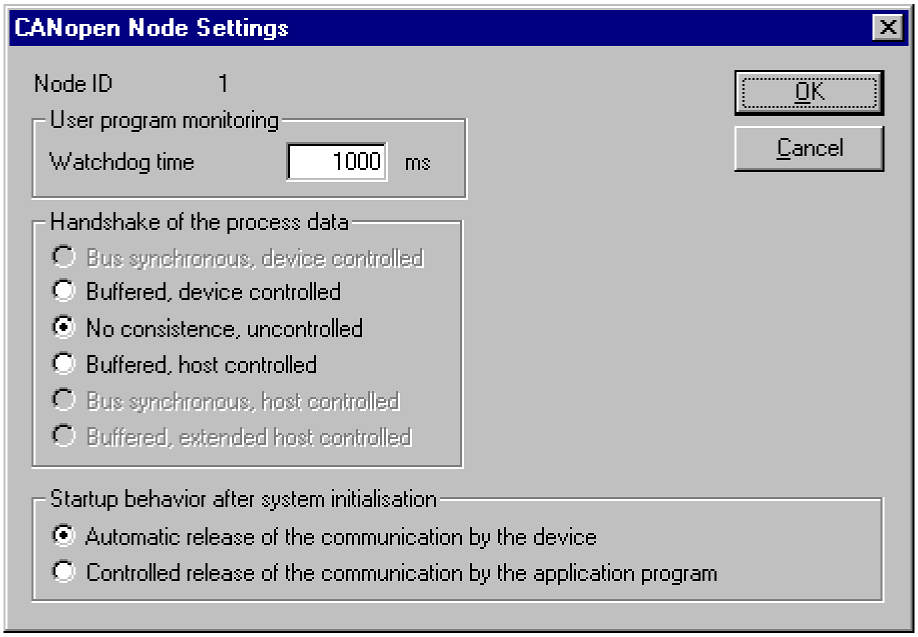
- Process Data Auto Addressing – Allows selection of Automatically assigned addressing or Manually assigned addressing during configuration. In Auto addressing the addresses will be allocated beginning with 0 and incremented in accordance with the entry sequence of the Slaves before downloading and can be viewed and checked in the menu View > Address Table. In Manual Addressing the address 0 is shown in the I Addr or O Addr and must be overwritten by the user.

- COB-ID Allocation during PDO insertion – The CANopen specification provides that the message number (COB-ID) of a PDO is given relative to the Node address according to a fixed definition. It is called the Pre-Defined Connection Set.
- Automatic Allocation in accordance with Profile 301 - If this option is selected, alteration of the message number of the PDOs is not possible and its assignment takes place automatically by the CANopen profile 301.
- Manual Allocation in range 0-2047 - If this menu option is selected, assignment of the message number of the PDOs is possible and can take place in the context of the 2048 (11 bit) different possible CAN-Identifiers.

5.8 CANopen Node

5.9 Node Settings

The CANopen Node Settings contain parameters that define the behaviour of the device at the user interface, which does not belong to the CANopen Node configuration. This menu is applicable only to SmartStack devices. These settings are transferred with the download of the CANopen configuration to the device.
To open the CANopen Node Settings menu, choose the Node and then open the window in the **Settings > Node Settings** menu. Or right mouse click on the symbol of the Hilscher Node device and then select **Node Settings**.



CANopen Node Settings

Node ID 1

User program monitoring

Watchdog time 1000 ms

Handshake of the process data

○ Bus synchronous, device controlled
○ Buffered, device controlled
● No consistence, uncontrolled
○ Buffered, host controlled
○ Bus synchronous, host controlled
○ Buffered, extended host controlled

Startup behavior after system initialisation

● Automatic release of the communication by the device
○ Controlled release of the communication by the application program

Figure 28: Settings > CANopen Node Settings

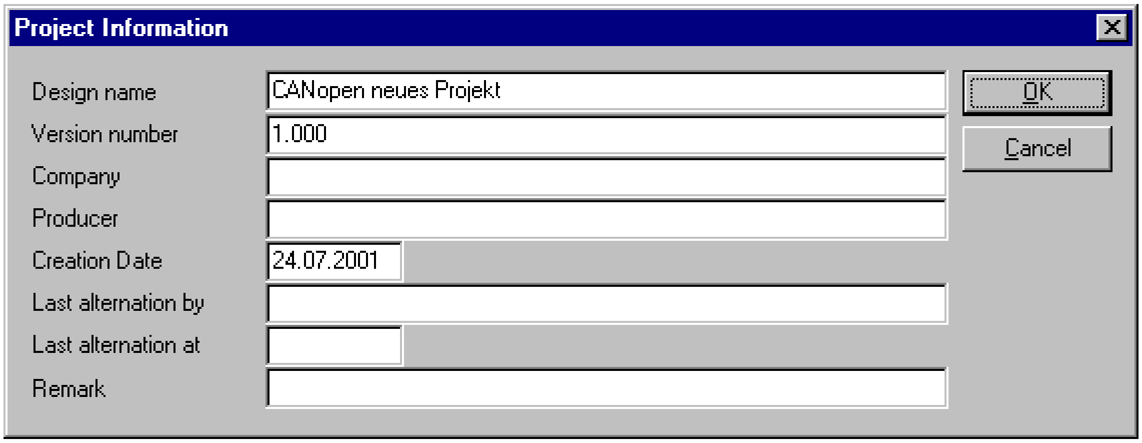
- User program monitoring - The watchdog time appoints how long the device will wait for a user trigger of the watchdog, until it resets all outputs to zero. This must be set to 0mS.

.

- Handshake of the process data – Must be set to Buffered, host controlled.
- Startup behaviour after system initialisation **– Must be set to** Automatic release of the communication by the device.

5.10 Project Information

The user project information can be typed into the **Settings > Project Information** menu. The entry may be read anytime by re-opening the menu.



Project Information

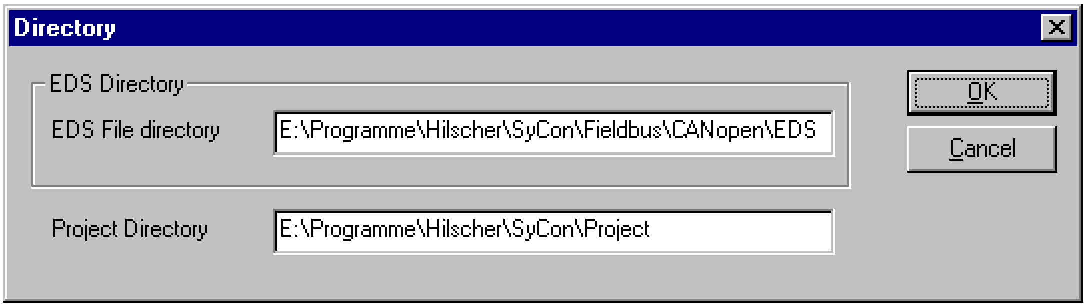
Design name	CANopen neues Projekt
Version number	1.000
Company	
Producer	
Creation Date	24.07.2001
Last alternation by	
Last alternation at	
Remark	

Figure 29: Settings > Project Information

Click the **OK** button to save the Project Information.

5.11 Path

When the **Settings > Path** menu is selected, the search path for EDS files is displayed.



Directory

EDS Directory

EDS File directory	E:\Programme\Hilscher\SyCon\Fieldbus\CANopen\EDS
Project Directory	E:\Programme\Hilscher\SyCon\Project

Figure 30: Settings > Path

Click the button **OK** to read in all the EDS files.

5.12 Languages

Choose the **Settings > Language** menu and the following window opens:

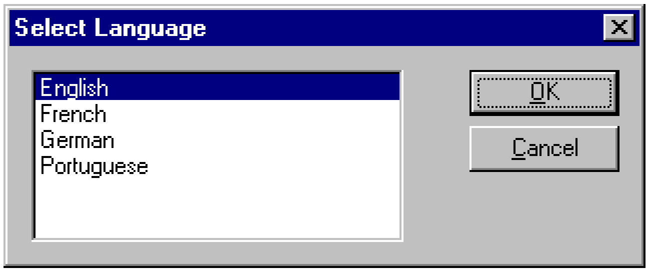


Figure 31: Settings > Language

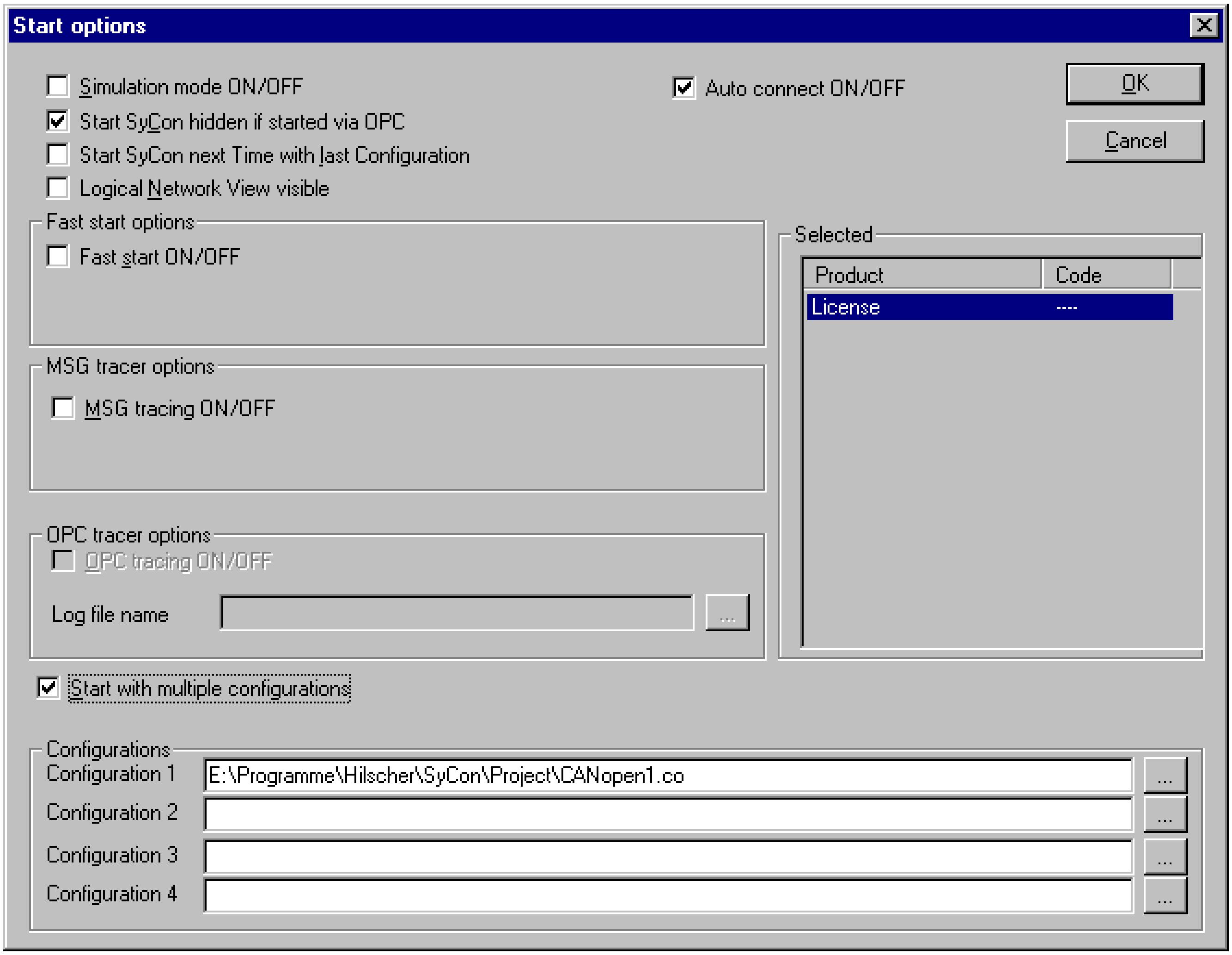
Select the desired language and confirm the entry with the **OK** button. A message appears that the System Configurator must be started again in order to activate the selected language. Upon restarting the System Configurator, the language will have changed to the one selected.

Note: Not all languages are available for all fieldbuses!

5.13 Start Options

Upon activating the **Settings > Start...** menu in the network mode, the following dialog will appear. Here it is possible to set the various starting options or modes. Some are only of importance for the OPC-Server operation.

Note: The point of menu start options appears only in the selection settings, if the network view is opened.



☐ Simulation mode ON/OFF
☑ Start SyCon hidden if started via OPC
☐ Start SyCon next Time with last Configuration
☐ Logical Network View visible
☑ Auto connect ON/OFF

☐ Fast start ON/OFF

☐ MSG tracing ON/OFF

☐ OPC tracing ON/OFF
Log file name

Product	Code
License	----

☑ Start with multiple configurations

Configuration 1 E:\Programme\Hilscher\SyCon\Project\CANopen1.co
Configuration 2
Configuration 3
Configuration 4

Figure 32: Settings > Start Options

- Simulation mode ON/OFF - Only valid for the OPC Server.
- Start SyCon hidden if started via OPC **- Only valid for the OPC Server.**
- Start SyCon next time with last Configuration – Restores the last configuration when next started.
- Logic Network View visible - Allows the possibility of diverting to the network mode without having to install the SyCon with OPC. It is also possible to use the Watch List from the network mode.
- Fast start ON/OFF - Only valid for the OPC Server.
- TAG tracing ON/OFF - Only valid for the OPC Server.
- OPC tracing ON/OFF - Only valid for the OPC Server.

Only valid for the OPC Server.

- Auto connect ON/OFF – Allows automatic connection to the module without having to use the Device Allocation menu.
- Start with multiple configurations – Allows the possibility to start SyCon with up to four configurations simultaneously. The paths are shown in the window and are configurable.

CHAPTER 6: ONLINE FUNCTIONS

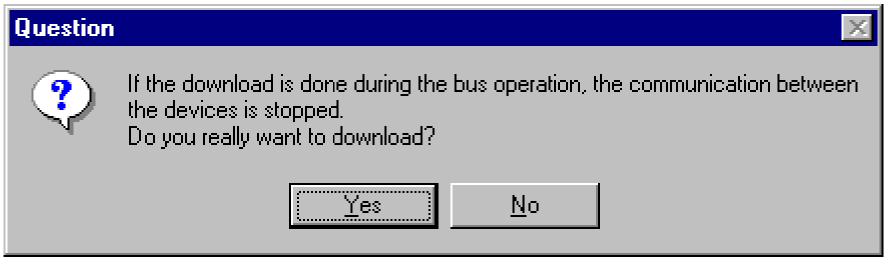
6.1 Introduction

In this section all the functions that directly influence SmartStack CANopen devices, e.g. COM-COM and COM-COS are presented.

Note: This also permits interruption of the communication or that input and output can be switched ON or OFF.

6.2 Downloading the Configuration

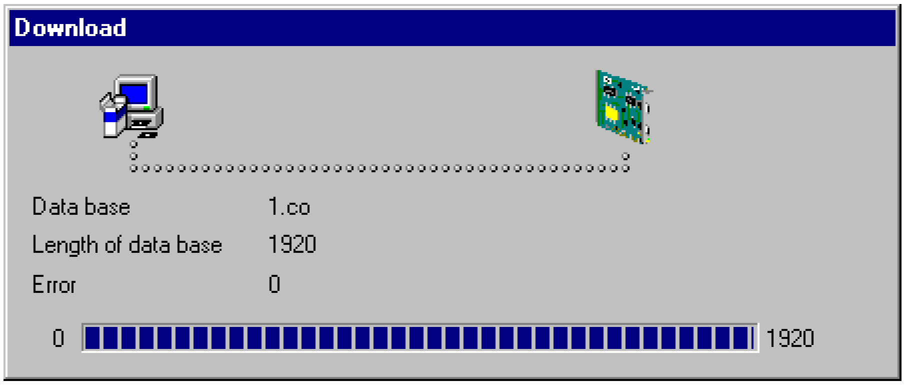
Chose the desired device by a left mouse click on the symbol of the device. In order to release the configuration and network access, a transfer (Download) to the COM device must be carried out on the **Online > Download** menu. A warning will appear that the communication on the CANopen will be interrupted. This warning must be confirmed.



If the download is done during the bus operation, the communication between the devices is stopped.
Do you really want to download?

Figure 33: Security question before Download

Attention: The download overwrites the configuration in the device and the communication with the connected devices is interrupted.



Data base 1.co
Length of data base 1920
Error 0

Figure 34: Online > Download

Before the Download is executed, the configuration is checked by the Configurator. The most common cause of error is overlapping of addresses in the process data image. This can be checked by calling up the address table with the **View > Address Table** menu. If the assignment of addresses in the process data image should be carried out automatically, then the **Auto Addressing** button in the **Master Configuration** window must be activated.
The configuration is transferred to the selected device and is stored in non-volatile FLASH memory so that the configuration is available when the voltage supply is switched off and on again.
After the download, the device carries out an internal restart and begins with the communication if in **CANopen Master Settings** the **Automatic Release of Communication by the Device** menu point has been set.

6.3 Firmware Download

If a firmware download is to be carried out, proceed as follows: Select the desired device to be loaded. Then, call up the **Online > Firmware Download** menu. Select the new Firmware and retrieve it with **Download** to the device. The Firmware is now retrieved.

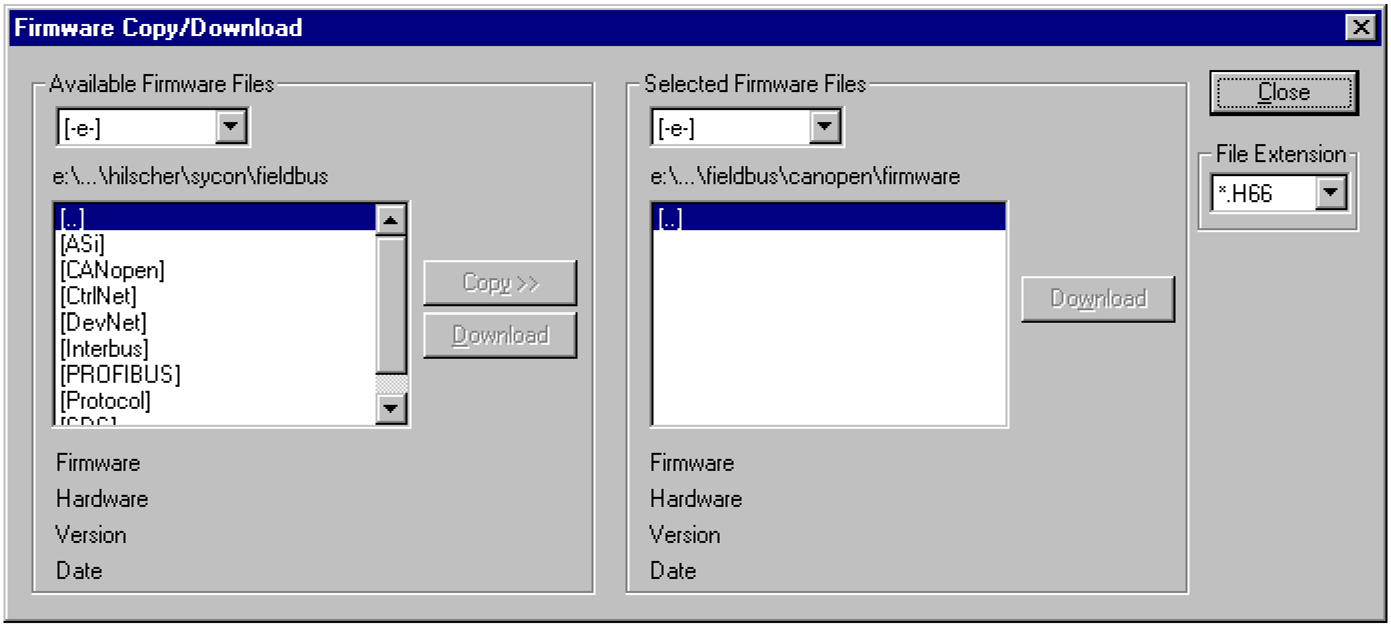
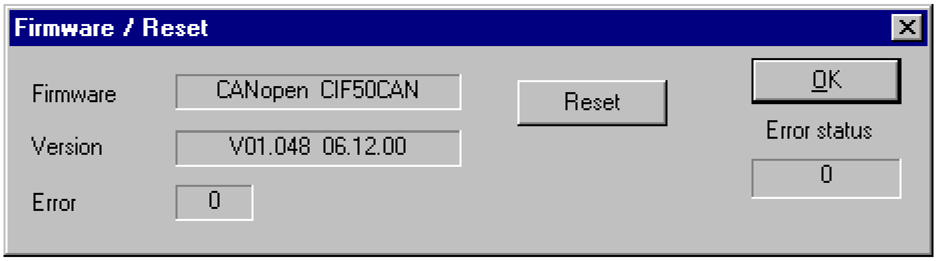


Figure 35: Online > Firmware Download

6.4 Firmware / Reset

Choose the desired device with a left mouse click on the symbol of the device. Then the **Online > Firmware / Reset** menu must be called up and the name and the version of the Firmware are displayed.

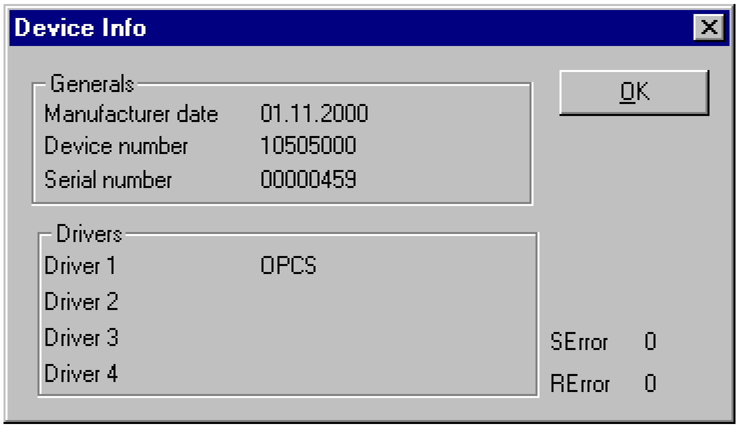


Firmware: CANopen CIF50CAN
Version: V01.048 06.12.00
Error: 0
Error status: 0

Figure 36: Online > Firmware / Reset

The device is reset by the **Reset** button.

Select the desired device with a left mouse click on the symbol of the device. Then select the **Online > Device Info** menu in order to obtain further information on the selected device. The manufacturer date, the device number and the serial number of the device is retrieved and shown.



Generals

Manufacturer date 01.11.2000

Device number 10505000

Serial number 00000459

Drivers

Driver 1 OPCS

Driver 2

Driver 3

Driver 4

SError 0

RError 0

Figure 37: Online > Device Info

6.5 Start/Stop Communication

The communication between CANopen Master and CANopen Node can be manually started or stopped. Select the desired device with a left mouse click on the symbol of the device. Then select the **Online > Communication start** or **Online > Communication stop** menu.

