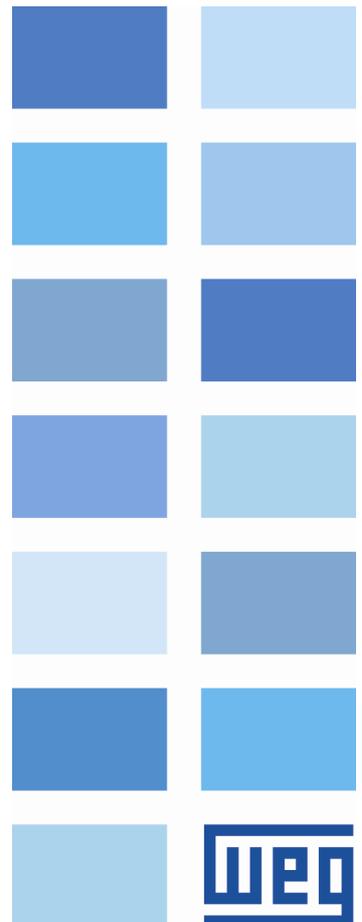


Software

WSCAN

User's Manual





User's Manual

Series: WSCAN V2.0X

Language: English

Publication Date: 11/2010

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1 General Information

1.1 About this manual

This manual describes the operation of the WSCAN software and the configuration of the CANopen masters designed by WEG. This manual shall be used along with the WLP software and CANopen master board manuals.

Related topics :

- [About the WSCAN](#) [6 ↗]
- [Abbreviations and definitions](#) [6 ↗]
- [Numerical representation](#) [7 ↗]
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- [Main advantages of WSCAN](#) [7 ↗]
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1.2 About the WSCAN

The WSCAN - “WEG Software CANopen Config” - is a Windows-based software used for configuring and programming the masters designed by WEG for the CANopen network.

1.3 Abbreviations and definitions

CAN	Controller Area Network
CiA	CAN in Automation
COB	Communication Object
COB-ID	Communication Object Identifier
SDO	Service Data Object
PDO	Process Data Object
RPDO	Receive PDO
TPDO	Transmit PDO
NMT	Network Management Object
ASCII	American Standard Code for Information Interchange
ro	Read only access
rw	Read/write access

1.4 Numerical representation

Decimal numbers are represented by digits without suffix. Hexadecimal numbers are represented with the 'h' letter after the number.

1.5 Documents

<i>Document</i>	<i>Version</i>	<i>Source</i>
CAN Specification	2.0	CiA
CiA DS 301 CANopen Application Layer and Communication Profile	4.02	CiA
CiA DS 302 Framework for CANopen Managers and Programmable CANopen Devices	3.2.1	CiA
CiA DS 405 Interface and Device Profile for IEC 61131-3 Programmable Devices	2.0	CiA
CiA DRP 303-1 Cabling and Connector Pin Assignment	1.1.1	CiA
CiA DSP 306 Electronic Data Sheet Specification for CANopen	1.1	CiA

1.6 Main advantages of WSCAN

- Network definition through graphical environment.
- Network configuration through dialog boxes.
- Download of configuration through the PC serial port.
- Possibility of configuring up to 25⁽¹⁾ slave devices on the CANopen network.
- Possibility of configuring up to 1600⁽²⁾ input digital points and 1600⁽²⁾ output digital points.
- On-line monitoring of network status and communication errors.

(1) 8 for PLC2 or 25 for PLC11-01

(2) 512 for PLC2 or 1600 for PLC11-01

2 Introduction to the CANopen protocol

2.1 CAN

The CANopen network is based on the CAN network. In other words, it uses CAN messages for network data exchange.

The CAN protocol is a serial communication protocol that describes the services of layer 2 of the ISO/OSI model (data link layer). This layer defines the different types of messages (frames), the error detection algorithm, and the validation and arbitration of messages.

NOTE !

On the CAN protocol specification, the ISO 11898 standard is used as reference for defining the layer 1 of this model (physical layer).

Related topics :

- [Data frame](#) ⁸
- [Remote frame](#) ⁸
- [Network access](#) ⁸
- [Error control](#) ⁸
- [CAN e CANopen](#) ⁹
- [Characteristics of the CANopen network](#) ⁹
- [Physical Media](#) ⁹
- [Address on the CANopen network](#) ⁹
- [Data access](#) ¹⁰
- [Data transmission](#) ¹⁰
- [Communication Objects – COBs](#) ¹⁰
- [COB-ID](#) ¹¹
- [EDS file](#) ¹²

2.2 Data frame

In a CAN network the data are transmitted through a data frame (telegram). This type of frame is basically composed of an 11-bit *standard* (11bits) and *extended* (29 bits). Only standard frames (11 bits) are accepted for the CANopen protocol of the WEG master. identifier field (arbitration field) and a data field that may contain up to 8 data bytes.

<i>Identifier</i>	<i>8 data bytes</i>							
11 bits	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7

NOTE !

The CAN 2.0 specification defines two types of data frames: *standard* (11bits) and *extended* (29 bits). Only standard frames (11 bits) are accepted for the CANopen protocol of the WEG master.

2.3 Remote frame

Besides the data frame, there is also the remote frame (RTR frame). This type of frame does not contain the data field, only the identifier. It works as a request so that another device on the network can transmit the intended data frame.

2.4 Network access

Any device on a CAN network can try transmitting a frame to the network in a certain instant. In case two devices try accessing the network at the same time, the message with higher priority will be transmitted. The message priority is defined by the identifier of the CAN frame - the lower the identifier value, the higher the message priority. Consequently, a message with identifier 0 (zero) has the higher priority.

2.5 Error control

The CAN specification defines several error control services, which renders it a very reliable network with a very low rate of transmission errors that are not detected. Each network device must be able to identify this error and inform the other network elements that an error was detected.

A CAN network device has internal counters that are incremented every time a transmission or reception error is detected and decremented when a telegram is successfully received. When a substantial number of errors is detected, the device may enter into the following states:

- Warning: the device enters into the warning state when the counter exceeds a predefined number of errors, which means that a high error rate was detected.
- Error Passive: the device enters into the error passive state when the counter value exceeds a higher limit. In this state the device is not active anymore on the network (cannot send or receive messages). It can only transmit Error Passive Flags.
- Bus Off: the device goes into this state when the Transmit Error Counter is greater than 255. In this mode, the device cannot send or receive messages, acknowledge messages, or transmit error frames of any kind.

2.6 CAN and CANopen

The definitions of error detection, frame generation and message transmission are not sufficient for completely defining the data that is transmitted through network. It is necessary that a specification indicates how the identifier and the data should be built and how the information should be exchanged. Thus, the network elements can properly interpret the data that is transmitted. The CANopen specification defines how to exchange data between devices and how each device should interpret these data.

There are several other protocols based on CAN that also use CAN frames for communication, such as DeviceNet, J1939, etc. However, these protocols cannot operate in the same network.

2.7 Characteristics of the CANopen network

Since message transfer is carried out through a CAN bus, all CANopen network devices have the same rights for accessing the network, where the priority of the identifier defines how to solve the conflicts when simultaneous accesses to the network take place. This feature makes possible the direct communication between network slaves, in addition to the fact that the data can be made available in an optimized manner without requiring a master, which cyclic access all devices on the network to update the data, for controlling the communication.

Another important characteristic of the CAN network is the adoption of the producer / consumer model for data transmission. It means that a message transmitted over the network does not have a fixed destination address. This message has an identifier that indicates which data type it is carrying. Any device on the network that needs to use this information for its operation can consume it and, therefore, the same message can be used for several network devices at the same time.

2.8 Physical Media

The physical media for data transmission in a CANopen network is specified by the ISO 11898 standard. The physical media specified by the standard is a twisted pair with differential electrical signal.

The master of a CANopen network uses an isolated interface circuit from the network with external power supply. The device responsible for the signal transmission and reception is known as transceiver and it follows what is specified on the ISO 11898 standard.

2.9 Address on the CANopen network

Every CANopen network shall have a master, which is responsible for the services of network management, and may also have a maximum set of 127 slaves. Each device on the network can also be named as “node”. Every slave on a CANopen network is identified by its address, or Node-ID, which must be unique for each slave on the network and can vary from 1 to 127.

The WEG CANopen master can control a maximum of 8 slaves, which can be addressed from 1 to 63.

2.10 Data access

Each slave on the CANopen network has a list called object dictionary that contains all the data that are accessible through the network. Each object in this list is identified by an index, which is used during the device configuration and message exchange to identify what is transmitted.

A more detailed description of how the object dictionary is structured is provided in the Addendum I.

2.11 Data transmission

The transmission of numerical data through CANopen messages is carried out by using the hexadecimal representation of the number (the least significant data byte must be sent first).

Example: transmission of a 32-bits signal integer (12345678h = 305419896 decimal) plus a 16-bits signal integer (FF00h = -256 decimal) in a CAN frame.