6.6 Diagnostic Functions

The following table shows diagnostic functions and their use with

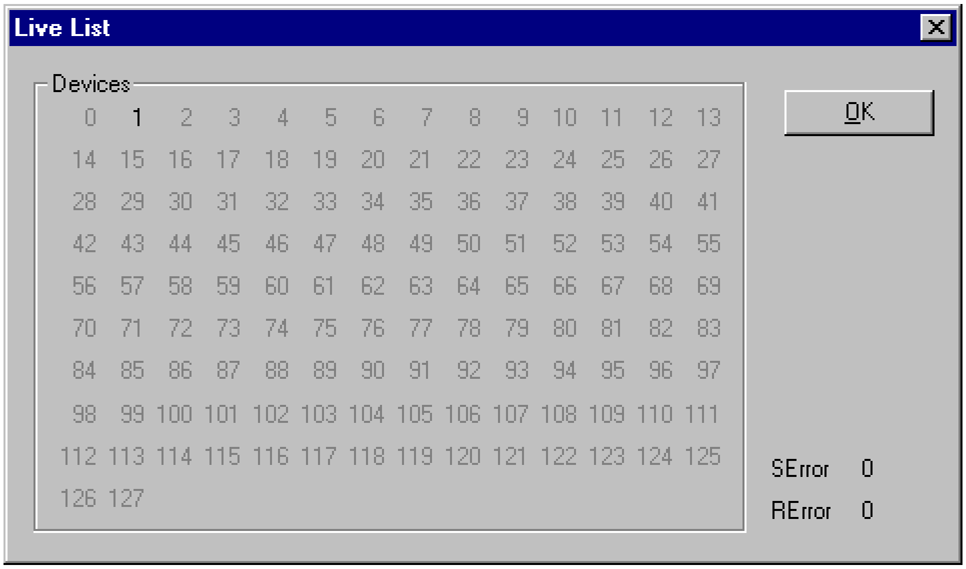
- SmartStack CANopen Master devices
- SmartStack CANopen Nodes (Slaves).

Diagnostic Function	Description	For SS Master devices	For SS Nodes
Live List	Determine, which devices are connected to the Hilscher CANopen Master device.	Yes	No
Debugmode (CANopen)	Determine, to which CANopen Nodes the Hilscher CANopen Master has communication	Yes	No
Global State Field	Status information of the Hilscher CANopen Master	Yes	No
Extended Device Diagnostic	Statistic information and status information from the Hilscher CANopen device	Yes	Yes

Table 12: Overview Diagnostic Functions

6.7 Live List

Select the desired device with a left mouse click on the device symbol. Then select the **Online > Live List** menu and obtain an overview of all active devices on the CANopen network.



0	1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79	80	81	82	83
84	85	86	87	88	89	90	91	92	93	94	95	96	97
98	99	100	101	102	103	104	105	106	107	108	109	110	111
112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127												

SError 0
RError 0

Figure 38: Online > Live List

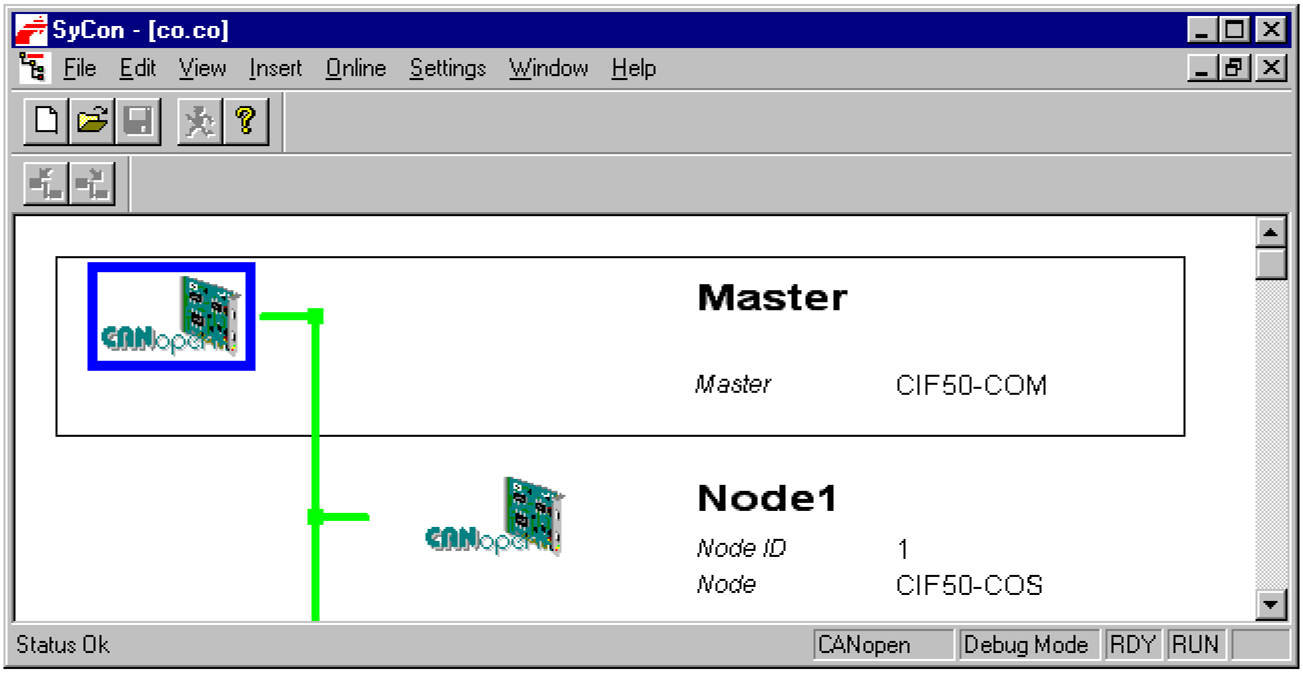
Generally all devices are displayed in grey. Any Nodes detected on the bus are represented in black on the appropriate Node address.

6.8 Debugmode (CANopen)

Select the menu item **Online > Start Debug Mode**. The System Configurator cyclically interrogates the status of the network communication from the COM and the individual conditions of the Nodes. To end the Debug Mode select the menu **Online > Stop Debug Mode**.

6.9 The Debugwindow

When the debug session is started the configuration window changes to the debug window. T he devices and the line between them are displayed in green or red colour depending on the established network communication.



Master

Master CIF50-COM

Node1

Node ID 1

Node CIF50-COS

Status Ok | CANopen | Debug Mode | RDY | RUN

Figure 39: The Debugwindow

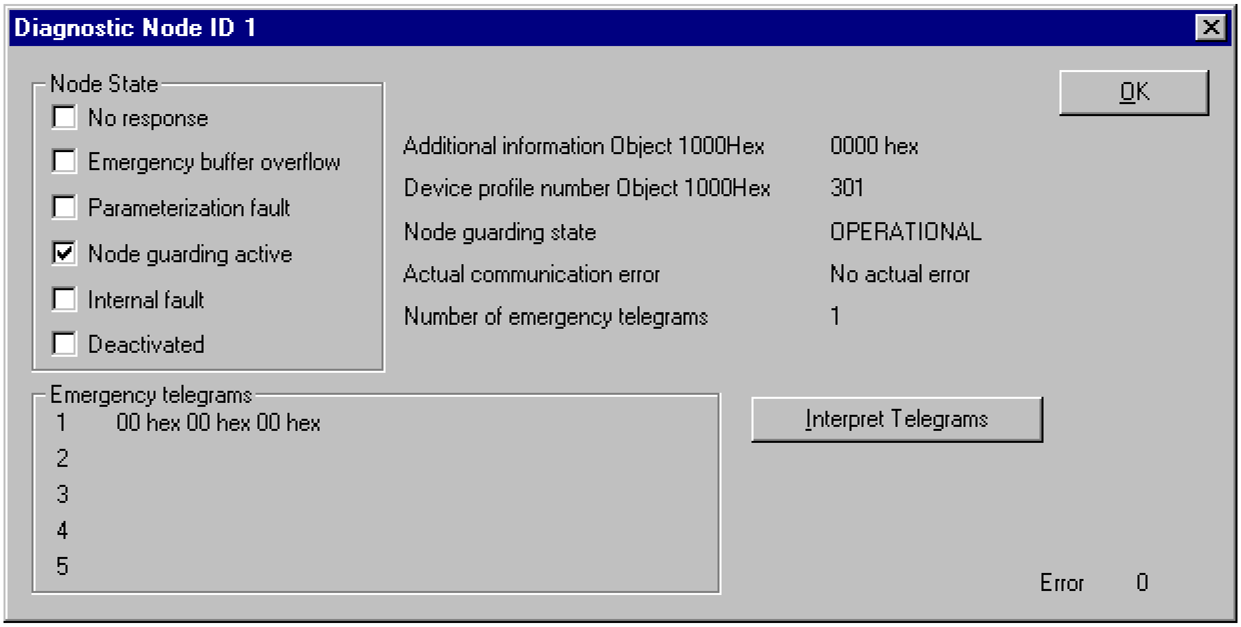
If diagnostic information is available for a specific device, next to the device Icon the text **Diag** appears in red. To get further device specific diagnostic information doubleclick on the device itself or set the focus to the device and select **Online > Device Diagnostic**.

Note: The CANopen Master (NMT-Master) can only recognize that the Node has failed if the CANopen Node supports Nodeguarding.

The Master icon has the ⚠ sign to show stop mode and in run mode has the sign 🏃.

6.10 CANopen Node specific Diagnostic

If the device indicates diagnostic information (**Diag** appears beside node). This information is displayed in detail by clicking with the mouse on the corresponding device in debug mode. To activate the debug mode mark the Master with a left mouse click and select the menu **Online > Start Debug Mode**. Now set the focus on the Node (left mouse click) and select the menu **Online > Device Diagnostic** to show the CANopen Device Diagnostic. To end the Debug Mode mark the Master again and select the menu **Online > Stop Debug Mode**.



Node State

- ☐ No response
- ☐ Emergency buffer overflow
- ☐ Parameterization fault
- ☑ Node guarding active
- ☐ Internal fault
- ☐ Deactivated

Additional information Object 1000Hex	0000 hex
Device profile number Object 1000Hex	301
Node guarding state	OPERATIONAL
Actual communication error	No actual error
Number of emergency telegrams	1

Emergency telegrams

1	00 hex 00 hex 00 hex
2	
3	
4	
5	

Error 0

Figure 40: Online > Device Diagnostic (CANopen Standard Diagnostic)

The individual bits in the **Device Diagnostic** and their meaning:

No Response - The Node is configured but is not present on the network. Check the physical connection between the Master and Node. Compare the selected baudrate of the Node with the baudrate of the Master. Check the Node address.

Emergency buffer overflow - CANopen defines a special reserved emergency channel for each Node with high priority to give the ability to report emergency messages triggered by the occurrence of a device internal fatal error situation. The emergency messages of each Node are saved in an internal buffer on the Master. The buffer will be cleared when HSyCon reads it out and shows the telegrams in the lower Emergency telegrams window. If the buffer overflows telegrams will be lost. In this case a buffer overflow event is reported. Emergency error codes are defined by the CANopen Communication Profile. Emergency telegrams in the lower table can be interpreted textually by clicking on the Interpret Telegrams button.

Parameterization fault - The Master compares the configured Device **Profile** and the corresponding **Device Type** value of the **Node Configuration** window with the real physically present ones in the Node by reading out the Node object 1000H. If the Master detects differences between the values it will report the Parameterization Fault. The actual Node value read by the master is shown beside the **Device profile number Object 1000H** and **Additional information Object 1000H** entry.

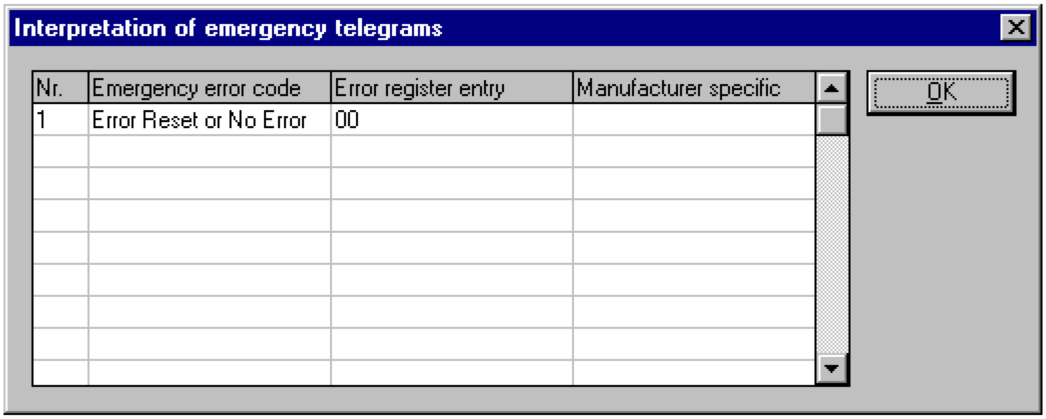
Node guarding active - As soon as the master has finished the configuration phase of the Node it will start the cyclic Node guarding mechanism and set the Node guarding active flag. The Node guarding will only be active if the Guard time and the Life time factor in the Node Configuration window are non zero.

Internal fault - The internal fault indication serves to report master internal fatal error situations. If it is reported then call Tech support or the distributer from whom the module was purchased.

Deactivated - This bit is automatically set by the master, if the Node state was configured to **Deactivate Node in actual configuration** in the **Node Configuration** window.

6.11 Emergency Telegrams

Emergency telegrams are sent by the Node when an internal event occurs. The CANopen Master can buffer 5 Emergency telegrams maximum per node.



Nr.	Emergency error code	Error register entry	Manufacturer specific
1	Error Reset or No Error	00	

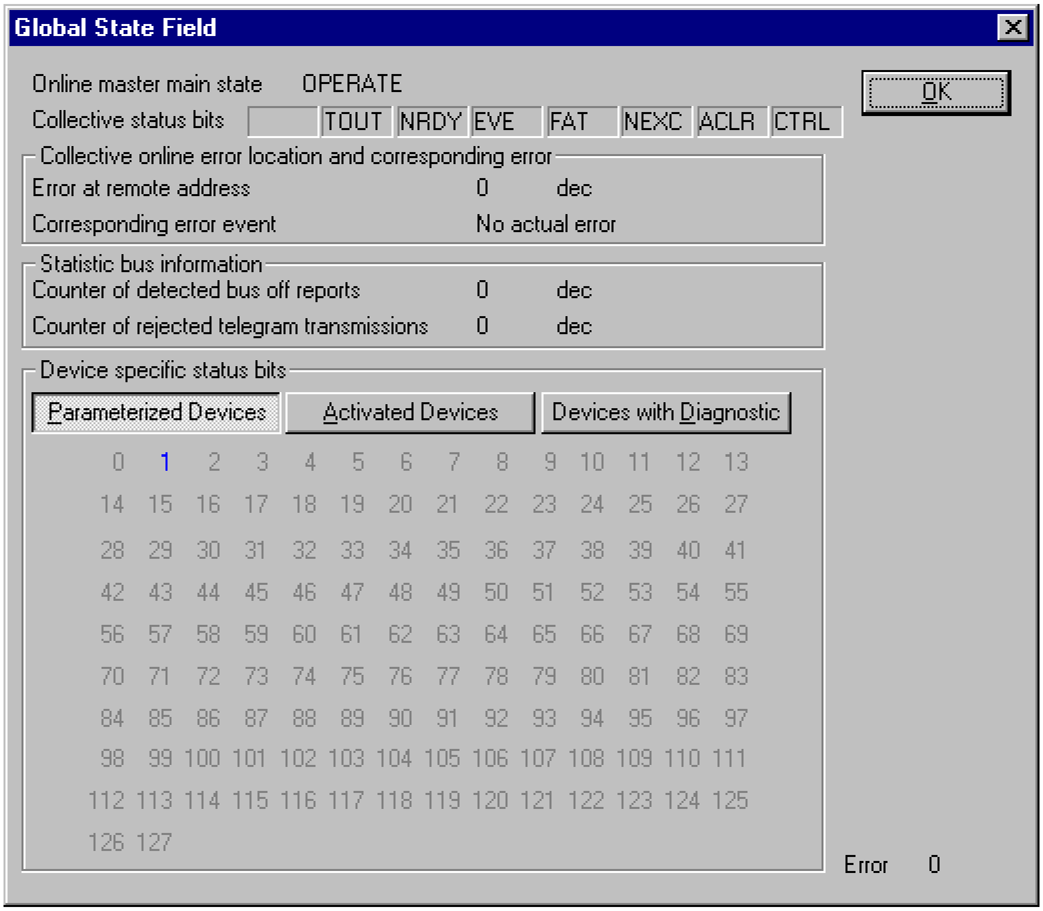
Figure 41: Online > Device Diagnostic > Interpretation of emergency telegrams

A table with the Error Codes is described in section ***Emergency Telegram Error Codes***.

Note: The table Emergency Error Codes is a general list. For the exact meaning it is referred to the manual of the Node manufacturer.

6.12 Global State Field

Menu option **Online > Global State Field** opens a window in which statistics about the bus status and connected devices are shown.



Online master main state OPERATE

Collective status bits TOUT NRDY EVE FAT NEXC ACLR CTRL

Collective online error location and corresponding error

Error at remote address 0 dec

Corresponding error event No actual error

Statistic bus information

Counter of detected bus off reports 0 dec

Counter of rejected telegram transmissions 0 dec

Device specific status bits

0	1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79	80	81	82	83
84	85	86	87	88	89	90	91	92	93	94	95	96	97
98	99	100	101	102	103	104	105	106	107	108	109	110	111
112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127												

Error 0

Figure 42: Online > Global State Field

The first row displays the main status of the Master. **OPERATE**, **STOP** or OFFLINE are the possible states. The next row displays individual bus errors. A pending error is displayed with a red field. The meaning of the individual abbreviations is described in the following:

	Bus error	Meaning
•	**TOUT**	Timeout Error
•	**NRDY**	HOST-NOT-READY-NOTIFICATION shows, if the application program is ready or not. If this bit is set the application program is not ready to communicate.
•	**EVE**	EVENT-ERROR the CAN chip has detected transmission errors. The number of detected events are counted in the bus off reports and the error warning limit counter. The bit will be set when the first event was detected and will not be deleted any more.
•	**FAT**	FATAL-ERROR because of heavy bus error, no further bus communication is possible.
•	**NEXC**	NON-EXCHANGE-ERROR At least one Node has not reached the data exchange state and no process data are exchanged with it.
•	**ACLR**	AUTO-CLEAR-ERROR device stopped the communication to all Nodes and reached the auto-clear end state.
•	**CTRL**	CONTROL-ERROR a parameterisation error has occurred.

Table 13: Meaning of collective status bits in the Global State Field

Further contents are given:

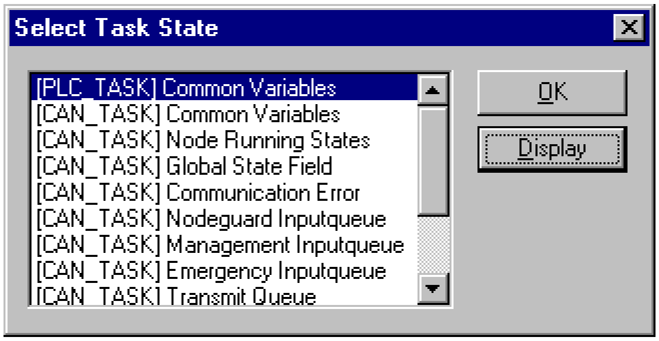
Collective online error location and corresponding error gives the address of the incorrect station and the lining up error in plain text.

Statistic bus information gives the number of detected bus short-circuits and rejected telegrams.

Device specific status bits - Parameterized Devices, Activated Devices and **Devices with Diagnostic** are shown by clicking on the button. The activated addresses are coloured numbers, double-click on a highlighted station address to see the diagnostic data.

6.13 Extended Device Diagnostic

The Extended Device Diagnostic helps to find Bus and configuration errors when the HSyCon menu functions are of no further help. Choose the required device by clicking on the device symbol with the left mouse button. Then select the **Online > Extended Device Diagnostic** menu.
This menu opens a list of diagnostic structures. These contain online counters, status and parameters:


Select Task State

[PLC_TASK] Common Variables
[CAN_TASK] Common Variables
[CAN_TASK] Node Running States
[CAN_TASK] Global State Field
[CAN_TASK] Communication Error
[CAN_TASK] Nodeguard Inputqueue
[CAN_TASK] Management Inputqueue
[CAN_TASK] Emergency Inputqueue
[CAN_TASK] Transmit Queue

Figure 43: Online > Extended Device Diagnostic

6.14 User Data Transfer

The following table showstest functions with user data transfer and the use for

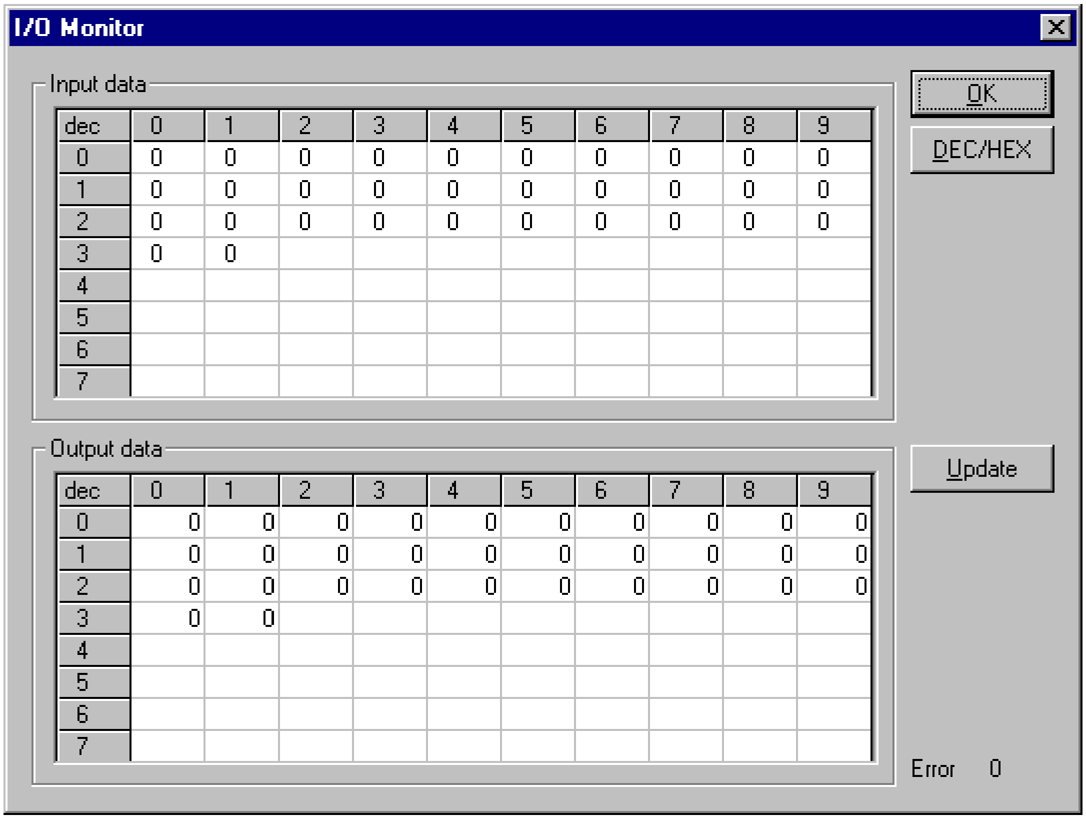
- SmartStack CANopen Master devices
- SmartStack CANopen Nodes

User data transfer function	**Usage**	**Use with SS CANopen Master**	**Use with SS CANopen Slave**
I/O-Monitor	Read input data and set output data. (cyclic I/O data exchange)	Yes	Yes
Error! Reference source not found.	Read input data and set output data. (cyclic I/O data exchange)	Yes	No
Read Objects (SDO Upload)	Read objects (SDO Upload)	Yes	No
Write Object (SDO Download)	Write objects (SDO Download)	Yes	No

Table 14: Overview User Data Transfer

6.15 I/O-Monitor

This is an easy way of viewing and changing the first 32 bytes of the process data image. The I/O Monitor is called up with the menu **Online > I/O Monitor**.



Input data

dec	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0								
4										
5										
6										
7										

Output data

dec	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0								
4										
5										
6										
7										

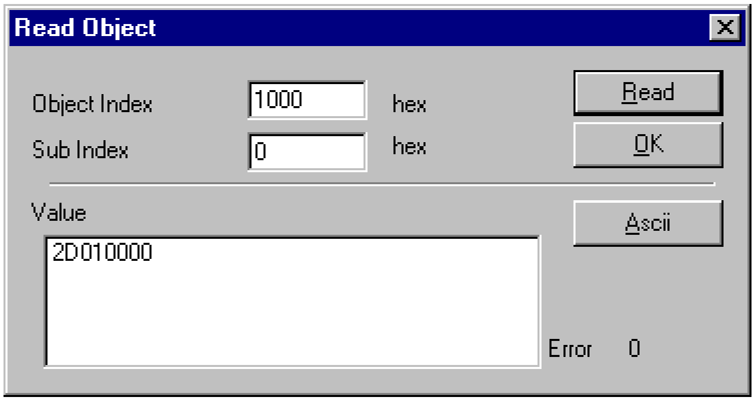
Error 0

Figure 44: Online > I/O-Monitor

DEC/HEX - Converts the display of the input data. The output data is always in decimal form.
Update - Enter the output value and then press.
The first 32 input and output bytes of the process data is shown, even when these bytes have not been occupied by the configuration. The display is always in a Byte manner.

6.16 Read Objects (SDO Upload)

Allows the execution of the CANopen services read object and write object based on the current configuration. Select the required device by clicking with the left mouse button on the Node symbol. Then select the menu **Online Read Object** or **Online > Write Object**.



Read Object

Object Index 1000 hex

Sub Index 0 hex

Value

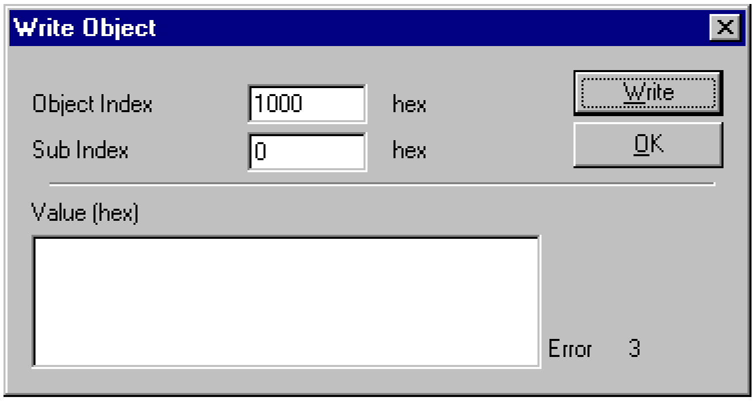
2D010000

Error 0

Figure 45: Online > Read Object

6.17 Write Object (SDO Download)

Allows the execution of the CANopen services read object and write object based on the current configuration. Select the required device by clicking with the left mouse button on the Node symbol. Then select the menu **Online Read Object** or **Online > Write Object**.



Write Object

Object Index 1000 hex

Sub Index 0 hex

Value (hex)

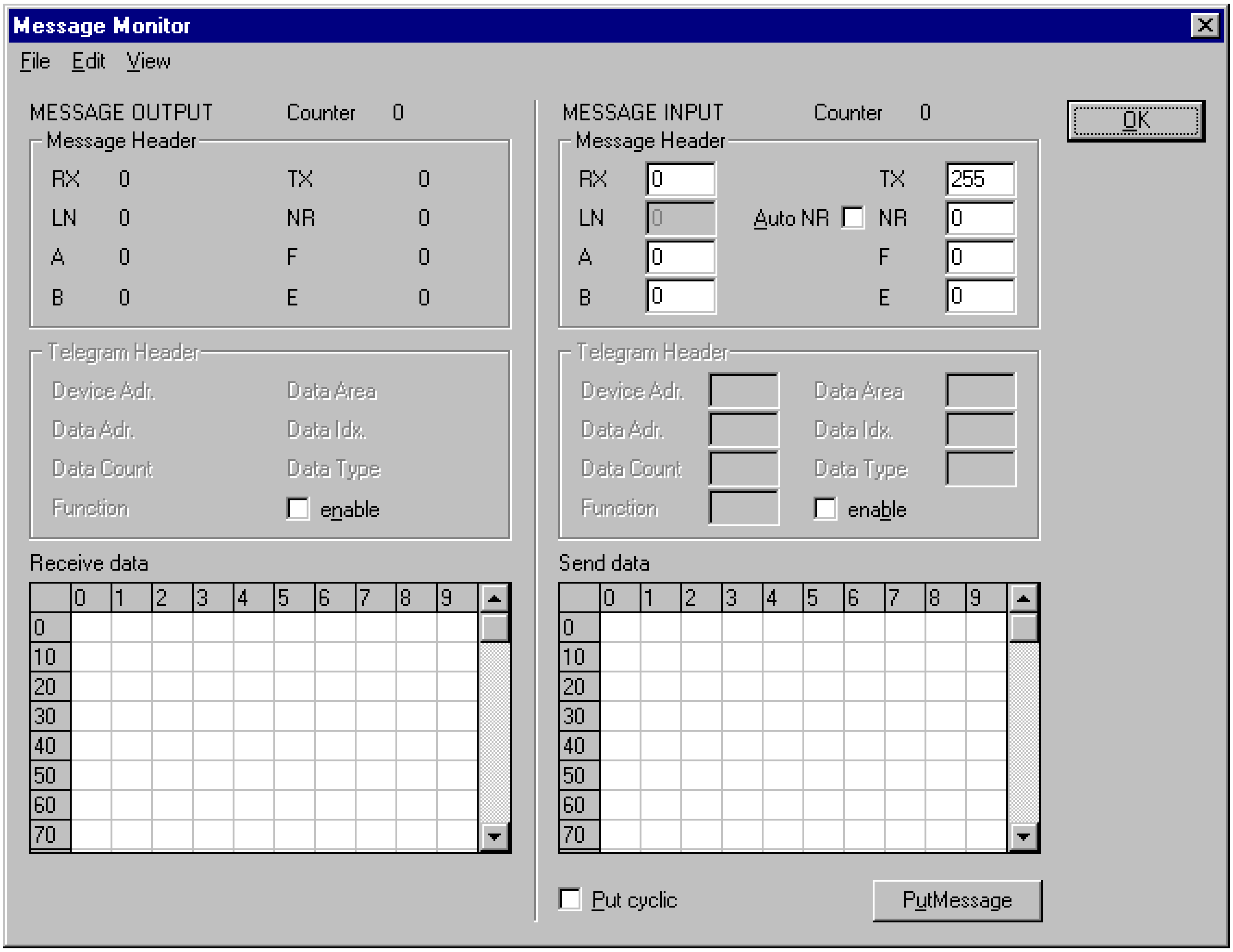
Error 3

Figure 46: Online > Write Object

Objects in CANopen are addresses in the manner Object-Index and Sub-Index. Both values must be specified in the selected window. Press **Read** or **Write** button to start the action. HSyCon informs about the success or failure of the action.

6.18 Message Monitor

The Message Monitor permits access to the Mailbox of the COM. The usage of the Message Monitor assumes advanced knowledge on the part of the user.
First the Hilscher device must be chosen with a left mouse click on the symbol of the Hilscher device. Then call up the **Online > Message Monitor** menu.



MESSAGE OUTPUT Counter 0

Message Header

RX	0	TX	0
LN	0	NR	0
A	0	F	0
B	0	E	0

□ enable

MESSAGE INPUT Counter 0

Message Header

RX	0		TX	255
LN	0	Auto NR □	NR	0
A	0		F	0
B	0		E	0

□ enable

□ Put cyclic

Figure 47: Online > Message Monitor

A Message can be saved and retrieved and has the file suffix *.MSG.
File > New: closes the window
File > Open: opens a Message (Message can be retrieved)
File > Save or **File > Save As**: saves a Message
File > Exit: ends the Message Monitor and returns to the SyCon.

6.19 Message Monitor for Using LSS/LMT

LSS/LMT services can be used to set the baud rate and the Node address for some Nodes.
The LSS/LMT Master sends telegrams to the LSS/LMT Slave with CAN telegram identifier 2021 (07E5H).
The LSS/LMT Slave replies to the LSS/LMT Master with the CAN telegram identifier 2020 (07E4H).

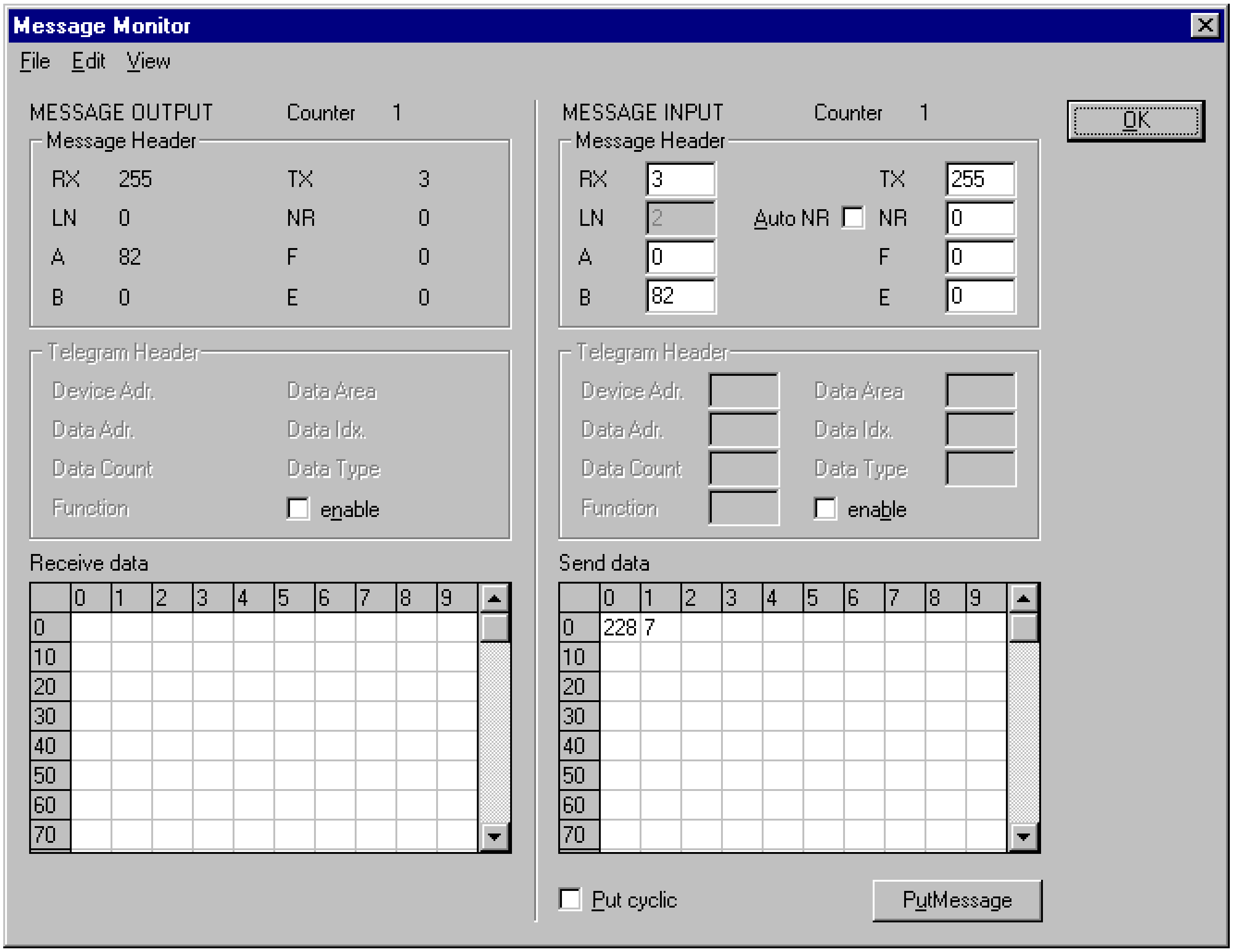
Note: Only one Node may be coupled to the Master at a time.

The baud rate of the SmartStack CANopen Master must be set equal to the baud rate of the Node.

Then the receive filter must be set to the CAN telegram identifier 2020.

Message for Setting the Receive Filter CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 82	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Receive ID Part 1 (LSB)	228
	CAN Receive ID Part 2 (MSB)	7

Table 15: Message Monitor for LSS/LMT > Setting the Receive Filter



MESSAGE OUTPUT Counter 1

Message Header

RX	255	TX	3
LN	0	NR	0
A	82	F	0
B	0	E	0

Receive data

	0	1	2	3	4	5	6	7	8	9
0										
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 1

Message Header

RX	3		TX	255
LN	2	Auto NR □	NR	0
A	0		F	0
B	82		E	0

Send data

	0	1	2	3	4	5	6	7	8	9
0	228	7								
10										
20										
30										
40										
50										
60										
70										

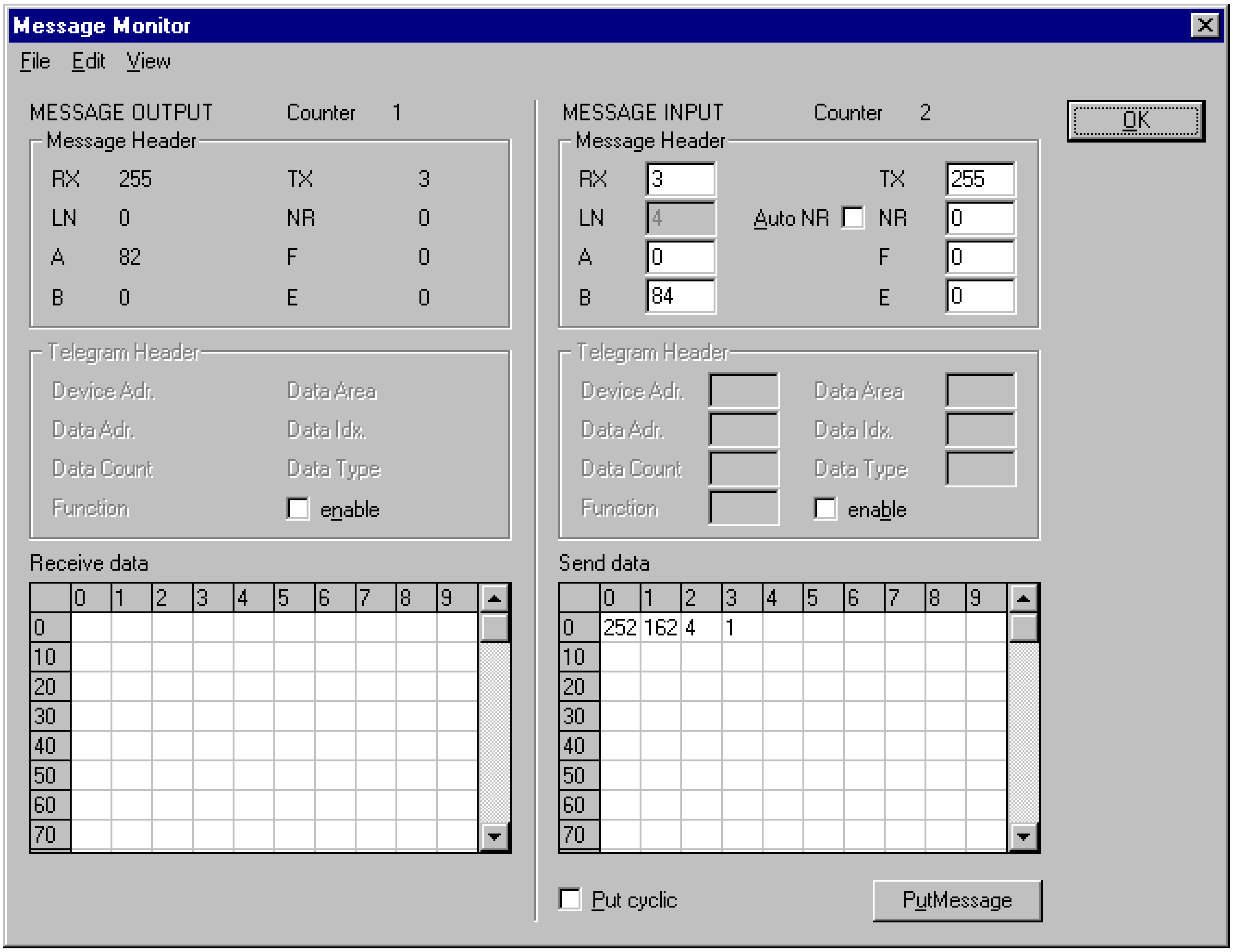
□ Put cyclic

Figure 48: Message Monitor for LSS/LMT > Set the Receive Filter

Switch in configuration mode

Message for Sending via CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 84	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Receive ID Part 1 (LSB)	252
	CAN Receive ID Part 2 (MSB)	162
	Send data 1: Mode Global Service	4
	Send data 2: Config Mode	1

Table 16: Message Monitor LSS/LMT (1) > Switch Configuration Mode on



Message Monitor

File Edit View

MESSAGE OUTPUT Counter 1

Message Header

RX	255	TX	3
LN	0	NR	0
A	82	F	0
B	0	E	0

Telegram Header: Device Adr. / Data Area / Data Adr. / Data Idx. / Data Count / Data Type / Function / □ enable

Receive data

	0	1	2	3	4	5	6	7	8	9
0										
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 2

Message Header

RX	3		TX	255
LN	4	Auto NR □	NR	0
A	0		F	0
B	84		E	0

Telegram Header: Device Adr. / Data Area / Data Adr. / Data Idx. / Data Count / Data Type / Function / □ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	252	162	4	1						
10										
20										
30										
40										
50										
60										
70										

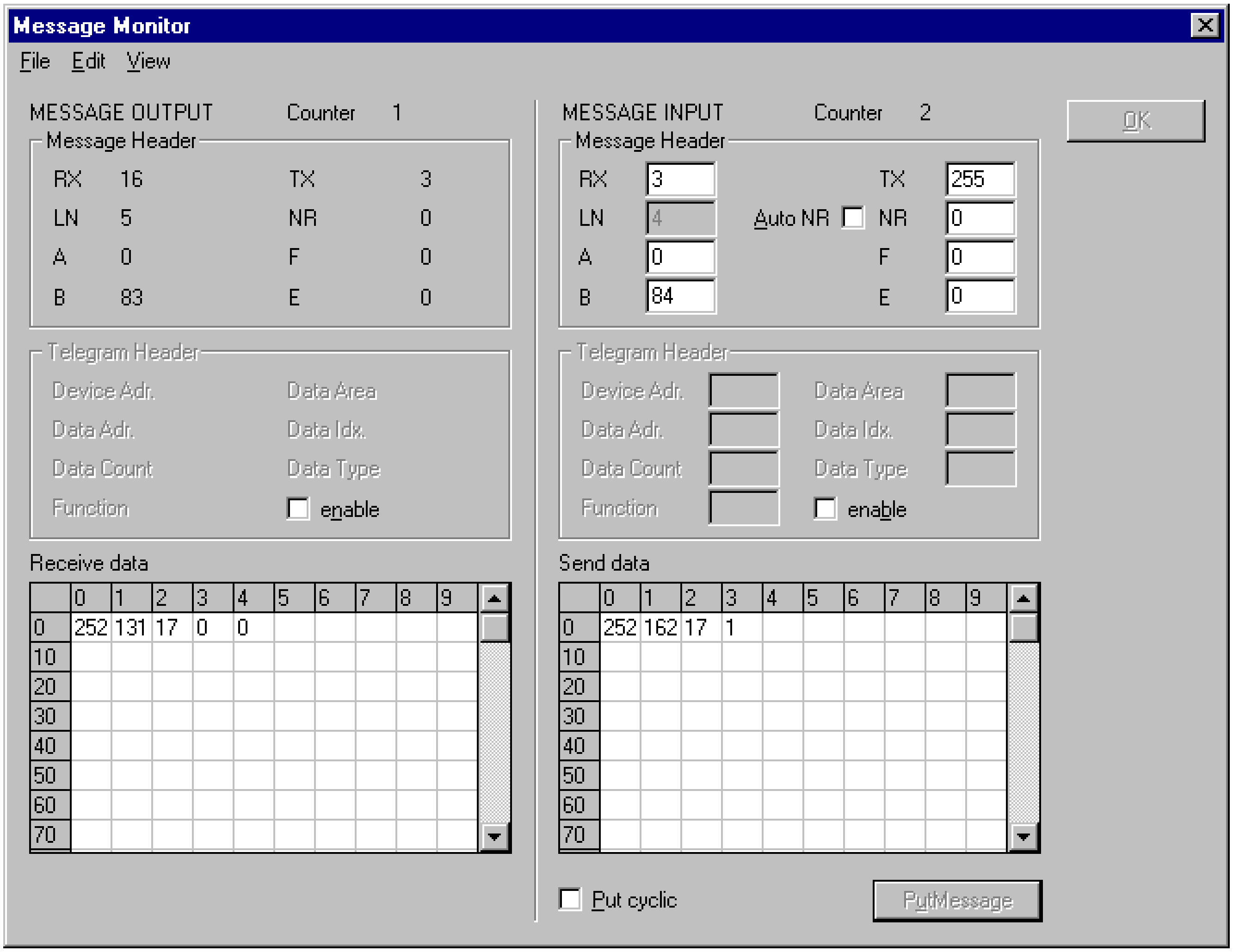
□ Put cyclic

Figure 49: Message Monitor LSS/LMT (1) > Switch Configuration Mode on

Set the Node Address

Message for Sending via CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 84	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Receive ID Part 1 (LSB)	252
	CAN Receive ID Part 2 (MSB)	162
	Send data 1: Set Node ID	17
	Send data 2: Node Address	1...127

Table 17: Message Monitor LSS/LMT (2) > Set Node Address



MESSAGE OUTPUT Counter 1

Message Header

RX	16	TX	3
LN	5	NR	0
A	0	F	0
B	83	E	0

Telegram Header

Device Adr. Data Area
Data Adr. Data Idx.
Data Count Data Type
Function □ enable

Receive data

	0	1	2	3	4	5	6	7	8	9
0	252	131	17	0	0					
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 2

Message Header

RX	3		TX	255
LN	4	Auto NR □	NR	0
A	0		F	0
B	84		E	0

Telegram Header

Device Adr. Data Area
Data Adr. Data Idx.
Data Count Data Type
Function □ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	252	162	17	1						
10										
20										
30										
40										
50										
60										
70										