<i>Identifier</i>	<i>6 data bytes</i>					
11 bits	32 bits Integer				16 bits Integer	
	byte 0	byte 1	byte 2	byte 3	byte 4	Byte 5
	78h	56h	34h	12h	00h	FFh

2.12 Communication Objects - COBs

There are a specific set of objects that are responsible for the communication between the network devices. These objects are divided according to the data type they carry and the way how they are transmitted and received by a device. The master of a CANopen network supports the following communication objects (COBs):

<i>Object Type</i>	<i>Description</i>
Service Data Object (SDO)	<p>The SDOs are responsible for the direct access to the object dictionary of a device. Through the messages using SDOs it is possible to explicitly indicate (by the object index) which data type is being accessed. There are two types of SDOs: Client SDO, which is responsible for the reading and writing requests to a network device, and the Server SDO, which is responsible for process this request.</p> <p>Since the SDOs are generally used to configure a network node, they have low priority when compared to other types of messages.</p>
Process Data Object (PDO)	<p>The PDOs are used for accessing device data without the need of explicitly indicating which dictionary object is being accessed. Therefore, it is necessary to previously configure which data the PDO will transmit (data mapping). There are also two types of PDOs: Receive PDO and Transmit PDO.</p> <p>The PDOs are generally used for transmission and reception of real-time data that is needed during the device operation, thus they have high priority when compared to the SDOs.</p>
Emergency Object (EMCY)	<p>This object is responsible for transmitting messages that indicate the occurrence of errors in the device. When an error is detected in a specific device (EMCY Producer), a message can be sent to the network. In case a network device is monitoring this message (EMCY Consumer), it is possible to set an action to be carried out (disable further network devices, error reset, etc.).</p>
Synchronization Object (SYNC)	<p>It is possible to set a device (SYNC Producer) on the CANopen network to transmit periodically a synchronization message to all network devices. Therefore, these devices (SYNC Consumers) can transmit, for instance, a specific data that needs to be available periodically.</p>
Network Management (NMT)	<p>Every CANopen network needs to have a master to control the other devices on the network (slaves). This master will be responsible for a set of services that control the slaves' communication and also their status on the network. The slaves are responsible for receiving the commands from the master and executing the requested actions.</p> <p>Therefore, the NMT object allows the master to execute the network management.</p>

The communication of the device with the network is always carried out through these objects. The data that can be accessed through the network are listed on object dictionary of each device.

2.13 COB-ID

A CANopen message is always transmitted by a communication object (COB). Every COB has an identifier that indicates the type of data it is transmitting. This identifier, named COB-ID, has an 11-bits length, and it is transmitted in the identifier field of the CAN message. It is subdivided in two parts:

<i>Function Code</i>				<i>Node Address</i>						
bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

- *Function code*: indicates the type of object that is being transmitted.

- *Node address*: indicates with which network device the message is related to.

The default values of the different communication objects that are available in the devices are presented in the table below. It is important to notice that the object default value is dependent upon the slave address, except the COB-Ids for NMT and SYNC objects that are common to all network devices. These values can also be changed during the device configuration step.

<i>COB</i>	<i>Function Code</i> (bits 10 - 7)	<i>Resulting COB-ID</i> (function + address)
NMT	0000	0
SYNC	0001	128 (80h)
EMCY	0001	129 - 255 (81h - FFh)
PDO1 (tx)	0011	385 - 511 (181h - 1FFh)
PDO1 (rx)	0100	513 - 639 (201h - 27Fh)
PDO2 (tx)	0101	641 - 767 (281h - 2FFh)
PDO2 (rx)	0110	769 - 895 (301h - 37Fh)
PDO3 (tx)	0111	897 - 1023 (381h - 3FFh)
PDO3 (rx)	1000	1025 - 1151 (401h - 47Fh)
PDO4 (tx)	1001	1153 - 1279 (481h - 4FFh)
PDO4 (rx)	1010	1281 - 1407 (501h - 57Fh)
SDO (tx)	1011	1409 - 1535 (581h - 5FFh)
SDO (rx)	1100	1537 - 1663 (601h - 67Fh)
NMT Error Control	1110	1793 - 1919 (701h - 77Fh)

2.14 EDS file

Each device on a CANopen network has a configuration file called EDS, which contains several data about the operation of the device over the CANopen network, as well as a description of all available objects for communication. In general this file is used by the master or by the configuration software for programming the devices connected to the CANopen network.

3 WSCAN Software

3.1 Running the WSCAN software

The WSCAN can be executed in two modes:

1st - Via WLP software, by using the option “CANopen” under the “Tools” menu or by using the shortcut keys “Shift+F11”



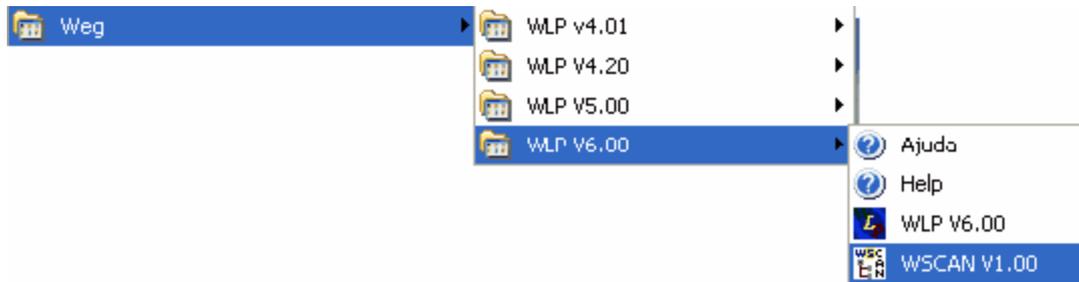
NOTE!