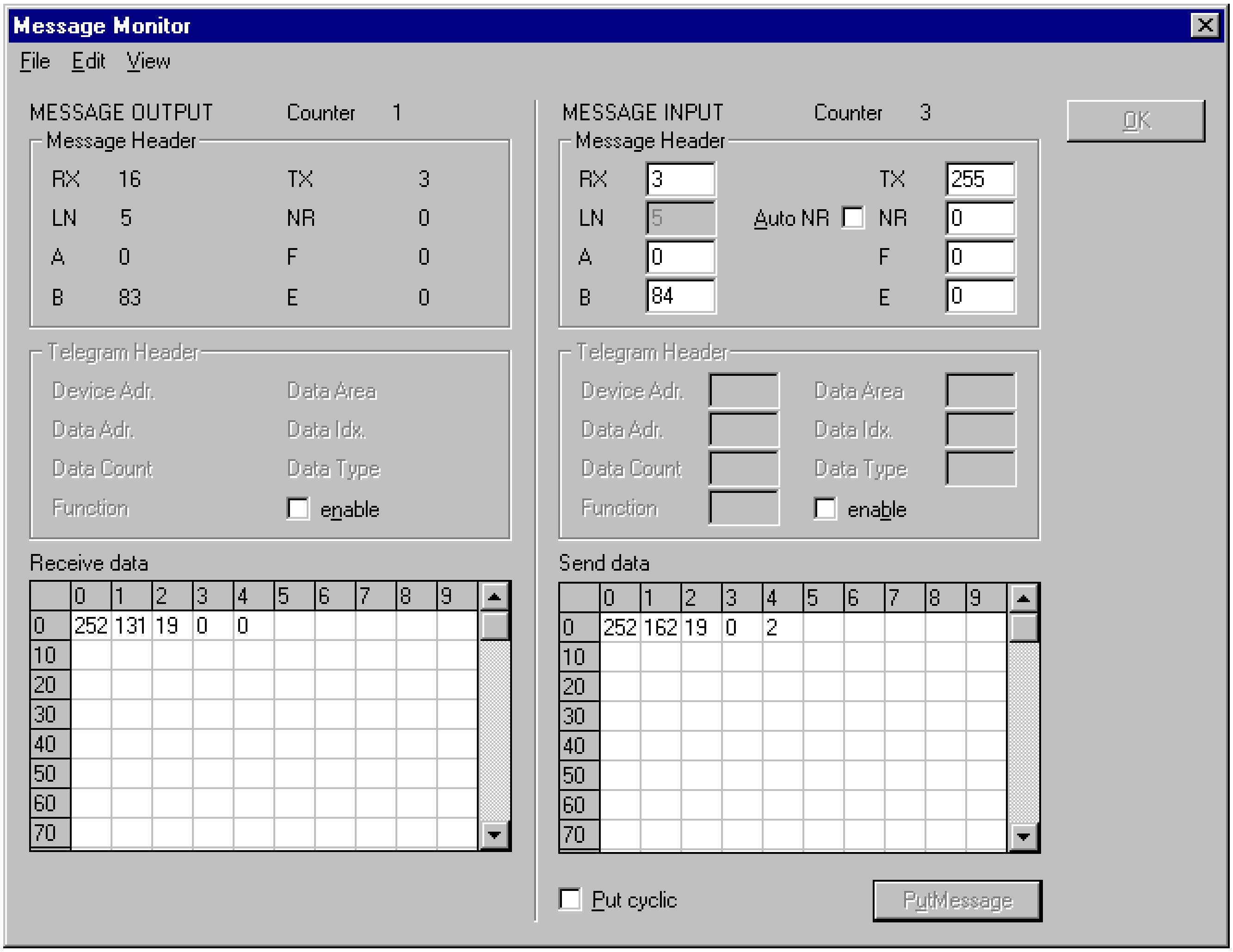
□ Put cyclic

Figure 50: Message Monitor LSS/LMT (2) > Set Node Address

Set Baud Rate

Message for Sending via CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 84	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Receive ID Part 1 (LSB)	252
	CAN Receive ID Part 2 (MSB)	163
	Send data 1: Set Baud Rate	19
	Send data 2: Table	0 (Standard Table) 128...255
	Send data 3: Baud Rate	In case of table 0: 0 = 1 Mbit/s 1 = 800 kbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 125 kbit/s 5 = 50 kbit/s 6 = 20 kbit/s

Table 18: Message Monitor LSS/LMT (3) > Set Baud Rate



MESSAGE OUTPUT Counter 1

Message Header

RX 16 TX 3
LN 5 NR 0
A 0 F 0
B 83 E 0

Telegram Header

Device Adr. Data Area
Data Adr. Data Idx.
Data Count Data Type
Function □ enable

Receive data

	0	1	2	3	4	5	6	7	8	9
0	252	131	19	0	0					
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 3

Message Header

RX 3 TX 255
LN 5 Auto NR □ NR 0
A 0 F 0
B 84 E 0

Telegram Header

Device Adr. Data Area
Data Adr. Data Idx.
Data Count Data Type
Function □ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	252	162	19	0	2					
10										
20										
30										
40										
50										
60										
70										

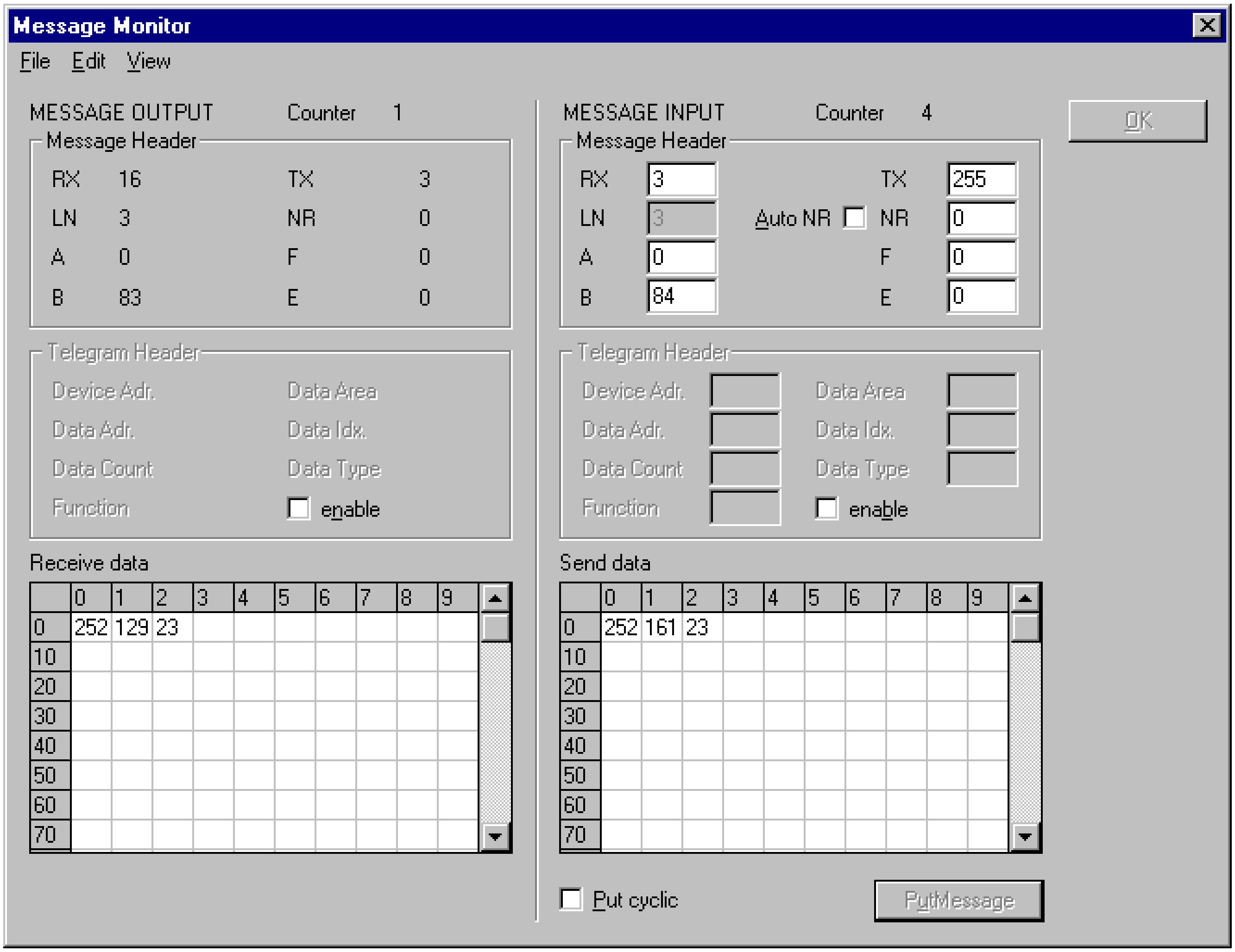
□ Put cyclic

Figure 51: Message Monitor LSS/LMT (3) > Set Baud Rate

Save Configuration

Message for Sending via CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 84	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Send ID Part 1	252
	CAN Send ID Part 2	161
	Send data 1: Save Configuration	23

Table 19: Message Monitor LSS/LMT (4) > Save Configuration



MESSAGE OUTPUT Counter 1

Message Header

RX	16	TX	3
LN	3	NR	0
A	0	F	0
B	83	E	0

Telegram Header

Device Adr. Data Area
Data Adr. Data Idx.
Data Count Data Type
Function □ enable

Receive data

	0	1	2	3	4	5	6	7	8	9
0	252	129	23							
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 4

Message Header

RX	3	TX	255
LN	3	Auto NR □ NR	0
A	0	F	0
B	84	E	0

Telegram Header

Device Adr. Data Area
Data Adr. Data Idx.
Data Count Data Type
Function □ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	252	161	23							
10										
20										
30										
40										
50										
60										
70										

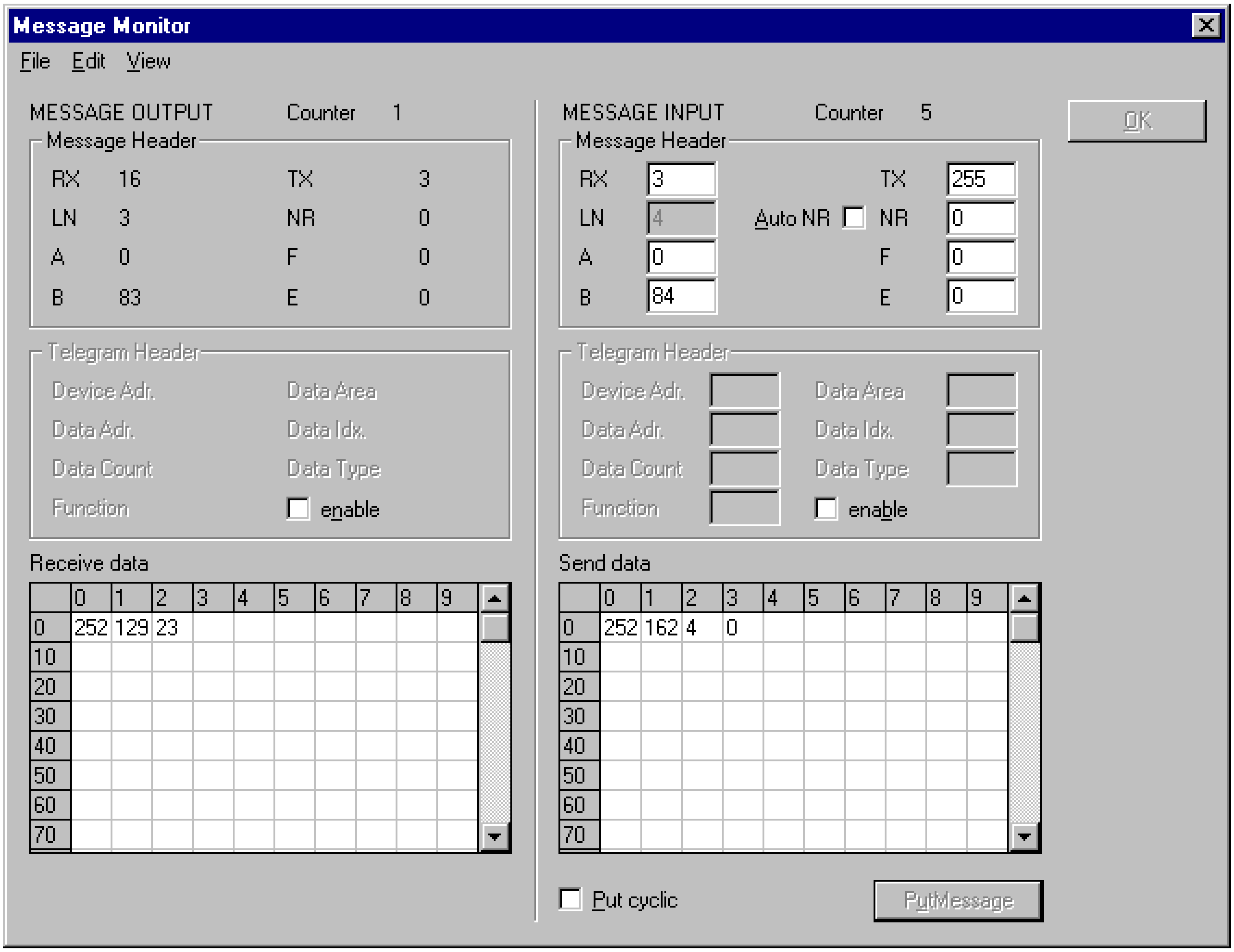
□ Put cyclic

Figure 52: Message Monitor LSS/LMT (4) > Save Configuration

Switch in Operating Mode

Message for Sending via CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 84	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Send ID Part 1	252
	CAN Send ID Part 2	161
	Send data 1: Save Configuration	23

Table 20: Message Monitor LSS/LMT (5) > Switch in Operating Mode



MESSAGE OUTPUT Counter 1

Message Header

RX	16	TX	3
LN	3	NR	0
A	0	F	0
B	83	E	0

Telegram Header

Device Adr. Data Area

Data Adr. Data Idx.

Data Count Data Type

Function □ enable

Receive data

	0	1	2	3	4	5	6	7	8	9
0	252	129	23							
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 5

Message Header

RX	3		TX	255
LN	4	Auto NR □	NR	0
A	0		F	0
B	84		E	0

Telegram Header

Device Adr. Data Area

Data Adr. Data Idx.

Data Count Data Type

Function □ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	252	162	4	0						
10										
20										
30										
40										
50										
60										
70										

□ Put cyclic

Figure 53: Message Monitor LSS/LMT (5) > Switch in Operating Mode

6.20 Message Monitor for Sending or Receiving Transparent CAN Telegrams

Using Messages it is possible to send and receive CAN telegrams (Layer 2).

6.21 Message Monitor for Sending CAN Telegrams (transparent)

The following steps show how to send CAN telegrams to the SmartStack Master and/or Node using the Message Monitor.

Message for Sending via CAN (Layer 2)		
Message Header		
Rx = 3 (fixed)	Tx = 255	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 84	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Send ID Part 1	0...255
	CAN Send ID Part 2	0...255
	Send data 1, if available	0...255
	Send data 2, if available	0...255
	Send data 3, if available	0...255
	Send data 4, if available	0...255
	Send data 5, if available	0...255
	Send data 6, if available	0...255
	Send data 7, if available	0...255
	Send data 8, if available	0...255

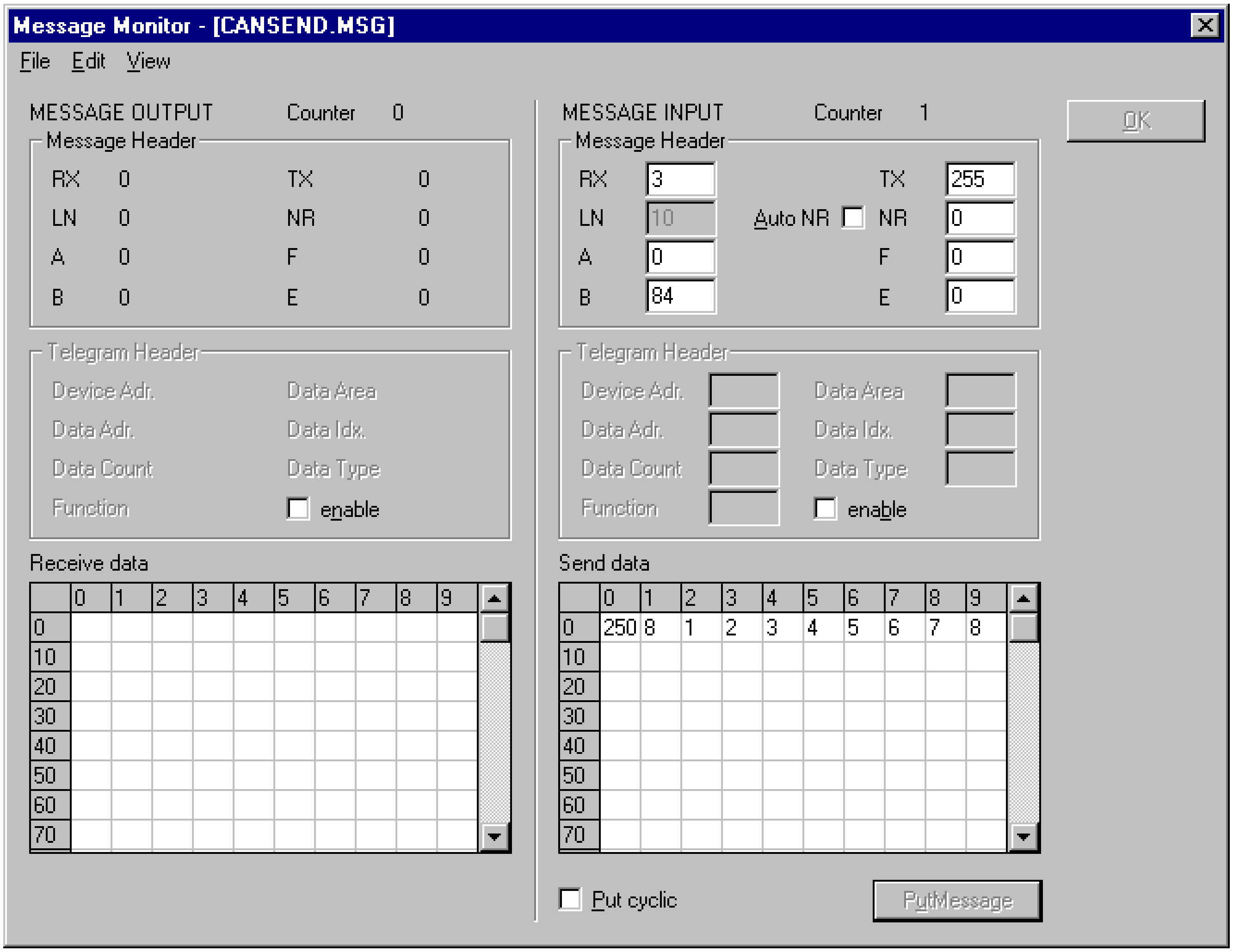
Table 21: Message Monitor for Sending CAN Telegrams (transparent)

Note: If the SmartStack device is used simultaneously with other CANopen device, then the Identifiers are already used. It is the responsibility of the user to ensure that no conflicts occur.

The CAN Send ID consists of two Bytes and is formed as follows:
The CAN ID (range : 0 to 2047) is multiplied by 32 and the data length (range : 0 to 8) is added. CAN Send ID Part 1 is then the high order byte and CAN Send ID Part 2 is the low order byte.

Example: If the CAN telegram with CAN ID 2000 and 8 bytes of user data should be sent, the following results: 2000 * 32 + 8 = 64008 (FA08H). Then the CAN Send IP Part 1 is 250 (FAH) and CAN Send IP Part 2 is 8 (08H).

The following picture shows how to send the message CAN ID 2000 with 8 user data bytes. The user data here is 1, 2, 3, 4, 5, 6, 7 and 8.



MESSAGE OUTPUT Counter 0

Message Header

RX	0	TX	0
LN	0	NR	0
A	0	F	0
B	0	E	0

□ enable

Receive data

MESSAGE INPUT Counter 1

Message Header

RX	3		TX	255
LN	10	Auto NR □	NR	0
A	0		F	0
B	84		E	0

□ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	250	8	1	2	3	4	5	6	7	8
10										
20										
30										
40										
50										
60										
70										

□ Put cyclic

Figure 54: Message Monitor for Sending CAN telegrams (transparent)

Note: The sending of the telegram is not confirmed and the error number 2025 appears.

6.22 Message Monitor for Receiving CAN Telegrams (transparent)

To receive messages the receive filter must be. In the following the Message Monitor for setting the receive filter of the SmartStack Master and/or SmartStack Node is described.
To set the receive filter type the following in the Message Monitor:

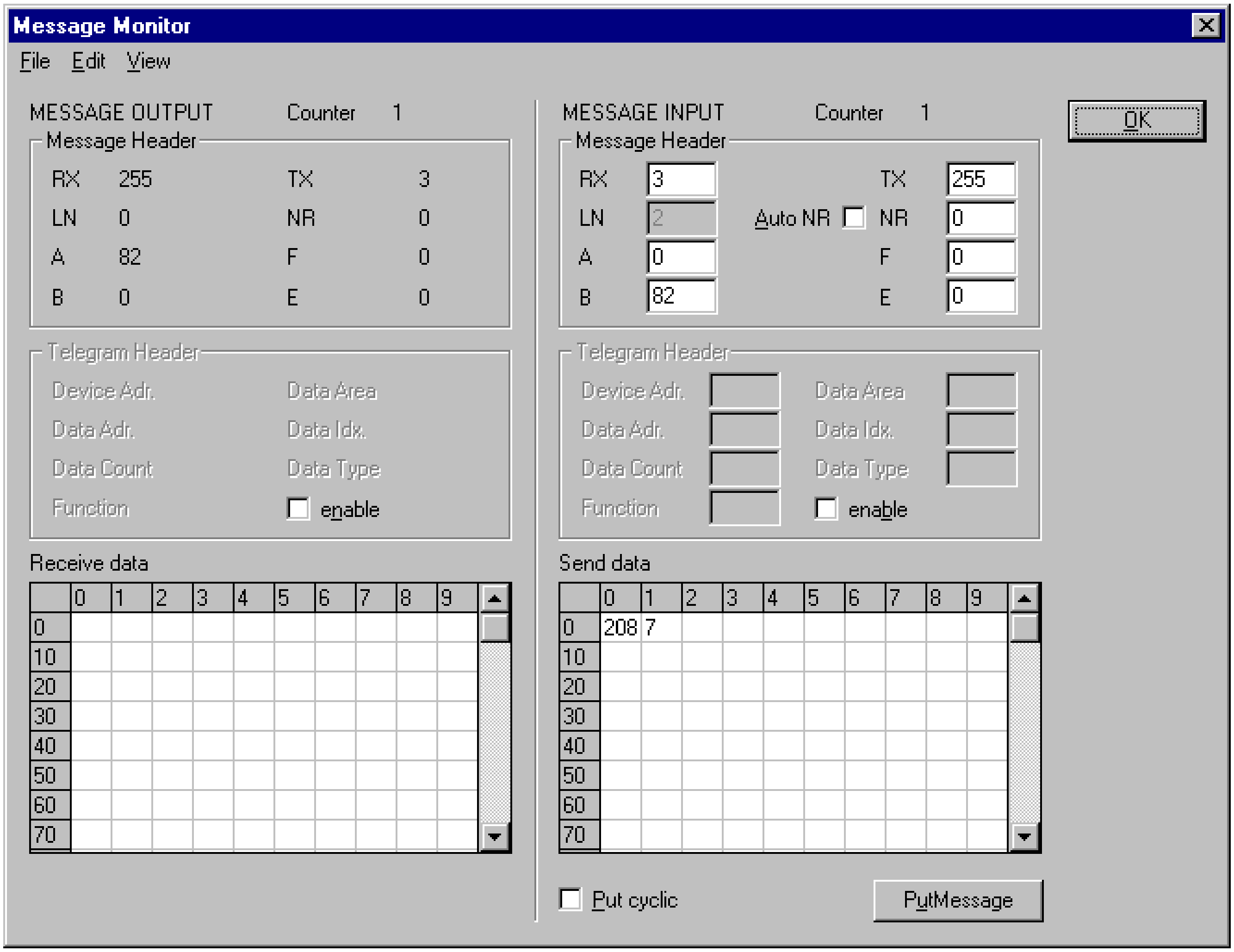
Message for Setting the Receive Filter CAN (Layer 2)	
Message Header	
Rx = 3 (fixed)	Tx = 255
Ln = (is calculated)	Nr = 0...255
A = 0	F = 0
B = 82	E = 0

Send Data	Meaning for CAN	Range of value
	CAN Receive ID Part 1	0...255
	CAN Receive ID Part 2	0...7

Table 22: Message Monitor for Setting the Receive Filter

The CAN Receive ID consists of two bytes and is formed as follows:
The CAN ID (range : 0 to 2047) is segmented in low and high order bytes. Where the CAN Receive ID Part 1 is the low order byte and the CAN Receive ID Part 2 the high order byte.
Example: If the CAN telegram with CAN ID 2000 is to be received, then : 2000 (07D0H). Then CAN Receive ID Part 1 is equal to 208 (D0H) and CAN Receive ID Part 2 is 7 (07H).