The CANopen master function is available only on versions 1.30 or later of the PLC2 board.

When the WSCAN software is executed from the WLP, a configuration file of the CANopen

network (with the same name of the current WLP project) will be created / opened and will be stored inside the current project folder.

2nd - Through the shortcut created in the Windows Start menu.



Related topics :

[Main Window](#) ¹⁴

[Main Menu](#) ¹⁴

[Button Bar](#) ¹⁵

[Device Tree](#) ¹⁶

[Log window](#) ¹⁶

[CANopen network](#) ¹⁷

[Configuring a new network](#) ¹⁷

[Configuring the master](#) ¹⁹

[Configuring the slaves](#) ²⁵

[Slave Object Dictionary](#) ³³

[Master/Slave PDOs Configuration](#) ³⁶

[Viewer/Configuration of PDOs connections](#) ⁴¹

[Create configuration](#) ⁴⁸

[Transfer configuration](#) ⁴⁹

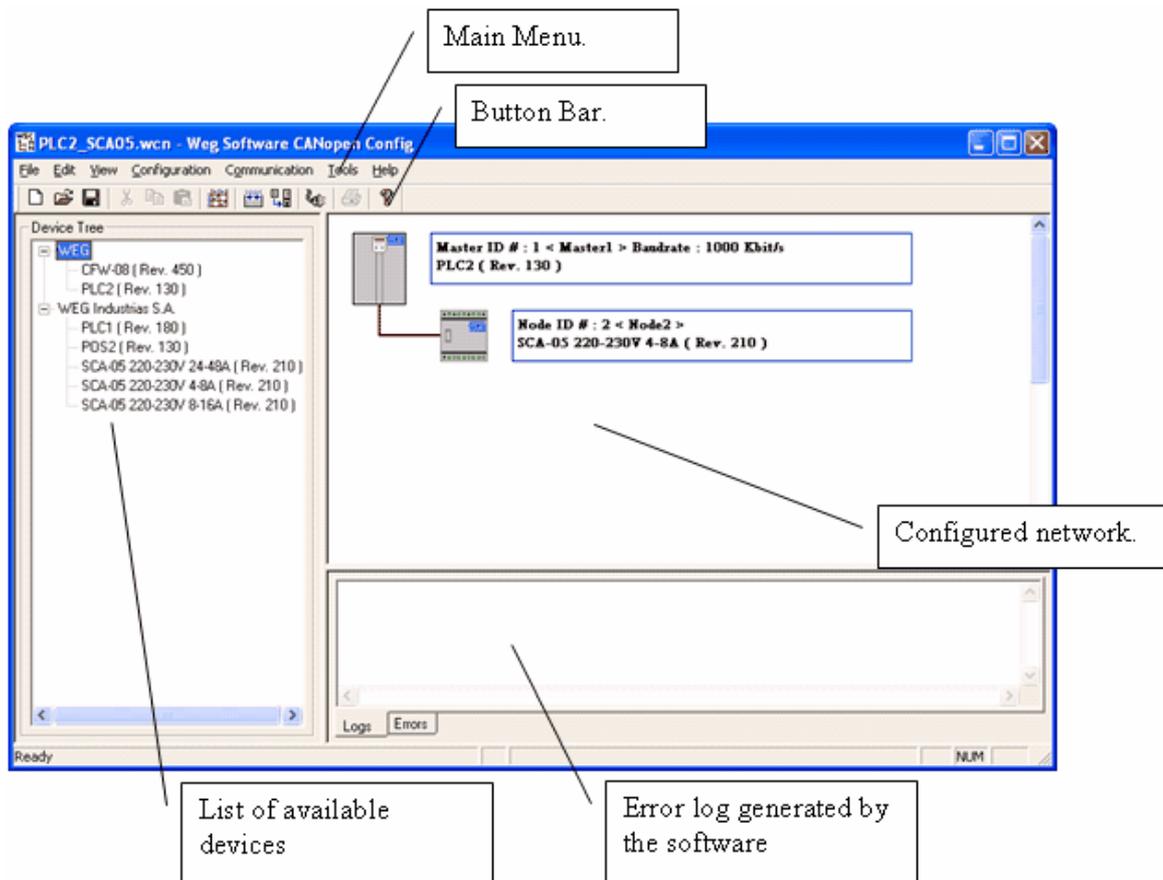
[Online monitoring](#) ⁴⁹

[Interface with the ladder programming](#) ⁵²

[Example of network configuration](#) ⁵⁷

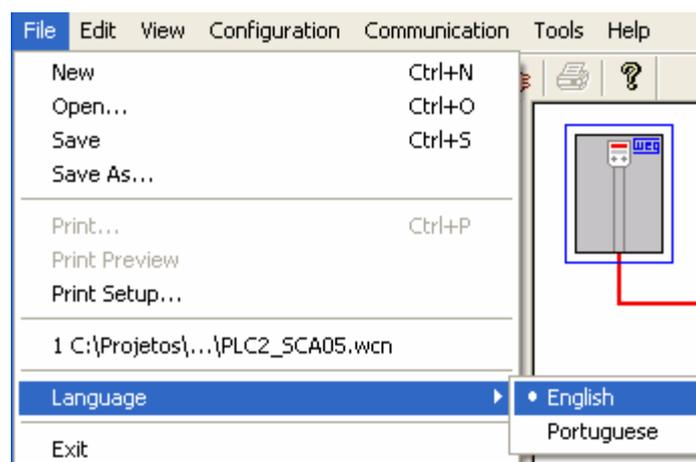
3.2 Main Window

The main window of the WSCAN software has the following appearance:

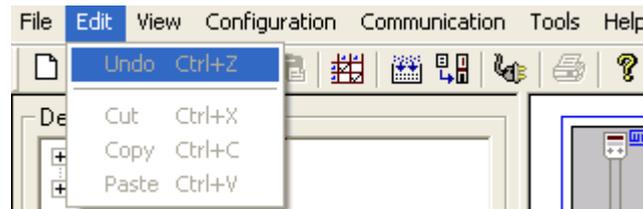


3.3 Main Menu