The following picture shows the setting of the receive filter for CAN ID 2000.



MESSAGE OUTPUT Counter 1

Message Header

RX	255	TX	3
LN	0	NR	0
A	82	F	0
B	0	E	0

Telegram Header

Device Adr. Data Area

Data Adr. Data Idx.

Data Count Data Type

Function □ enable

Receive data

	0	1	2	3	4	5	6	7	8	9
0										
10										
20										
30										
40										
50										
60										
70										

MESSAGE INPUT Counter 1

Message Header

RX	3		TX	255
LN	2	Auto NR □	NR	0
A	0		F	0
B	82		E	0

Telegram Header

Device Adr. Data Area

Data Adr. Data Idx.

Data Count Data Type

Function □ enable

Send data

	0	1	2	3	4	5	6	7	8	9
0	208	7								
10										
20										
30										
40										
50										
60										
70										

□ Put cyclic

Figure 55: Message Monitor for Setting the Receive Filter

The following describes the Message Monitor with the Receive of CAN telegrams at the SmartStack Master and/or SmartStack Node.
Upon receipt of a telegram the following appears in the Message Monitor:

Message for Setting the Receive Filter CAN (Layer 2)		
Message Header		
Rx = 16 (fixed)	Tx = 3	
Ln = (is calculated)	Nr = 0...255	
A = 0	F = 0	
B = 83	E = 0	
Send Data	**Meaning for CAN**	**Range of value**
	CAN Receive ID Part 1	0...255
	CAN Receive ID Part 2	0...255
	Receive data 1, if available	0...255
	Receive data 2, if available	0...255
	Receive data 3, if available	0...255
	Receive data 4, if available	0...255
	Receive data 5, if available	0...255
	Receive data 6, if available	0...255
	Receive data 7, if available	0...255
	Receive data 8, if available	0...255

Table 23: Message Monitor for Receiving of CAN telegrams (transparent)

Note: This is only possible via the dual-port memory. It is not possible via a serial connection (COM Serial Driver). The CAN Receive ID consists of two bytes and contains the CAN telegram ID and the data length. It is evaluated like follows:
CAN Receive ID Part 1 is the high order byte and the ID part 2 is the low order byte.

CHAPTER 7: FILE, PRINT, EDIT, EXPORT AND VIEW

7.1 File

7.1.1 Open

An existing project can be opened with **File > open**.

7.1.2 Save and Save As

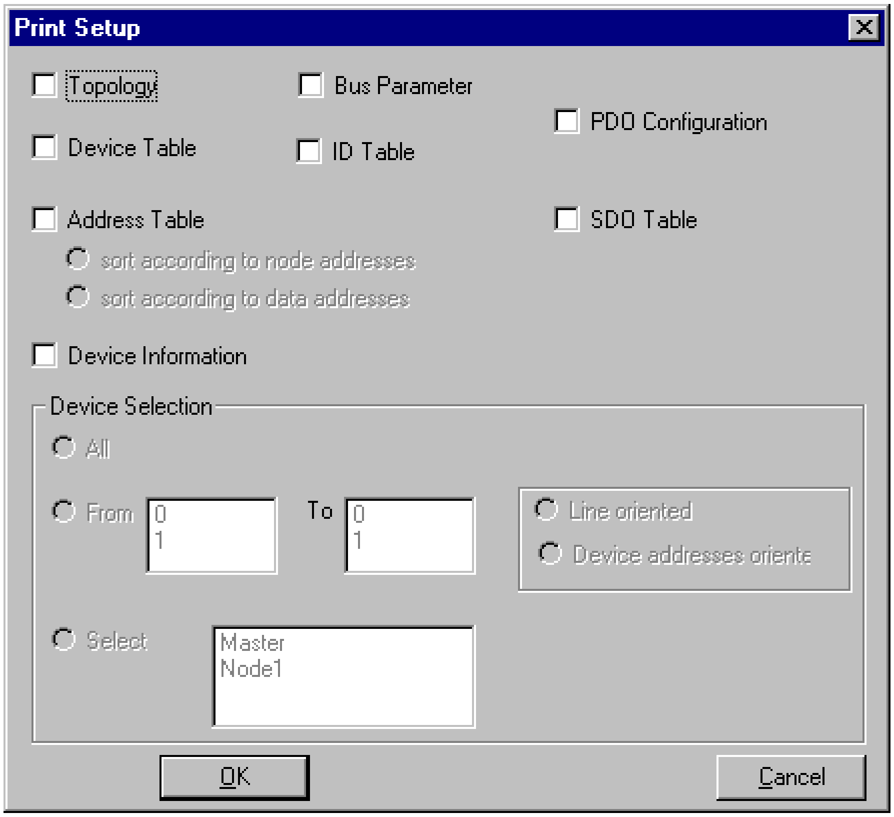
When the file name is known, the configuration can be saved under the **File > Save** menu, otherwise the **File > Save As** menu must be selected.

7.1.3 Close

The current project can be closed with **File > Close**.

7.2 Print

Once the required printer has been selected in the **File > Printer Setup** menu, the configuration can be printed out under the **File > Print** menu. For a page view, select the **File > Page View** menu.



Print Setup

□ Topology
□ Bus Parameter
□ PDO Configuration
□ Device Table
□ ID Table
□ Address Table
○ sort according to node addresses
○ sort according to data addresses
□ SDO Table
□ Device Information

Device Selection
○ All
○ From 0 1 To 0 1
○ Line oriented
○ Device addresses oriente
○ Select Master Node1

Figure 56: File > Print

The default setting prints information one sheet per device.
Topology - prints the topology of the Bus system.
Bus parameters - prints the Bus Parameters of the Bus system.
Address table - prints the address table of the Master.

Device table - prints the device table.
ID Table - prints the ID Table.
PDO Configuration - prints the **PDO Configuration**.
SDO Table - prints the **SDO Table**.
The scope can be given with the **Device Selection** menu point. The following can be chosen:

- All
- From Station address to Station address
- Selection of a device by means of its description

If no option is selected and the **OK** button is pressed nothing will be printed.

7.3 Export Functions

7.3.1 DBM Export

Select the **File > Export > DBM menu** in order to save the previously saved project file (*.PB Microsoft Access Format) in a DBM file (HSyCon binary format). This DBM file can be retrieved in the DOS Compro program. The configuration is stored in the Project directory in the path of the HSyCon Installation with the extension *.dpm.

Attention: The file name can have max. 8 characters.

7.3.2 CSV Export

With the menu **File > Export > CSV** the configuration data of the connected Slaves can be exported into a table. The configuration must be saved before the export is executed. The exported file has the ending .csv (comma separated value) and is saved in the same directory as the configuration, but with the ending *.csv.
The CSV file can be read with a table program such as Excel.
The CSV Export only saves the text and the values of the configured Slaves. The meaning of the individual values must be shown in the table.

Here are the description of the parameters:

Parameter	Meaning
Stationaddress	The Station address is the unique device address of the Slave on the bus.
RecordType	The Record Type defines the version of the following structure and is always 2.
IdentNumber	This number is the unique device number of the Slave.
VendorNumber	The Vendor Number is the unique number of the vendor (if available).
VendorName	Here the name of the vendor is shown (max. 32 characters).
Device	Name of the device (max. 32 characters).
Description	This is the description of the device, which is set by the user (max. 32 char).
MasterAddress	This is the number of the Master Address, which the devices are related to.
Settings	Contains information about the addressing mode and the storage format of the process data (words, double words and floats).
Reserved	reserved
ModulCount	Number of the modules of the device. For each modul the parameters data type, data size, data position and offset address are given. It can be follow ed by max 60 modules. The parameters for modul 1 are marked with ..._0 and of the modul 60 are marked with ..._59.

DataSize_0	Number of bytes, which are used by the module.
DataType_0	The Data Type, which is used in the configuration.
DataPosition_0	The byte Data Position, which is used in the configuration.
Address_0	Offset Address in the Dual-port memory
...	...
DataSize_59	if used, see at the top
DataType_59	if used, see at the top
DataPosition_59	if used, see at the top
Address_59	if used, see at the top

Table 24: CSV Export - Meaning of the values

7.3.2.1 Description of the Parameter Settings

D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
Reserved Area						Format	Address Mode
reserved						1 little endian (LSB/MSB) 0 big endian (MSB/LSB)	0 byte Address 1 word Address

Table 25: CSV-Export - Description of the Byte Settings

7.3.2.2 Description of the Parameter DataType

D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
SubFlag	Data Direction			Data Format			
0 start of a module 1 submodule	0 emty space 1 input 2 output			according EN standard 0 blank space 1 Boolean 2 Integer 8 3 Integer 16 4 Integer 32 5 Unsigned Integer 8 6 Unsigned Integer 16 7 Unsigned Integer 32 8 Float 9 ASCII 10 String 14 Bit			

Table 26: CSV Export > DataType Code

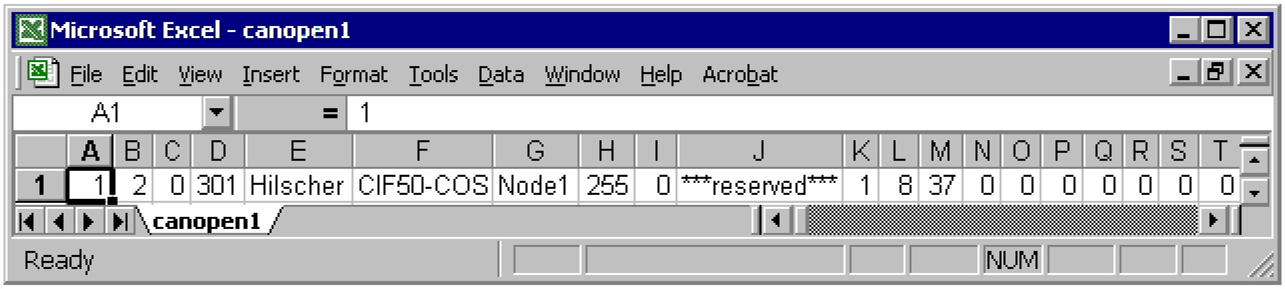
7.3.2.3 Description of the Parameter DataPosition

D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
Reserved Area				Bit Position			
reserved				Bit Position of the Offset Address			

Table 27: CSV Export > DataPosition Code

7.3.2.4 Example of a CSV file

Example of a CSV file which was exported to Excel:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	1	2	0	301	Hilscher	CIF50-COS	Node1	255	0	***reserved***	1	8	37	0	0	0	0	0	0	0

Figure 57: Example of a CSV File in Excel

Cell	**Parameter**	**Value**	**Meaning**
A1	StationAddress	1	Station address of the CANopen Node.
B1	RecordType	2	The RecordType is always 2.
C1	IdentNumber	0	IdentNumber of the Node.
D1	VendorNumber	301	The vendor number is 301.
E1	VendorName	Hilscher	Vendor name of the device.
F1	Device	CIF 50-COS	Description of the device.
G1	Description	Node1	Description of the device which is also shown in HSyCon as the name of the device.
H1	MasterAddress	255	Address of the related Master.
I1	Settings	0	The addressing mode (byte- or word addressing) and the data format of the process data are shown.
J1	reserved	reserved	reserved
K1	ModulCount	1	Number of the modules of the device. For each modul the information with datatype, data size, data position and the offsetaddress follow. The information for modul 1 you find in the cells L1, M1, N1, O1 and for modul 2 in the cells P1, Q1, R1, S1 and so on.
L1	DataSize	8	The size of the modul is 8 bytes.
M1	DataType	37	Input; Datatype unsigned Integer 8
N1	DataPosition	0	Output; Datatype unsigned Integer 8
O1	Offsetaddress	0	The Offset address is 0.
P1...IQ1	DataSize	0	The modules 2 till 59 are not used for this device and so a 0 is shown.

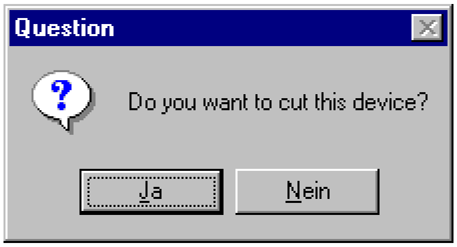
Table 28: Example of a CSV File in Excel

If two or more Slave devices are connected to the Master, these are displayed in the next lines of the table.

7.4 Edit

7.4.1 Cut, Copy and Paste

The menus **Edit > Cut** and **Edit > Copy** allow the cut/copied device with its settings and configuration (not the description of the device) to be put in the Clipboard and with **Edit > Paste** it can be inserted. The difference between **Cut** and **Copy** is:
Menu option **Edit > Cut** moves a device from one point in the configuration to another. While menu option **Edit > Copy** duplicates an existing device. If the **Edit > Cut** is selected a security question appears.

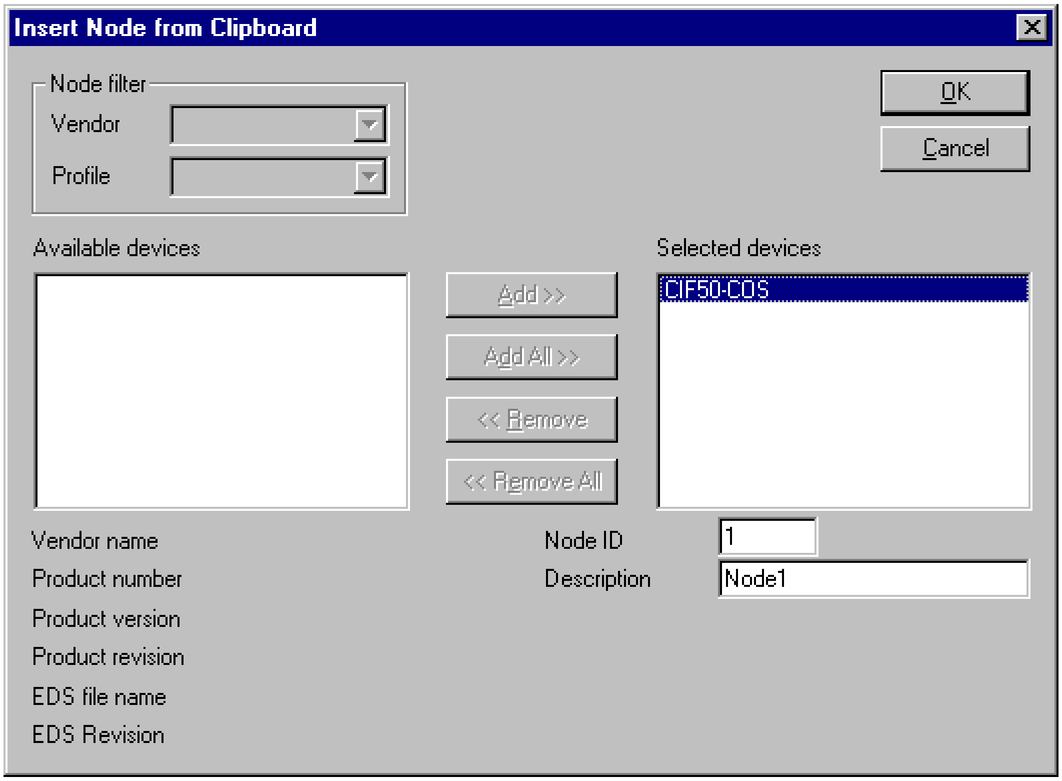


Question

Do you want to cut this device?

Figure 58: Security question cut device

Answer **Yes** to cut the device to the clipboard.
With the menu **Edit > Insert** click on the position where the device should be inserted, a window opens where the cut/copied device can be selected.



Insert Node from Clipboard

Node filter
Vendor:
Profile:

Available devices:

Selected devices: CIF50-COS

Vendor name
Product number
Product version
Product revision
EDS file name
EDS Revision

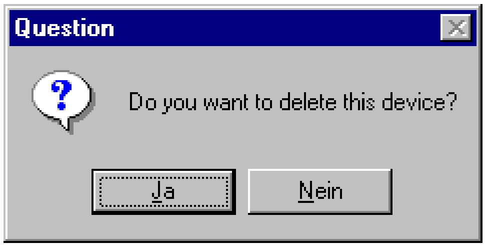
Node ID: 1
Description: Node1

Figure 59: Edit > Insert cut/copied device

Click the **OK** button to insert the device to the configuration.

7.4.2 Delete

To delete the Master or a Slave device mark the device and then select the menu **Edit > Delete**. Before HSyCon deletes the Master or a Slave a security question appears.



Question

Do you want to delete this device?

Figure 60: Security question delete device

Note: Deleted device settings and configuration are lost.

7.4.3 Replace

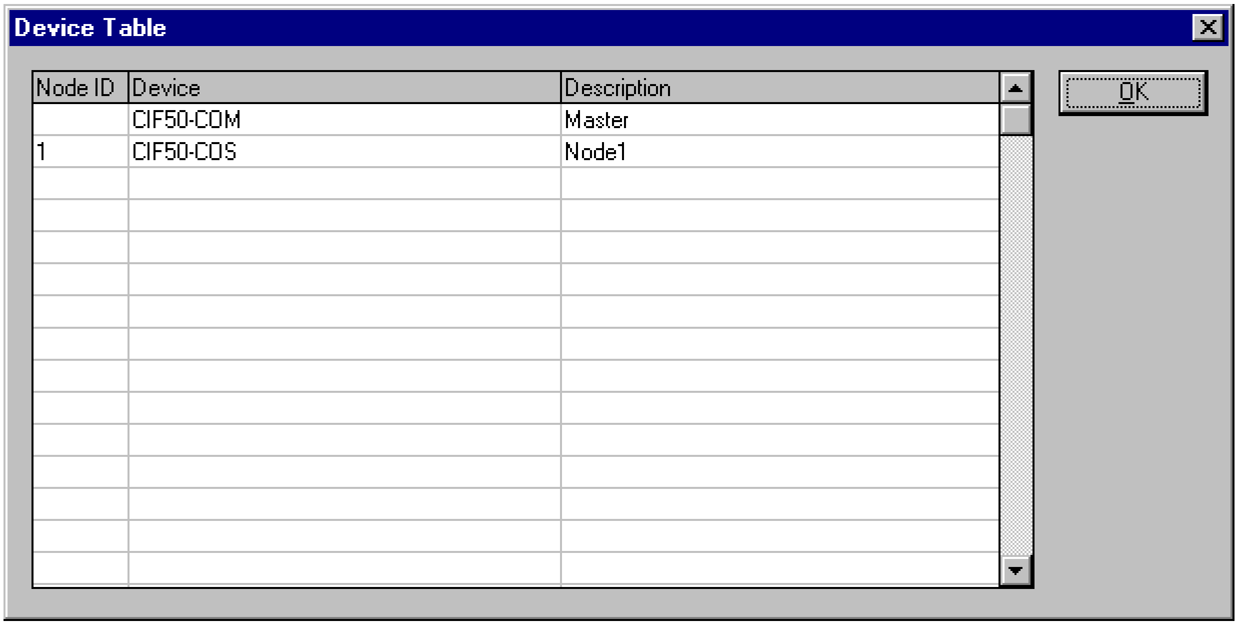
With the menu **Edit > Replace** the Master or a Slave device can be replaced.

7.5 View of the Configuration

The configuration can be displayed in a table. The following tables are available:
- Device Table
- Address Table
- ID Table
- SDO Table

7.5.1 Device Table

The list of all devices added is displayed with the menu item **View > Device Table**. Apart from the Node address the name of the device displayed with the pertinent alterable description.

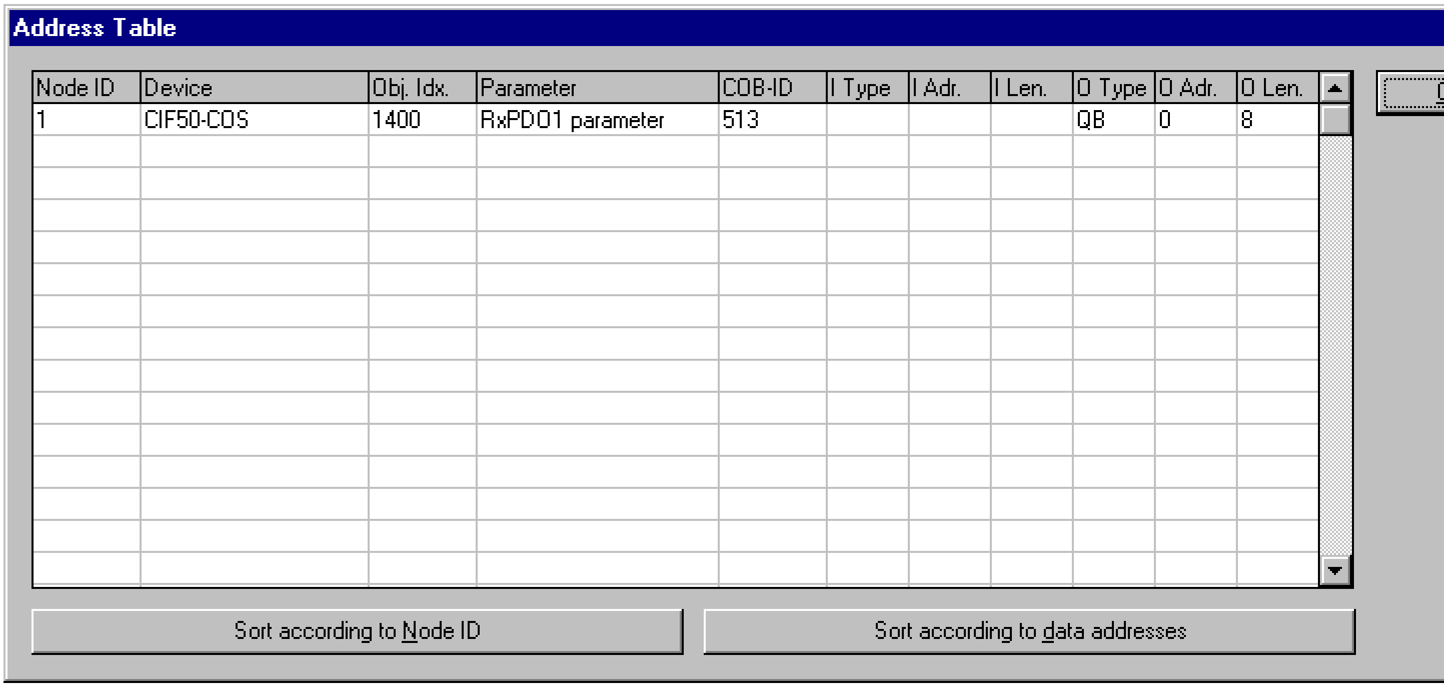


Node ID	Device	Description
	CIF50-COM	Master
1	CIF50-COS	Node1

Figure 61: View > Device Table

7.5.2 Address Table

Menu item **View > Address Table** gives an overview of all configured PDOs and the assigned start addresses in the process image including their length.