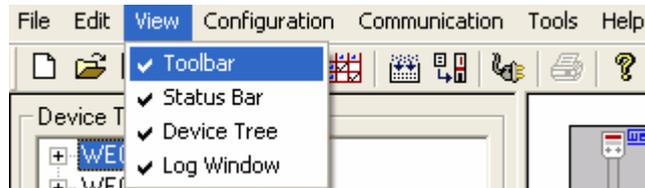
File menu:



Edit menu:



View menu:



Configuration menu:



Communication menu:



Tools menu:



Help menu:



3.4 Button Bar

It is composed of the following buttons:

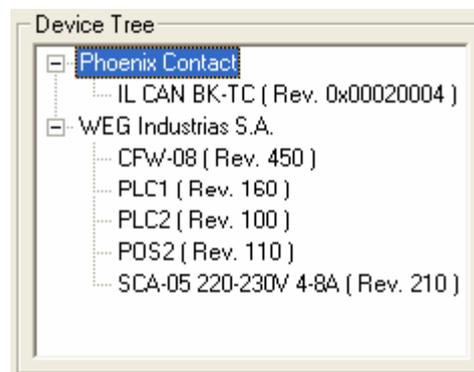
-  - New CANopen configuration file.
-  - Open CANopen configuration file.
-  - Save CANopen configuration file.

-  - Cut.
-  - Copy.
-  - Paste.
-  - Viewer/Configuration of PDOs connections.
-  - Create configuration.
-  - Transfer configuration.
-  - Online monitoring.
-  - Print.
-  - About the WSCAN.

3.5 Device Tree

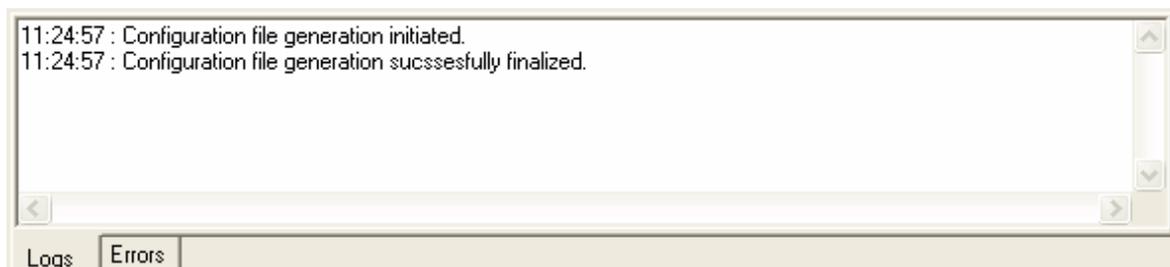
It contains the list of available devices that can be used as slaves on the CANopen network. This list is created from the content of the “EDS” folder that is located inside the WSCAN installation folder, which is the same of the WLP (usually “C:\Weg\WLP VX.YZ” where X.YZ is the WLP version).

In order to add a device to this list, just copy the EDS (Electronic Data Sheet) file provided by the device manufacturer to the “EDS” folder mentioned previously. It is necessary to restart the software so that the added files can be included in this list.



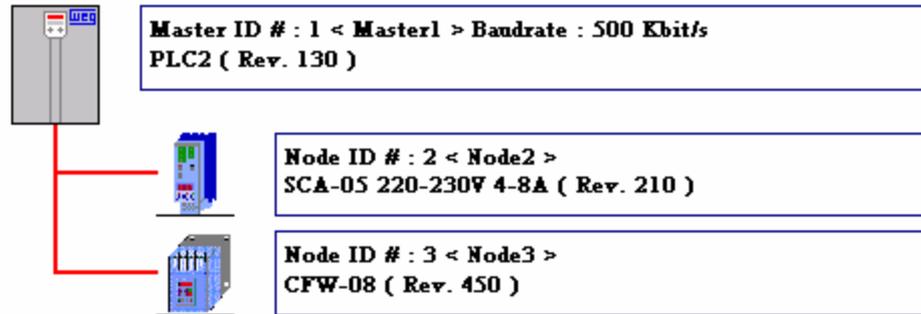
3.6 Log Window

It contains the list of registers/errors generated by the software. Registers or errors that may happen during the analysis of the “EDS” files and creation of configuration will be listed on this window.

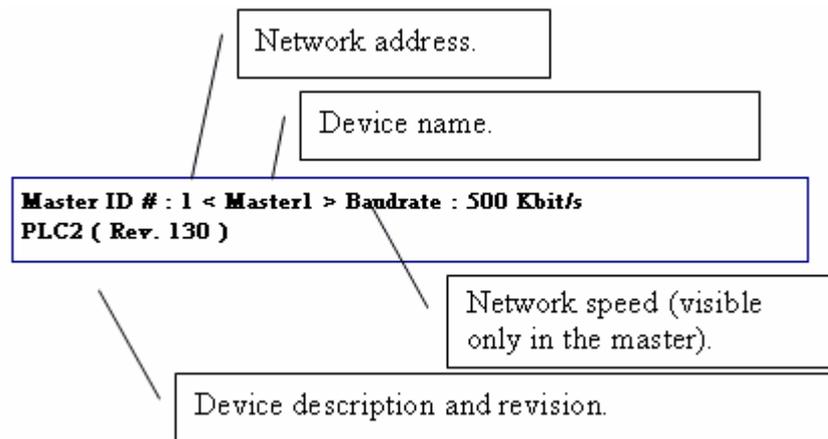


3.7 CANopen network

The network structure will be always graphically represented on the WSCAN software. The main data related to master and slaves are listed in this representation.



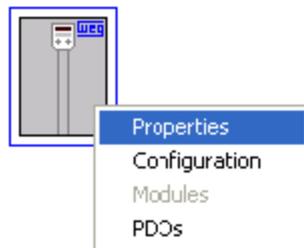
The device data will be organized in the following mode:



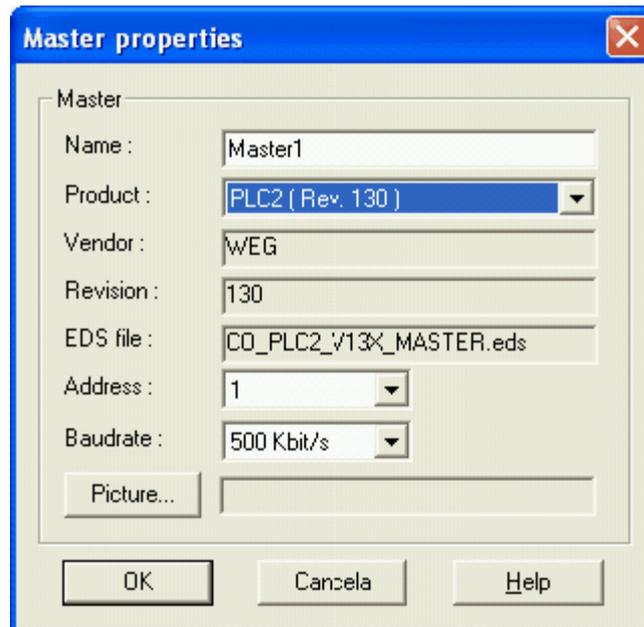
3.8 Configuring a new network

When creating a new CANopen network project the devices will be not configured (including the master). Therefore, the following procedures shall be carried out:

1st - Define the network master by clicking on the master picture and select the option "Properties".