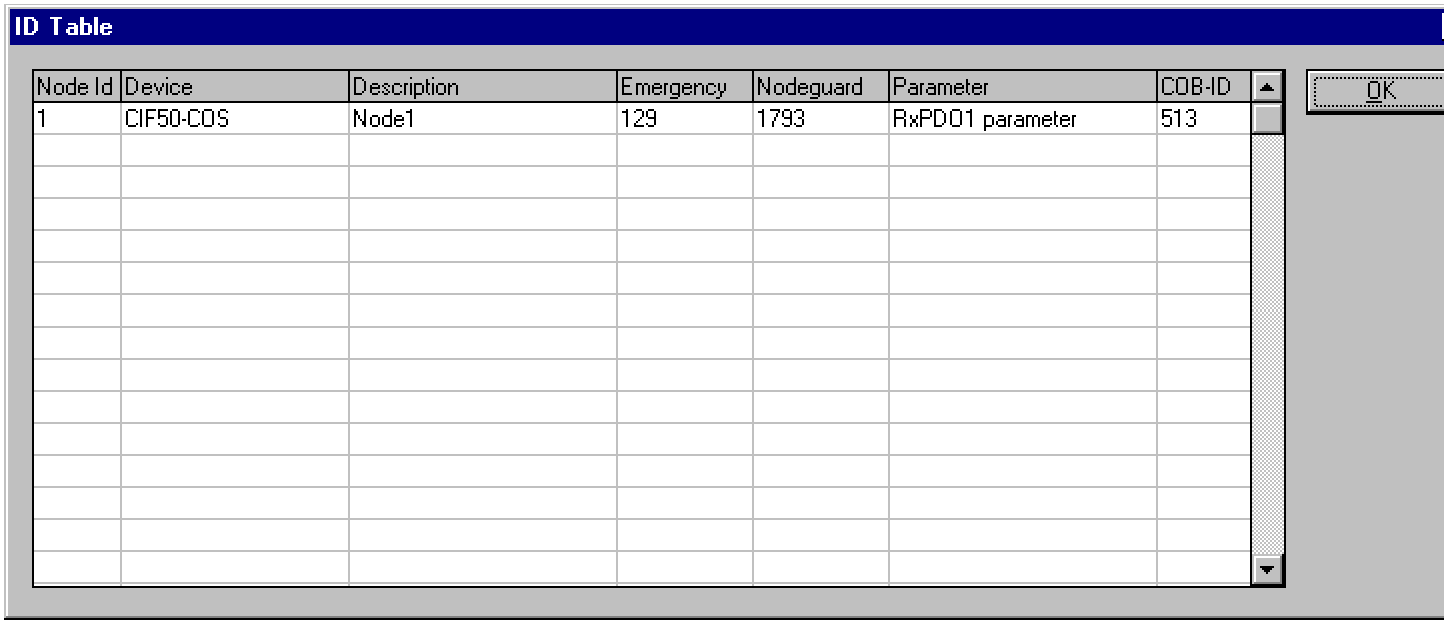
Node ID	Device	Obj. Idx.	Parameter	COB-ID	I Type	I Adr.	I Len.	O Type	O Adr.	O Len.
1	CIF50-COS	1400	RxPDO1 parameter	513				QB	0	8

Figure 62: View > Address Table

It is possible to sort the addresses according to Station Addresses or according to Data Addresses.

7.5.3 ID Table

Menu item **View > ID Table** shows a sorted list for each Node, what message numbers in the CAN network are occupied by the respective Nodes. These are the Emergency ID, Nodeguard ID and PDO IDs.



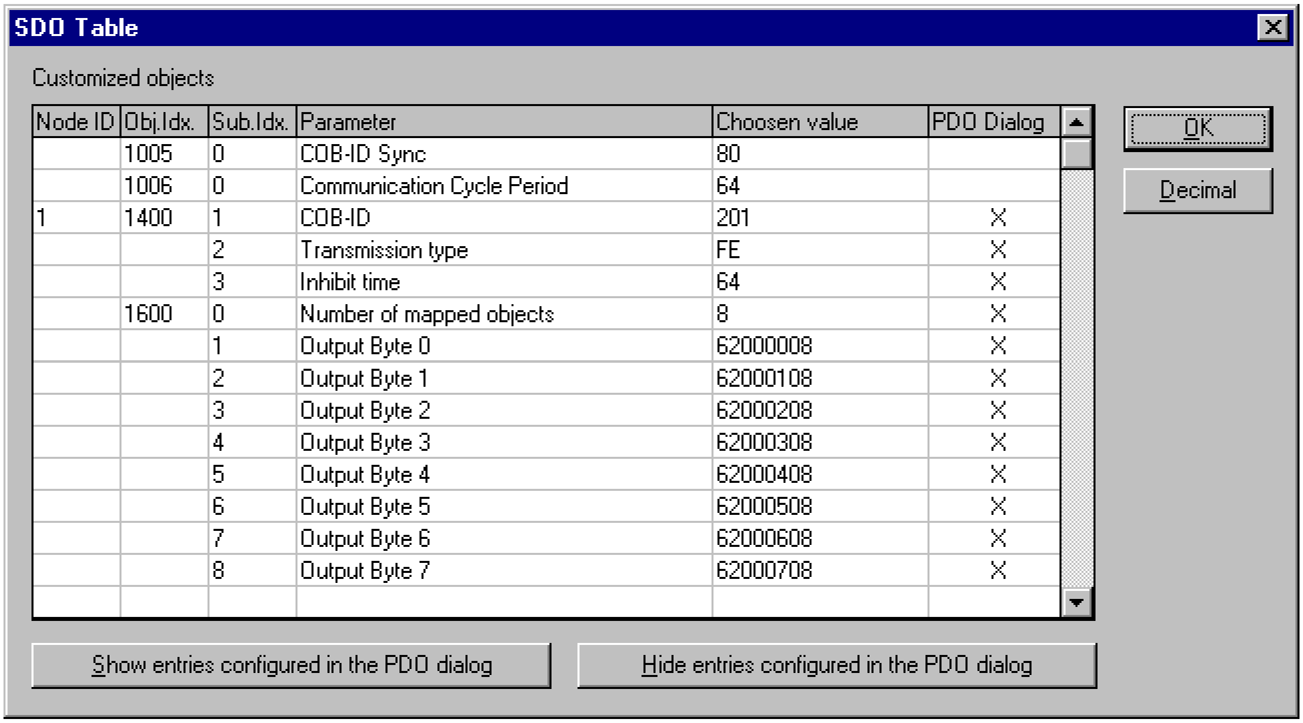
ID Table

Node Id	Device	Description	Emergency	Nodeguard	Parameter	COB-ID
1	CIF50-COS	Node1	129	1793	RxPDO1 parameter	513

Figure 63: View > ID Table

7.5.4 SDO Table

Menu item **View > SDO Table** shows an overview of the transmitted objects during the Node BootUp phase for each Node. Apart from the Node Address for each entry the Object and Subindex are displayed with the pertinent value. Thereby if a line contains a cross in the column PDO Dialog, then the entry was created automatically when inserting a PDO by HSyCon and can be changed. If an entry does not contain a cross in the column PDO Dialog, then the appropriate object is manually created and can be changed there. Exceptions are the entries COB-ID SYNC and Communication Cycle Period, which can only be changed in the dialog. It is possible to hide or display the configured objects of the PDO Dialog. The object values can be shown in decimal or hexadecimal.


SDO Table
Customized objects
OK
Decimal
Show entries configured in the PDO dialog
Hide entries configured in the PDO dialog

Node ID	Obj.Idx.	Sub.Idx.	Parameter	Choosen value	PDO Dialog
	1005	0	COB-ID Sync	80	
	1006	0	Communication Cycle Period	64	
1	1400	1	COB-ID	201	X
		2	Transmission type	FE	X
		3	Inhibit time	64	X
	1600	0	Number of mapped objects	8	X
		1	Output Byte 0	62000008	X
		2	Output Byte 1	62000108	X
		3	Output Byte 2	62000208	X
		4	Output Byte 3	62000308	X
		5	Output Byte 4	62000408	X
		6	Output Byte 5	62000508	X
		7	Output Byte 6	62000608	X
		8	Output Byte 7	62000708	X

Figure 64: View > SDO Table

7.6 View Menu SyCon

7.6.1 Logical Network View

In the menu **View > Logical Network View** the user can activate or deactivate the network view by selecting it (with hook) or by not selecting it (without hook).
The network view is used for example for the Start Options.

7.6.2 Toolbars

In the menu **View > Toolbars** the user has the possibility to activate or deactivate the Toolbars **Standard** and **Fieldbus**. If this function is deactivated the toolbars are not shown.

7.6.3 Status Bar

In the menu **View > Status Bar** this bar can be activated (with hook) or deactivated (without hook).

CHAPTER 8: ERROR CODES

8.1 CIF Serial Driver Error Numbers (-20 .. -71)

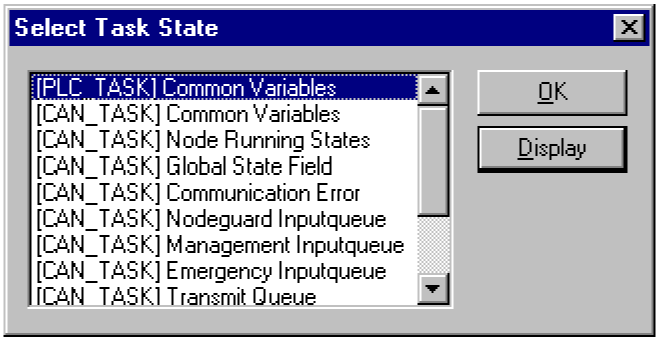
This is the list of error numbers using the serial driver.

Error No.	Description	Error No.	Description
-20	Driver: No COM port found or COM port already in use.	-50	User: Send message, timeout error
-21	Driver: COM port already opened	-51	User: Could not send a message : Cable not connected. Wrong cable. Device does not respond.
-22	Driver: Function call into driver has failed	-52	User: Send message, no device connected
-23	Driver: Internal driver error	-53	User: Error by send message, message receiving.
-24	Driver: Could not create read thread	-54	User: Telegram collision
-25	Driver: Could not create read event	-55	User: Telegram, no acknowledgement received
-26	Driver: Could not create write event	-56	User: Telegram, noise
-27	Driver: Could not create timer event	-57	User: Telegram, data overrun
-28	Driver: Error by writing data	-58	User: Telegram, parity error
-29	Driver: Wrong COM state	-59	User: Telegram, framing error
-30	Driver: COM state error is set	-60	User: Telegram, unknown error
-31	Driver: COM buffer setup failed	-70	User: Timeout by receive a message
-32	Driver: COM set timeout failed	-71	User: No message received
-33	Driver: Receive buffer overrun		
-34	Driver: Receive buffer full		
-35	Driver: Send busy		
-36	Driver: Error during close driver		
-40	User: COM port not opened		
-41	User: Invalid handle value		
-42	User: Invalid COM number		
-43	User: Size parameter invalid		
-44	User: Size parameter zero		
-45	User: Buffer pointer is NULL		
-46	User: Buffer too short		
-47	User: Setup error		

Table 29: CIF Serial Driver Error Numbers (-20..-71)

9.1 Extended Device Diagnostic Master

The menu item **Online > Extended Device Diagnostic** helps to find possible network and configuration faults while trying to get the network fully operative. This menu shows a list of available structures. The listed structures can be displayed to show the values. The structures will be reset after power on and after a cold or warmstart command.



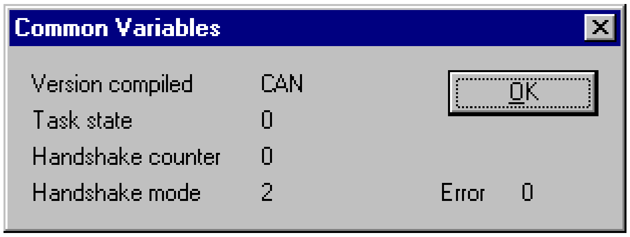
Select Task State

[PLC_TASK] Common Variables
[CAN_TASK] Common Variables
[CAN_TASK] Node Running States
[CAN_TASK] Global State Field
[CAN_TASK] Communication Error
[CAN_TASK] Nodeguard Inputqueue
[CAN_TASK] Management Inputqueue
[CAN_TASK] Emergency Inputqueue
[CAN_TASK] Transmit Queue

Figure 65: Online > Extended Device Diagnostic

These functions contain online counters, values, parameters and status. Several task states are also available.

9.1.1 PLC_TASK Common Variables



Common Variables

Version compiled CAN
Task state 0
Handshake counter 0
Handshake mode 2
Error 0

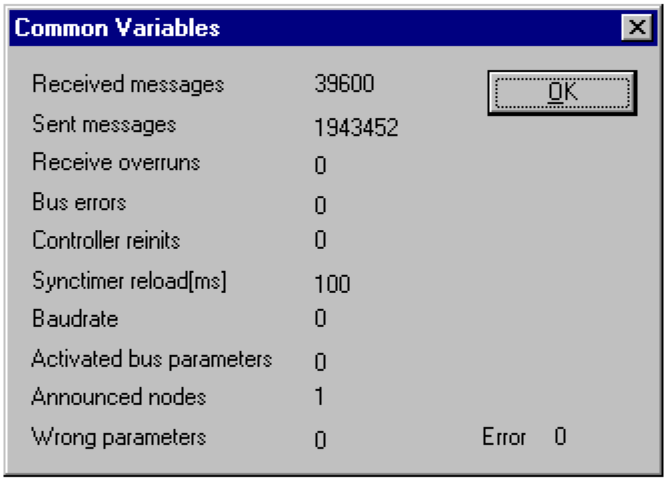
Figure 66: PLC_TASK Common Variables

The definition of the data is explained below :

Variable	Meaning
Version compiled	- Indicates the hardware version the software is compiled for.
Task state	- Is always 0.
Handshake counter	- Number of process data handshakes done with the application.
Handshake mode	- Represents the process data handshake mode the card is running with. The mode can be switched in the menu **Settings > CANopen Master Settings.**

Table 30: PLC_TASK Common Variables

9.1.2 CAN_TASK Common Variables



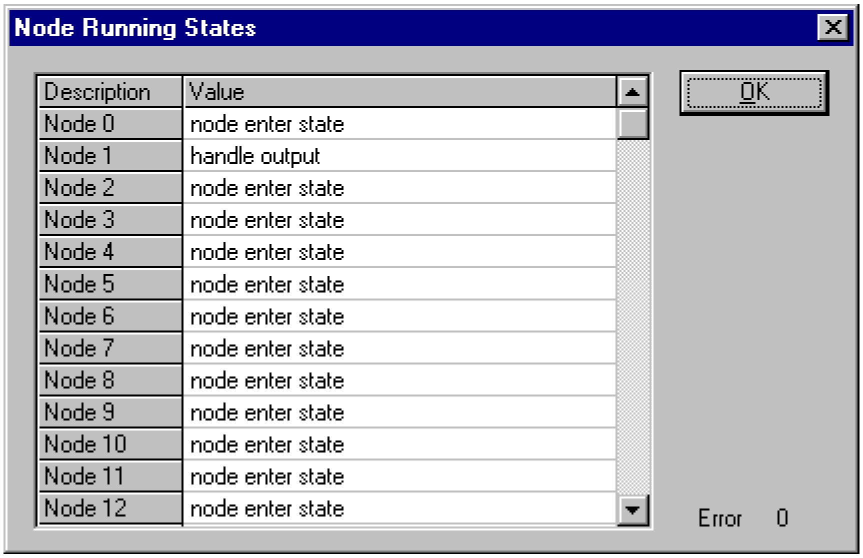
Received messages 39600
Sent messages 1943452
Receive overruns 0
Bus errors 0
Controller reinits 0
Synctimer reload[ms] 100
Baudrate 0
Activated bus parameters 0
Announced nodes 1
Wrong parameters 0
Error 0

Figure 67: CAN_TASK Common Variables

Variable	Meaning
Received messages	Number of received CAN-Messages
Sent messages	Number of sent CAN-Messages
Receive overruns	This counter is incremented when to many incoming CAN messages overload the master. It should normally contain 0.
Bus errors	The CAN controller has two internal error frame counters for detecting transmission errors, one for receive and one for transmit messages. If one of these error counter oversteps a defined value, the bus error counter is incremented.
Controller reinits	If the internal CAN controller error frame counter oversteps a defined limit the controller goes into the bus off state. If this occurs the controller is reinitialized to be pre-operative and this counter is incremented. A non 0 value is an indication of bad transmission quality, poor bus wiring or low power in the CAN-controller interface driver.
Synctimer reload	This value represents the value that was configured via the menu **Settings > Bus parameter** in HSyCon and shows the actual configured and real value.
Baudrate	This value shows the actual baudrate the master is working with where : 0 = 1Mbaud, 1 = 800Kbaud, 2 = 500kBaud, 3 = 250Kbaud, 4 = 125kBaud, 5 = 100Kbaud, 6 = 50kBaud, 7 = 20kBaud, 8 = 10kBaud
Activated bus parameter	Value 0, the master device has found a configuration data base coming from HsyCon. Value 1, the master device isn't configured and needs to be configured via HSyCon
Announced Nodes	This value represents the number of Node data sets found in the download database.
Wrong parameters	This value indicates if the master has detected any error in a Node data set which in the actual downloaded data base. The counter is incremented for each Node which has an incorrect entry.

Table 31: CAN_TASK Common Variables

9.1.3 CAN_TASK Node Running State



Description	Value
Node 0	node enter state
Node 1	handle output
Node 2	node enter state
Node 3	node enter state
Node 4	node enter state
Node 5	node enter state
Node 6	node enter state
Node 7	node enter state
Node 8	node enter state
Node 9	node enter state
Node 10	node enter state
Node 11	node enter state
Node 12	node enter state

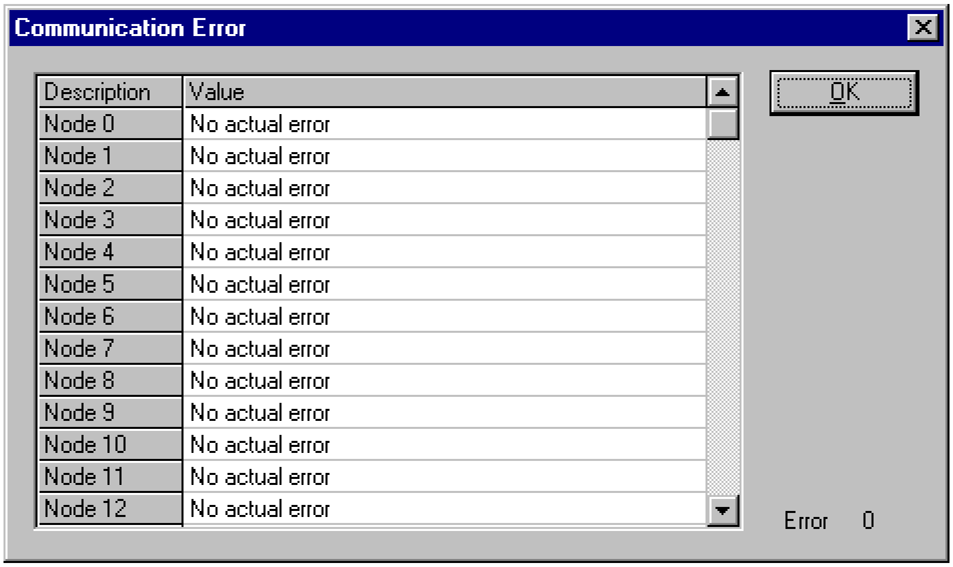
Error 0

Figure 68: CAN_TASK Node Running State

The master device has a Node handler to keep track of the different states of the Nodes. HSyCon interprets the current state of each Node and prints it on the screen in textual form.

9.1.4 CAN_TASK Communication Error

For each Node the master has an internal online error buffer. HSyCon interprets the actual error condition and prints it on the screen in textual form :



Description	Value
Node 0	No actual error
Node 1	No actual error
Node 2	No actual error
Node 3	No actual error
Node 4	No actual error
Node 5	No actual error
Node 6	No actual error
Node 7	No actual error
Node 8	No actual error
Node 9	No actual error
Node 10	No actual error
Node 11	No actual error
Node 12	No actual error

Error 0

Figure 69: CAN_TASK Communication Error

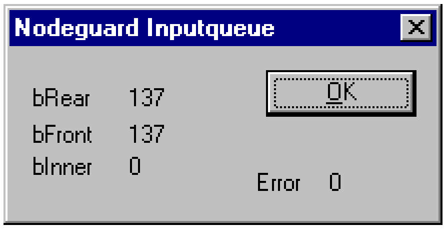
9.1.5 **Queues**

The incoming CAN messages are assigned to an input message queue. Similarly outgoing messages are queued while the CAN transmits the current message. The message queue handler has three parameters the contents of which are shown by HsyCon:

bInner - is the number of actual stored messages.
bFront - is the pointer to where the next message will be stored.
bRear - is the pointer to the next message to be processed.

In a properly operating system the value **bInner** should automatically decrease to 0 and **bFront** and **bRear** should be equal.

9.1.5.1 CAN_TASK Nodeguard Inputqueue



Nodeguard Inputqueue

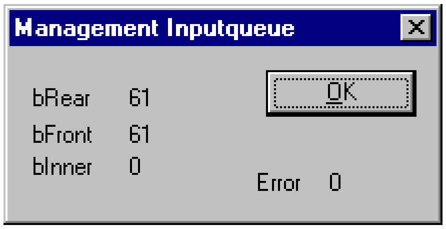
bRear 137
bFront 137
bInner 0
Error 0

Figure 70: CAN_TASK Nodeguard Inputqueue

Variable	Meaning
bRear	Position of the next read access to the received CAN telegrams buffer
bFront	Position of the next write access
bInner	Number of CAN telegrams which are in the buffer

Table 32: CAN_TASK Nodeguard Inputqueue

9.1.5.2 CAN_TASK Management Inputqueue



Management Inputqueue

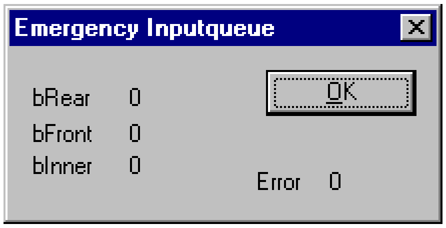
bRear 61
bFront 61
bInner 0
Error 0

Figure 71: CAN_TASK Management Inputqueue

Variable	Meaning
bRear	Position of the next read access in the receive buffer.
bFront	Position of the next write access
bInner	Number of CAN telegrams which are in the buffer

Table 33: CAN_TASK Management Inputqueue

9.1.5.3 CAN_TASK Emergency Inputqueue



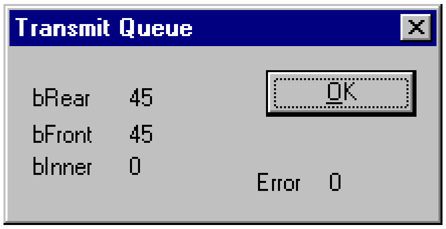
bRear 0
bFront 0
bInner 0
Error 0

Figure 72: CAN_TASK Emergency Inputqueue

Variable	Meaning
bRear	Position of the next read access in the receive buffer.
bFront	Position of the next write access
bInner	Number of CAN telegrams which are in the buffer

Table 34: CAN_TASK Emergency Inputqueue

9.1.5.4 CAN_TASK Transmit Queue



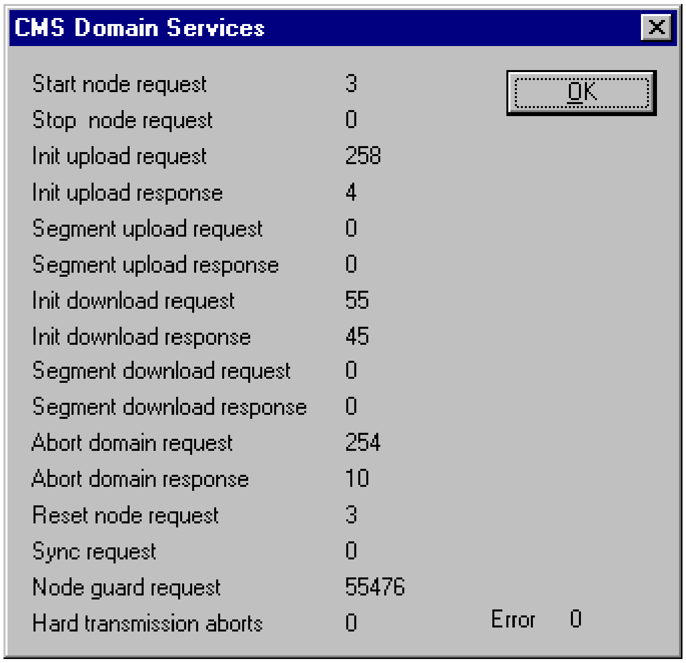
bRear 45
bFront 45
bInner 0
Error 0

Figure 73: CAN_TASK Transmit Queue

Variable	Meaning
bRear	Position of the next read access in the receive buffer.
bFront	Position of the next write access
bInner	Number of CAN telegrams which are in the buffer

Table 35: CAN_TASK Transmit Queue

9.1.6 CAN_TASK CMS Domain Services

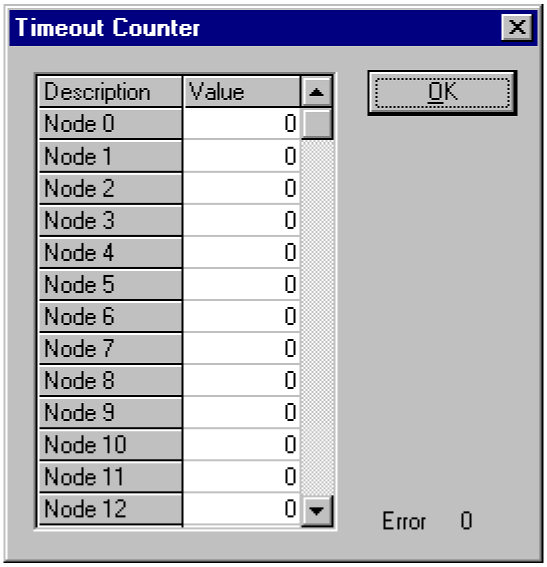


Start node request	3
Stop node request	0
Init upload request	258
Init upload response	4
Segment upload request	0
Segment upload response	0
Init download request	55
Init download response	45
Segment download request	0
Segment download response	0
Abort domain request	254
Abort domain response	10
Reset node request	3
Sync request	0
Node guard request	55476
Hard transmission aborts	0
Error	0

Figure 74: CAN_TASK CMS Domain Services

The CANopen protocol defines different services which are summarised under the name **Domain Services**. All Domain Services that are transmitted and received are counted in this table and shown online by HSyCon. A special value is the **Hard transmission abort** counter. Each CAN message sent is supervised by a timer started simultaneously. If the CAN controller cannot sent the message the timer expires. If this happens the message is discarded and the next message in the queue is readied for attempted transmission. An incrementing **Hard transmission abort** counter is an indication of a physical hardware problem in the network. The fault could be that the baud rate is not correctly configured on a node.

9.1.7 CAN_TASK Timeout Counter



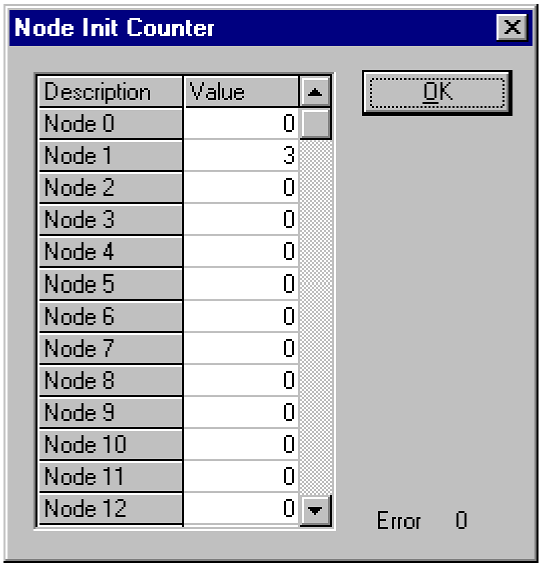
Description	Value
Node 0	0
Node 1	0
Node 2	0
Node 3	0
Node 4	0
Node 5	0
Node 6	0
Node 7	0
Node 8	0
Node 9	0
Node 10	0
Node 11	0
Node 12	0

Error 0

Figure 75: CAN_TASK Timeout Counter

In the CANopen protocol PDOs are transferred without any acknowledge message. However if input PDO data is polled by the master with a remote request telegram each addressed Node must respond. If a Node does not respond to an outstanding remote request, then the **Timeout Counter** of the corresponding Node is incremented. If a counter shows a non zero value it is an indication that the remote request rate is to high for the Node which cannot answer every request. In such case decrease the Node request poll rate in the Node configuration window.

9.1.8 CAN_TASK Node Init Counter



Description	Value
Node 0	0
Node 1	3
Node 2	0
Node 3	0
Node 4	0
Node 5	0
Node 6	0
Node 7	0
Node 8	0
Node 9	0
Node 10	0
Node 11	0
Node 12	0

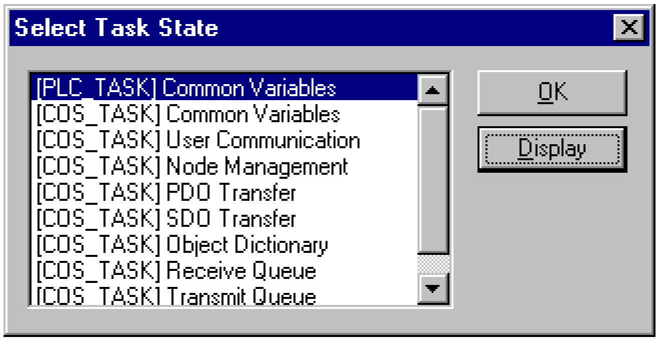
Error 0

Figure 76: CAN_TASK Node Init Counter

The Node init counter is incremented whenever a Node is initialized. The counter should show the value 1 for each configured Node, but if a Node is detected as inactive during the Node guarding procedure, then the master tries to reinitialize the Node. If this happens the Node init counter is incremented . So values larger than 1 are an indication of communication error to the corresponding Node.

9.2 Extended Device Diagnostic Node

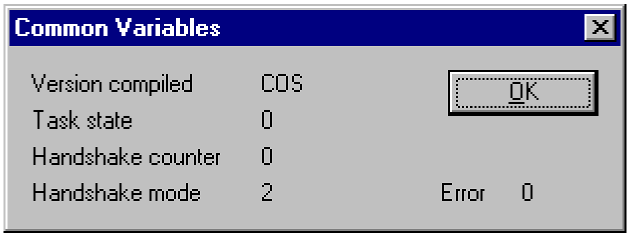
The menu **Online > Extended Device Diagnostic** helps to find possible bus and configuration faults while trying to get the bus fully operative. This menu shows a list of available structures. Click with the right mouse button on the required Node and select the menu Select as actual master. Then select the menu **Online > Extended Device Diagnostic**. This menu activates the following list:



[PLC_TASK] Common Variables
[COS_TASK] Common Variables
[COS_TASK] User Communication
[COS_TASK] Node Management
[COS_TASK] PDO Transfer
[COS_TASK] SDO Transfer
[COS_TASK] Object Dictionary
[COS_TASK] Receive Queue
[COS_TASK] Transmit Queue

Figure 77: Extended Device Diagnostic Node

9.2.1 PCL_TASK Common Variables



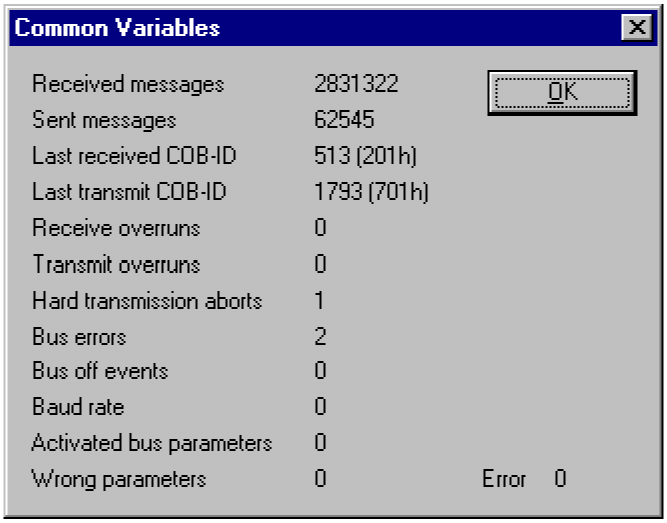
Version compiled	COS
Task state	0
Handshake counter	0
Handshake mode	2
Error	0

Figure 78: PCL_TASK Common Variables

Variable	Meaning
Version compiled	Holds a static text ('COS') indicating the hardware the PLC task was compiled for
Task state	Internal state of the PLC task
Handshake counter	Number handshake cycles executed
Handshake mode	Currently activated handshake mode (1, 2 or 3)

Table 36: PCL_TASK Common Variables

9.2.2 COS_TASK Common Variables



Common Variables

Received messages	2831322
Sent messages	62545
Last received COB-ID	513 (201h)
Last transmit COB-ID	1793 (701h)
Receive overruns	0
Transmit overruns	0
Hard transmission aborts	1
Bus errors	2
Bus off events	0
Baud rate	0
Activated bus parameters	0
Wrong parameters	0

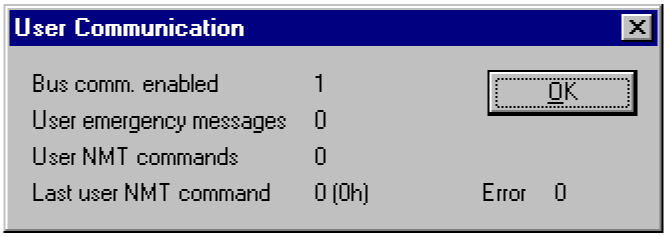
Error 0

Figure 79: COS_TASK Common Variables

Variable	**Meaning**
Received messages	Number of received CAN messages
Sent messages	Number of messages handed over to CAN chip for transmission (This does not necessarily mean these messages were sent over the bus, see below).
Last received COB-ID	COB ID of most recently received CAN message.
Last transmit COB-ID	COB ID of last CAN message handed over to CAN chip.
Receive overruns	Number of overrun situations in the CAN chip internal receive queue.
Transmit overruns	Reserved for future use.
Hard transmission aborts	Number of discarded messages because no acknowledging partner could be found on the bus.
Bus errors	Counter for bus events detected by the CAN chip. This includes warnings, bus off situations and receive queue overruns. The latter two are also counted in separate variables (see below/above).
Bus off events	Number of bus off events. These indicate severe communication problems on the CAN bus. When the CAN chip detects such a situation it goes to the disabled state and is not involved in bus operations anymore. To resume to work it must be re-initialized which is done by the firmware automatically.
Baud rate	Current baud rate the CAN chip is operating at on the bus 0 - 1 Mbit/s 1 - 800 Kbit/s 2 - 500 Kbit/s 3 - 250 Kbit/s 4 - 125 Kbit/s 5 - 100 Kbit/s 6 - 50 Kbit/s 7 - 20 Kbit/s 8 - 10 Kbit/s
Activated bus parameters	0 - valid configuration data received 255 - current configuration data is invalid
Wrong parameters	Reserved for future use

Table 37: COS_TASK Common Variables

9.2.3 COS_TASK User Communication



Bus comm. enabled 1

User emergency messages 0

User NMT commands 0

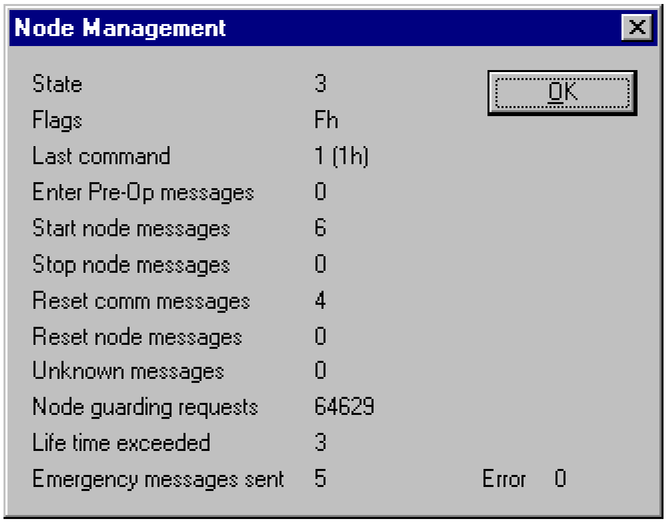
Last user NMT command 0 (0h) Error 0

Figure 80: COS_TASK User Communication

Variable	**Meaning**
Bus comm. enabled	0 - bus communication is disabled because of Not Ready bit set in DPM or HOST watchdog error 1 - bus communication is enabled
User emergency messages	Number of user generated emergency messages sent
User NMT commands	Number of NMT commands received from user
Last user NMT command	NMT command received most recently from user

Table 38: COS_TASK User Communication

9.2.4 COS_TASK Node Management



State	3		
Flags	Fh		
Last command	1 (1h)		
Enter Pre-Op messages	0		
Start node messages	6		
Stop node messages	0		
Reset comm messages	4		
Reset node messages	0		
Unknown messages	0		
Node guarding requests	64629		
Life time exceeded	3		
Emergency messages sent	5	Error	0

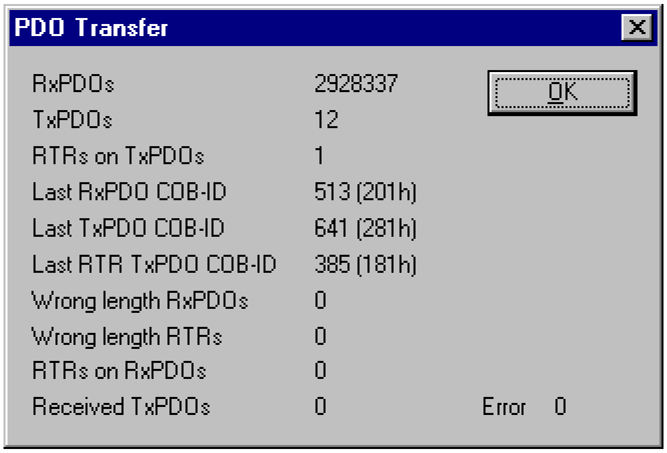
Figure 81: COS_TASK Node Management

Variable	**Meaning**
State	Current Node management state of the DEVICE 0 - Init 1 - Pre-Operational 2 - Prepared 3 - Operational
Flags	Some flags Bit 0 - PDO communication enable Bit 1 - SDO communication enable Bit 2 - Node guarding enable Bit 3 - life guarding enable Bit 7 - Node guarding toggle bit
Last command	Last Node management command received
Enter Pre-Op messages	Number of Enter Pre-Operational State messages received
Start Node messages	Number of Start Node messages received
Stop Node messages	Number of Stop Node messages received
Reset comm messages	Number of Reset Communication messages received

Reset Node messages	Number of Reset Node messages received
Unknown messages	Number of unknown (and ignored) Node management messages received
Node guarding requests	Number of Node guarding requests received
Life time exceeded	Number of life time supervision failures
Emergency messages sent	Number of emergency messages sent by the DEVICE

Table 39: COS_TASK Node Management

9.2.5 COS_TASK PDO Transfer



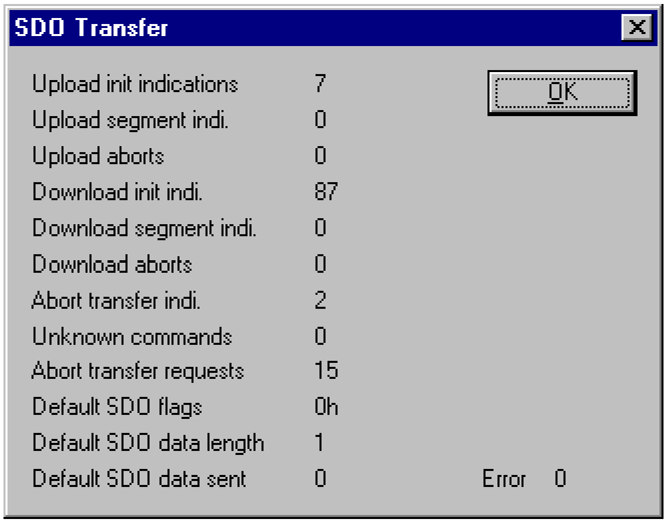
RxPDOs 2928337
TxPDOs 12
RTRs on TxPDOs 1
Last RxPDO COB-ID 513 (201h)
Last TxPDO COB-ID 641 (281h)
Last RTR TxPDO COB-ID 385 (181h)
Wrong length RxPDOs 0
Wrong length RTRs 0
RTRs on RxPDOs 0
Received TxPDOs 0 Error 0

Figure 82: COS_TASK PDO Transfer

Variable	**Meaning**
RxPDOs	Number of valid RxPDOs received.
TxPDOs	Number of TxPDOs sent.
RTRs on TxPDOs	Number of valid RTRs and TxPDOs received.
Last RxPDO COB-ID	COB ID of RxPDO most recently received.
Last TxPDO COB-ID	COB ID of RxPDO most recently sent.
Last RTR TxPDO COB-ID	COB ID of RTR or TxPDO most recently received.
Wrong length RxPDOs	Number of RxPDOs with incorrect length (unequal internally configured length of this PDO)..
Wrong length RTRs	Number of RTRs on TxPDOs with wrong length (unequal 0).
RTRs on RxPDOs	Number of RTRs or RxPDOs.
Received TxPDOs	Number TxPDOs received (and ignored).

Table 40: COS_TASK PDO Transfer

9.2.6 COS_TASK SDO Transfer



SDO Transfer

Upload init indications	7
Upload segment indi.	0
Upload aborts	0
Download init indi.	87
Download segment indi.	0
Download aborts	0
Abort transfer indi.	2
Unknown commands	0
Abort transfer requests	15
Default SDO flags	0h
Default SDO data length	1
Default SDO data sent	0

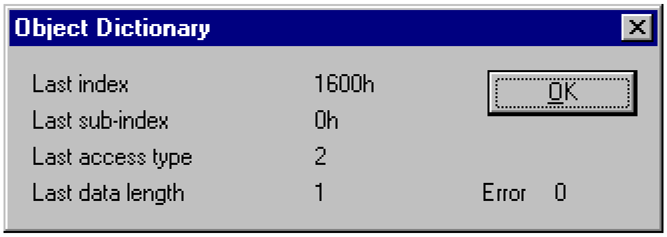
Error 0

Figure 83: COS_TASK SDO Transfer

Variable	**Meaning**
Upload init indications	Number of upload initial segment indications received
Upload segment indi.	Number of upload segment indiciations received
Upload aborts	Number of upload operations aborted
Download init indi.	Number of download initial segment indications received
Download segment indi.	Number of download segment indiciations received
Download aborts	Number of download operations aborted
Abort transfer indi.	Number of abort transfer indications received
Unknown commands	Number of unknown SDO commands received
Abort transfer requests	Number of abort requests sent
Default SDO flags	Flags indicating the current state of the default SDO Bit 0 - upload operation running Bit 1 - download operation running Bit 7 - SDO transfer toggle bit
Default SDO data length	**Download:** number of bytes received during last download **Upload:** number of bytes to be uploaded
Default SDO data sent	**Download:** 0 **Upload:** number of bytes already uploaded

Table 41: COS_TASK SDO Transfer

9.2.7 COS_TASK Object Dictionary



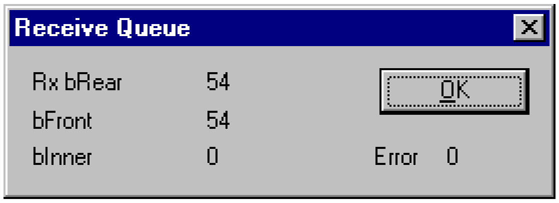
Last index 1600h
Last sub-index 0h
Last access type 2
Last data length 1
Error 0

Figure 84: COS_TASK Object Dictionary

Variable	**Meaning**
Last index	Index of most recent access to object dictionary
Last sub-index	Sub-index of most recent access to object dictionary
Last access type	Operation type of most recent access to object dictionary 1 - read operation 2 - write operation
Last data length	Number of bytes transferred during most recent access to object dictionary

Table 42: COS_TASK Object Dictionary

9.2.8 COS_TASK Receive Queue



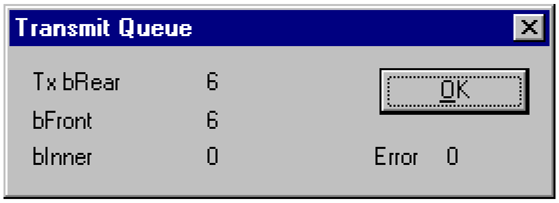
Rx bRear 54
bFront 54
bInner 0
Error 0

Figure 85: COS_TASK Receive Queue

Variable	**Meaning**
Rx bRear	Position of the next message to be read from the queue of incoming CAN messages
bFront	Position of the next incoming CAN message to be inserted into the queue
bInner	Number of messages currently in the queue

Table 43: COS_TASK Receive Queue

9.2.9 COS_TASK Transmit Queue



Tx bRear 6
bFront 6
bInner 0
Error 0

Figure 86: COS_TASK Transmit Queue

Variable	**Meaning**
Tx bRear	Position of the next message to be sent from the Tx queue.
bFront	Position of the next available CAN message space in the queue, messages to be sent are queued only if the CAN chip is not able to immediately send the message because the preceding message transfer is pending.
bInner	Number of messages currently in the queue

Table 44: COS_TASK Transmit Queue

9.3 COB-ID (Predefined Connection Set)

COB-ID means Communication Object Identifier. This is the 11 bit telegram identifier of the CAN telegram. The higher 4 bits (bit 10 to 8) are the function code and the lower 7 bits (bit 7 to 0) are the bus address of the Node.
Broadcast Objects:

Object	**Function Code**	**COB ID hex**	**COB ID dec**	**Index in the Object Directory**
NMT	0000	00H	0	-
SYNC	0001	80H	128	1005H, 1006H, 1007H
TIME STAMP	0010	100H	256	1012H, 1013H

Table 45: COB ID - Broadcast Objects

Peer-to-Peer Objects:

Object	**Function Code**	**COB ID hex**	**COB ID dec**	**Index in the Object Directory**
Emergency	0001	81H-FFH	129-255	1014H, 1015H
PDO 1 (tx)	0011	181H-1FFH	385-511	1800H
PDO 1 (rx)	0100	201H-27FH	513-639	1400H
PDO 2 (tx)	0101	281H-2FFH	641-767	1801H
PDO 2 (rx)	0110	301H-37FH	769-895	1401H
PDO 3 (tx)	0111	381H-3FFH	897-1023	1802H
PDO 3 (rx)	1000	401H-47FH	1025-1151	1402H
PDO 4 (tx)	1001	481H-4FFH	1153-1279	1803H
PDO 4 (rx)	1010	501H-57FH	1281-1407	1403H
SDO (tx)	1011	581H-5FFH	1409-1535	1200H
SDO (rx)	1100	601H-67FH	1537-1663	1200H
NMT Error Control	1110	701H-77FH	1793-1919	1016H, 1017H

Table 46: COB ID - Peer-to-Peer Objects

9.4 Object Dictionary

The Object Dictionary is a collection of data, which have influence on the application and the communication of a CANopen device and the device can be configured with this data collection. The entries are structured by the index and the subindex.