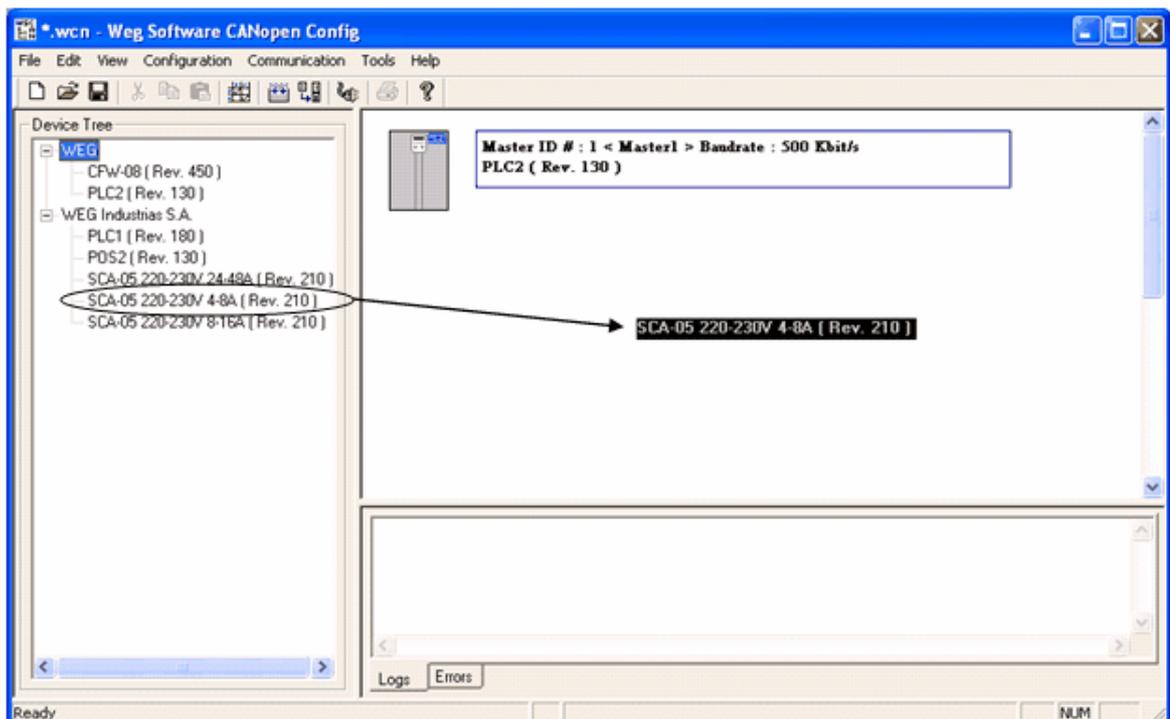


The following dialog box appears:

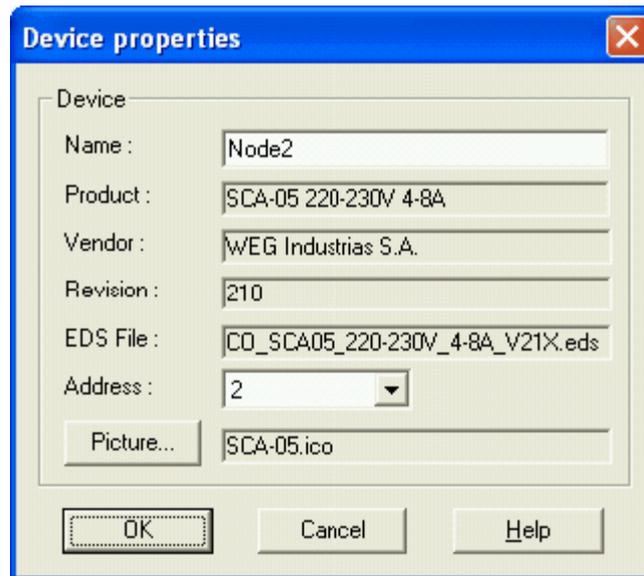


The basic properties of the master, such as the master device (in this case the “PLC2”), the master address and the network baudrate are defined in this box.

2nd - Add slave devices, which are available on the list of devices, by dragging and dropping them into the network structure area.

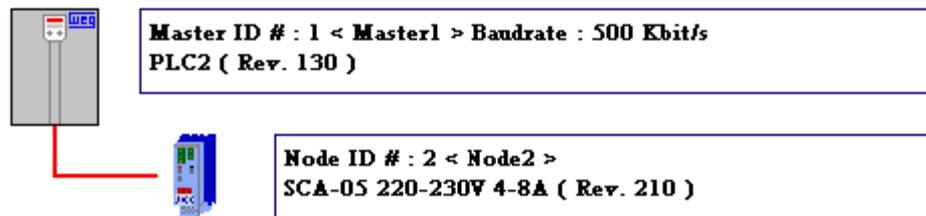


After the device is dragged and dropped, the following dialog box appears:



At this time, the basic properties of the slave will be defined, such as the slave address. Once the slave address was defined and the “OK” button was pressed, it cannot be changed anymore. Therefore, if it is necessary to change the slave address, remove the device from the network structure and repeat this procedure.

After completion of these procedures, the network will be configured with a slave device and it will be represented as follows:



3.9 Configuring the master

3.9.1 Configuring the master

Click on the master picture and select the option “Configuration” to access the master configuration. Then, a dialog box appears with the options that are described in the next items.