9.4.1 Object Name and Object Code

The following table shows a list of the Object Codes:

Object Name	Comment	Object Code
NULL	A dictionary entry with no data fields.	0
DOMAIN	Large variable amount of data e.g. executable program code.	2
DEFTYPE	Denotes a type definition such as a Boolean, UNSIGED 16, float and so on.	5
DEFSTRUCT	Complex Data type definition, e.g. PDO Mapping-Structure.	6
VAR	A single value such as Unsigned 8, Boolean, visible string etc.	7
ARRAY	A multiple data field object where each data field is a simple variable of the same basic data type e.g. array of Unsigned 16 Sub-index 0 is of Unsigned 8 and not part of the array data.	8
RECORD	A multiple data field object where the data fields may be any combination of simple variables. Sub-index 0 is of Unsigned 8 and not part of the record data.	9

Table 47: Object Codes

Note: The list of the Object Names and Object Codes does not imply that the Master or the Node support the respective data type.

9.4.2 **Object Dictionary Data Types**

The following table is a survey of the data types and an extract of the CANopen specification.

Range	**Index (Hex)**	**Object**	**Name**
Reserved	0000	reserved	reserved
Static data types	0001	DEFTYPE	BOOLEAN
	0002	DEFTYPE	INTERGER 8
	0003	DEFTYPE	INTERGER 16
	0004	DEFTYPE	INTERGER 32
	0005	DEFTYPE	UNSIGNED 8
	0006	DEFTYPE	UNSIGNED 16
	0007	DEFTYPE	UNSIGNED 32
	0008	DEFTYPE	REAL 32
	0009	DEFTYPE	VISIBLE_STRING
	000A	DEFTYPE	OCTET_STRING
	000B	DEFTYPE	UNICODE_STRING
	000C	DEFTYPE	TIME_OF_DAY
	000D	DEFTYPE	TIME_DIFFERENCE
	000E	DEFTYPE	BIT_STRING
	000F	DEFTYPE	DOMAIN
	0010	DEFTYPE	INTERGER 24
	0011	DEFTYPE	REAL 64
	0012	DEFTYPE	INTERGER 40
	0013	DEFTYPE	INTERGER 48
	0014	DEFTYPE	INTERGER 56
	0015	DEFTYPE	INTERGER 64
	0016	DEFTYPE	UNSIGNED 24
	0017	reserved	reserved
	0018	DEFTYPE	UNSIGNED 40
	0019	DEFTYPE	UNSIGNED 48
	001A	DEFTYPE	UNSIGNED 56
	001B	DEFTYPE	UNSIGNED 64
	001C-001F	reserved	reserved

Continuation see next page.

Complex data types	0020	DEFSTRUCT	PDO_COMMUNICATION_PARAMETER
	0021	DEFSTRUCT	PDO_MAPPING
	0022	DEFSTRUCT	SDO_PARAMETER
	0023	DEFSTRUCT	IDENTITY
	0024-003F	reserved	reserved
Manufacturer specific complex data types	0040-005F	DEFSTRUCT	Manufacturer specific complex data types
Device profile data types	0060-007F	DEFTYPE	Device profile (0) specific standard data types
	0080-009F	DEFSTRUCT	Device profile (0) specific complex data types
	00A0-00BF	DEFTYPE	Device profile 1 specific standard data types
	00C0-00DF	DEFSTRUCT	Device profile 1 specific complex data types
	00E0-00FF	DEFTYPE	Device profile 2 specific standard data types
	0100-011F	DEFSTRUCT	Device profile 2 specific complex data types
	0120-013F	DEFTYPE	Device profile 3 specific standard data types
	0140-015F	DEFSTRUCT	Device profile 3 specific complex data types
	0160-017F	DEFTYPE	Device profile 4 specific standard data types
	0180-019F	DEFSTRUCT	Device profile 4 specific complex data types
	01A0-01BF	DEFTYPE	Device profile 5 specific standard data types
	01C0-01DF	DEFSTRUCT	Device profile 5 specific complex data types
	01E0-01FF	DEFTYPE	Device profile 6 specific standard data types
	0200-021F	DEFSTRUCT	Device profile 6 specific complex data types
	0220-023F	DEFTYPE	Device profile 7 specific standard data types
	0240-025F	DEFSTRUCT	Device profile 7 specific complex data types
Reserved	0300-0FFF	reserved	reserved

Table 48: Object Dictionary Data Types

Note: The list of the data types is no information that the Master or the Node support the respective data type.

9.4.3 Object Dictionary Profile

The following table is a survey of the profile object dictionary and an extract of the CANopen specification.

Range	**Index (Hex)**	**Object**	**Name**	**Type / Access**
Communication Profile	1000	VAR	Device Type	Unsigned 32 / ro
	1001	VAR	Error Register	Unsigned 8 / ro
	1002	VAR	Manufacturer Status Register	Unsigned 32 / ro
	1003	ARRAY	Pre-defined Error Field	Unsigned 32 / ro
	1004	-	Reserved	-
	1005	VAR	COB-ID SYNC	Unsigned 32 / rw
	1006	VAR	Communication Cycle Period	Unsigned 32 / rw
	1007	VAR	Synchronous Window Length	Unsigned 32 / rw
	1008	VAR	Manufacturer Device Name	Visible_string / c

	1009	VAR	Manufacturer Hardware Version	Visible_string / c
	100A	VAR	Manufacturer Software Version	Visible_string / c
	100B	-	Reserved	-
	100C	VAR	Guard Time	Unsigned 32 / rw
	100D	VAR	Life Time Factor	Unsigned 32 / rw
	100E	-	Reserved	-
	100F	-	Reserved	-
	1010	VAR	Store Parameters	Unsigned 32 / rw
	1011	VAR	Restore Default Parameters	Unsigned 32 / rw
	1012	VAR	COB-ID TIME	Unsigned 32 / rw
	1013	VAR	High Resolution Time Stamp	Unsigned 32 / rw
	1014	VAR	COB-ID EMCY	Unsigned 32 / rw
	1015	VAR	Inhibit Time EMCY	Unsigned 16 / rw
	1016	ARRAY	Consumer Heartbeat Time	Unsigned 32 / rw
	1017	VAR	Producer Heartbeat Time	Unsigned 16 / rw
	1018	RECORD	Identity Object	Identity / ro
	1018 / 0		Number of Entries	Unsigned 8
	1018 / 1		Vendor Information	Unsigned 32
	1018 / 2		Product Code	Unsigned 32
	1018 / 3		Revision Number	Unsigned 32
	1018 / 4		Serial Number	Unsigned 32
	1019-11FF	-	Reserved	-

Continuation see next page.

Range	Index (Hex)	Object	Name	Type / Access
Communication Profile	1200	RECORD	Server 1. SDO Parameter	SDO_Parameter / ro
	1200 / 0		Number of Entries	Unsigned 8
	1200 / 1		COB-ID Client -> Server	Unsigned 32
	1200 / 2		COB-ID Client <- Server	Unsigned 32
	1200 / 3		NodeID	Unsigned 8
	1201-1277	RECORD	Server 2. to 127. SDO Parameter	SDO_Parameter / rw
	1280-12FF	RECORD	Client SDO Parameter	SDO_Parameter / rw
	1300-13FF	-	Reserved	-
	1400-15FF	RECORD	Receive PDO Parameter	PDO_Com_Para / rw
	1400 / 0		Number of Entries	Unsigned 8
	1400 / 1		COB-ID	Unsigned 32
	1400 / 2		Transmission Type	Unsigned 8
	1400 / 3		Transmit Prohibited Time	Unsigned 16
	1400 / 4		Reserved	Unsigned 8
	1400 / 5		Event Timer	Unsigned 16
	1600-17FF	ARRAY	Receive PDO Mapping	PDO_Mapping / rw
	1600 / 0		Number of Entries	Unsigned 8
	1600 / 1		1. Object	Unsigned 32
	1600 / 2		2. Object	Unsigned 32
	1600 / ...		n. Object	Unsigned 32
	1600 / 40		64. Object	Unsigned 32
	1800-19FF	RECORD	Transmit PDO Parameter	PDO_Com_Para / rw
	1A00-1BFF	ARRAY	Transmit PDO Mapping	PDO_Mapping / rw
	1C00-1FFF	-	Reserved	-
Manufacturer Specific Profile	2000-5FFF			
Standardized Device Profiles	6000-67FF		Device Profile 1	
	6800-6FFF		Device Profile 2	
	7000-77FF		Device Profile 3	
	7800-7FFF		Device Profile 4	
	8000-87FF		Device Profile 5	
	8800-8FFF		Device Profile 6	
	9000-97FF		Device Profile 7	
	9800-9FFF		Device Profile 8	
Reserved	A000-FFFF	-	Reserved	-

Table 49: Object Dictionary Profile

Note: The list of the single objects is no information that the Master or the Node support the respective object and the function which is associated with it.

9.5 Communication Profile, Device Profile and Device Type

The Communication Profile DS 301 specifies, how to communicate. The Device Profiles DS 401ff specify, what is communicated.

Device Profile	Description
301	Common communication profile according to DS301
401	Device profile for I/O modules
402	Device profile for drives
406	Device profile for encoder

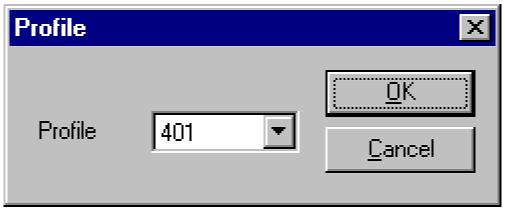
Table 50: Device Profile and Device Type

9.5.1 Communication Profile 301

The communication profile DS 301 is a common profile. It is the basis of CANopen communication and lays down how the devices on the CANopen network communicate with each other.

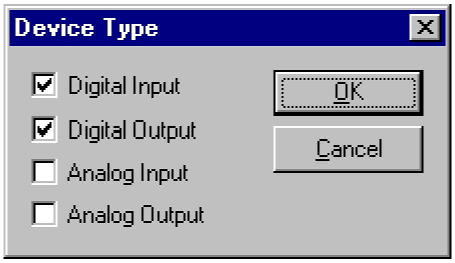
9.5.2 Device Profile 401 - Device Profile for I/O Modules

The DS 401 device profile is a profile for I/O modules.


Profile

Profile: 401

Figure 87: Device Profile 401


Device Type

☑ Digital Input
☑ Digital Output
□ Analog Input
□ Analog Output

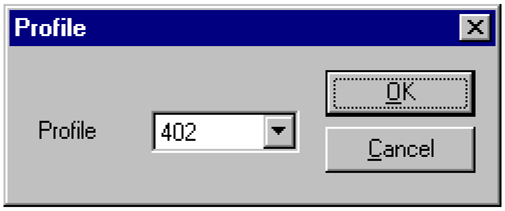
Figure 88: Selection of the Device Type in case of Device Profile 401

Device Profile	Device Type	Description
401	Digital Input Digital Output Analog Input Analog Output	Device Profile for I/O Modules

Table 51: Device Profile for I/O Modules

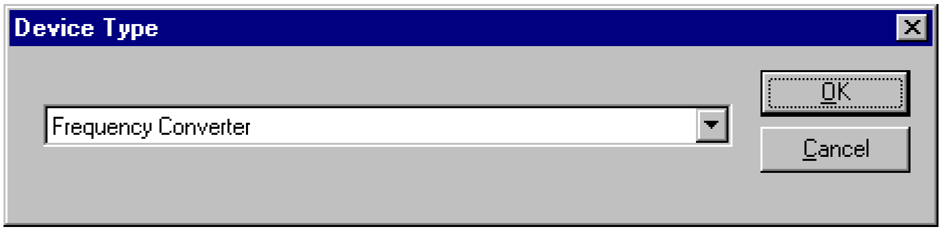
9.5.3 Device Profile 402 - Device Profile for Drives

The DS 402 device profile is a profile for drives.


Profile

Profile 402

Figure 89: Device Profile 402


Device Type

Frequency Converter

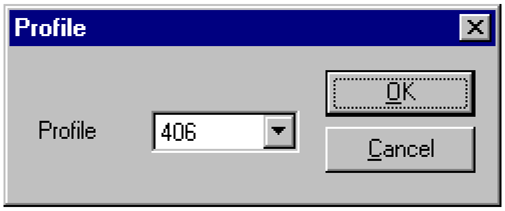
Figure 90: Selection Device Type in case of Device Profile 402

Device Profile	Device Type	Description
402	Frequency Converter Servo Drive Stepper Motor I/O Module Multi device module	Device profile for drives

Table 52: Device Profile for Drives

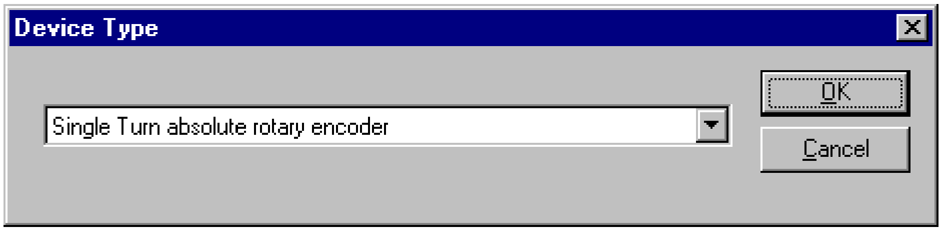
9.5.4 Device Profile 406 - Device Profile for Encoder

The DS 406 device profile is a profile for encoder.


Profile

Profile 406

Figure 91: Device Profile 406



Single Turn absolute rotary encoder

Figure 92: Selection of the Device Type in case of Device Profile 406

Device Profile	Device Type	Description
406	Single Turn absolute rotary encoder. Multi Turn absolute rotary encoder Single Turn absolute rotarey encoder with electronic turncount Incremental rotary encoder Incremental rotary encoder with electronic counting Incremental linear encoder Incremental linear encoder with electronic counting Absolute linear encoder Absolute linear encoder with cyclic coding	Device profile for encoder

Table 53: Device Profile for Encoder

9.6 PDO Mapping Method

The PDO Mapping with a degree of freedom was fixed in the specification DS301 V3. The System Configurator produces the following PDO Mapping:

- Subindex 0 the number of objects (value N) is entered in object 16xx (and object 1Axx respectively).
- Subindex 1 to N are entered in the objects which are to be mapped in object 16xx (and object 1Axx respectively).

The specification DS301 V4 further specified PDO Mapping more exactly. This defines that the initial mapped data is deleted, then the same or new data is mapped and finally it is set valid.

- To delete the information of the PDO Mapping in the Node (and to set it back to the default mapping respectively), in object 16xx (and object 1Axx respectively) Subindex 0 the value 0 is written down.
- The objects which are to be mapped are entered in object 16xx (and respectively object 1Axx) Subindex 1 to N.
- The number of objects is entered (value N) in object 16xx (and respectively object 1Axx).

9.7 NMT State Machine (State Diagram)

NMT stands for Network Management.
The following diagram shows the possible states of a CANopen Node.

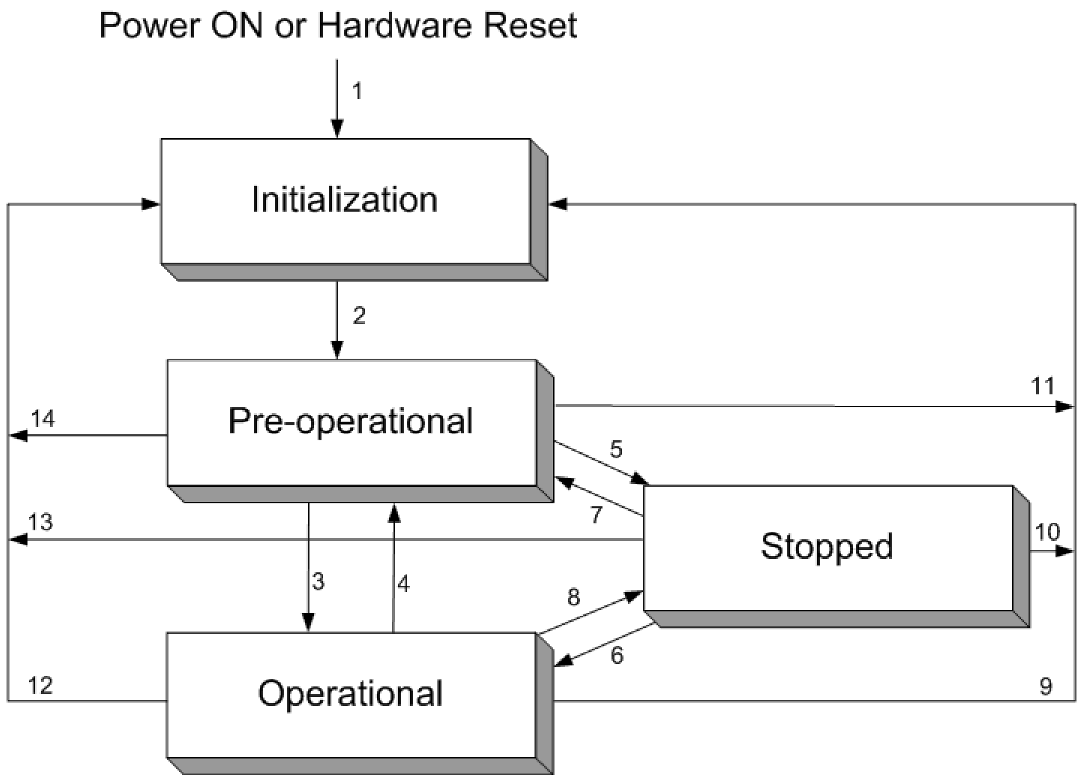


Figure 93: NMT-State Machine

Number	Meaning
1	At Power on the initialisation state is entered autonomously
2	Initialisation finished -enter PRE_OPERATIONAL automatically
3, 6	Start_Remote_Node indication
4, 7	Enter_PRE-OPERATIONAL_State indication
5, 8	Stop_Remote_Node indication
9, 10, 11	Reset_Node indication
12, 13, 14	Reset_Communication indication

Table 54: Description NMT-State Machine

9.7.1 Communication Characteristics in the different NMT States

The following table shows the possible communication in the respective NMT states.

Communication	Initialization	Pre-Operational	Operational	Stopped
PDO			X	
SDO		X	X	
SYNC		X	X	
Time Stamp		X	X	
EMCY		X	X	
BootUp	X			

NMT		X	X	X

Table 55: Communication in the different NMT States

9.8 LSS/LMT Services

LSS stands for Layer Setting Services, LMT stands for Layer Management and is an older designation. LSS/LMT supports access to the basic parameters such as shown below via the CAN network without having to set mechanical switches on the Node :

- Baud Rate
- Node ID

The communication is based on a Master/Slave relationship and uses the COB-ID 2020 (07E4H, Slave to Master) and 2021 (07E5H, Master to Slave). The LSS/LMT Slave must to be in the NMT Stop state to perform the LSS/LMT services. The LSS/LMT Slave is able to take the following states :

- Operation Mode = Operating mode with valid parameters and
- Configuration Mode = Configuration Mode.

Note: It is only permitted to couple one Node to the Master at a time.

9.9 Emergency Telegrams

Emergency Telegrams are sent by a Node in the case of a Node internal event.
The Emergency Telegram has the following structure:

Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
Error Code LSB	Error Code MSB	Error Register	Comm. Error	Device Error	Emergency Trigger	Info 0	Info 1

Table 56: Emergency Telegram (Structure)

- Error Code (Byte 1 and 2): See the section on *Emergency Telegram Error Codes*.
- Error Register (Byte 3): Object 1001H. See device description of the Node manufacturer.
- Manufacturer specific error field (Byte 4 to 8): See device description of the Node manufacturer.

9.10 Emergency Telegram Error Codes

The meaning of the Error Codes are shown in the following table:

Error Code (Hex)	**Meaning**
00xx	No error or reset
10xx	Generic error
20xx	Current
21xx	Current, device input side
22xx	Current inside the device

23xx	Current, device output side
30xx	Voltage
31xx	Mains voltage
32xx	Voltage, inside the device
33xx	Output Voltage
40xx	Temperature
41xx	Ambient temperature
42xx	Device temperature
50xx	Device Hardware
60xx	Device Software
61xx	Internal Software
62xx	User Software
63xx	Data Set
70xx	Additional Modules
80xx	Monitoring
81xx	Communication
8110	CAN Overrun (Object lost)
8120	CAN in Error Passive Mode
8130	Life Guarding Error or Heartbeat Error
8140	recoverefrom bus off
82xx	Protocol Error
8210	PDO not processed due to length error
8220	PDO length exceeded
90xx	External Error
F0xx	Additional Functions
FFxx	Device specific

Table 57: Emergency Error Codes

Note: The table Emergency Error Codes is a common list. To see the exact meaning of these codes we refer to the Node manufacturer.

CHAPTER 10: GLOSSARY

COB-ID - Communication object identifier. Table in section COB-ID.
LMT - Layer Management.
LSS - Layer Setting Services.
NMT - Network Management. This contains the functions configuration, initialization and supervision of the network devices.
HsyCon - Horner System Configurator, Configurations- and Diagnostic Tool.