Related topics :

[NMT](#) ^[20]

[SYNC PRODUCER](#) ^[20]

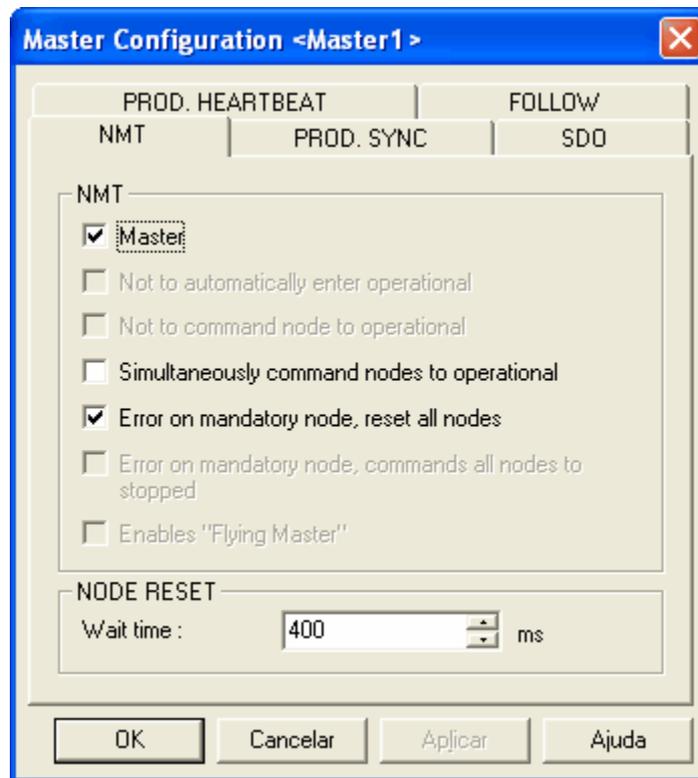
[SDO](#) ^[21]

[HEARTBEAT PRODUCER](#) ^[22]

[FOLLOW](#) ^[24]

3.9.2 NMT

This option configures the network control and management properties of the CANopen master. Defines the basic properties of the master during the initialization and management of the network:



- Master: if this option is not selected, the device will behave as a network slave and it will not be possible to configure the other slaves and start the network communication.
- Simultaneously command the slaves to the operational: it allows selecting if the master will command the slaves to the operational mode after the initialization of each slave, or if the master will command all slaves to the operational mode at the same time (after the whole network initialization is done).
- Error on mandatory slave, reset all nodes: it allows programming the master to restart all the network slaves or only the faulty slave in case of detecting a communication error with a slave programmed as “mandatory”. The slave is defined as mandatory or not in the configuration of the slave itself.

NODE RESET :

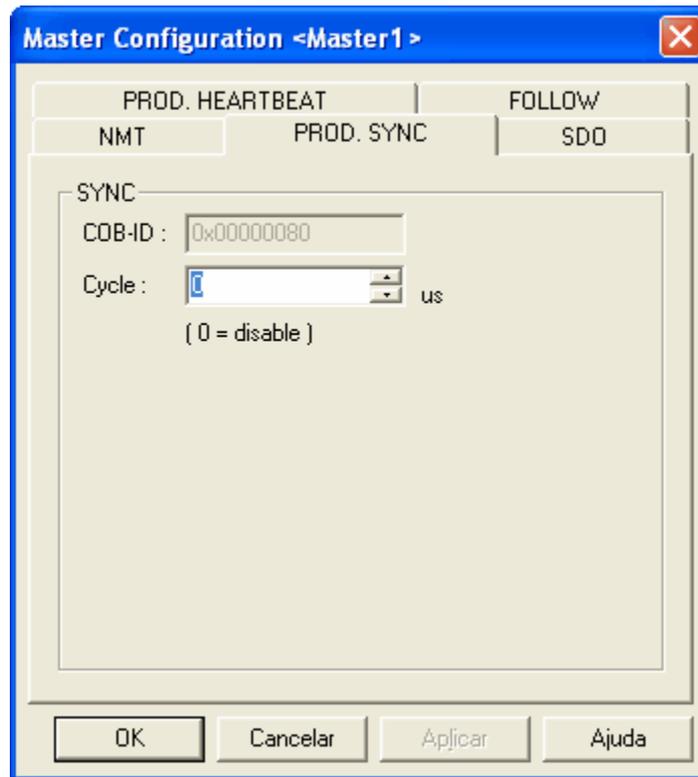
- Wait Time ⁽¹⁾ ²⁰: wait time after node reset command sent by master.

(1) Only for PLC11-01 board.

3.9.3 SYNC PRODUCER

This option enables the synchronization service of the CANopen master.

This service is used for synchronizing the data transmission of the PDO service, ensuring that the information will be produced and consumed at the same time in different devices.



- COB-ID: indicates the identifier of the SYNC message. Modifications in this identifier are not allowed. Therefore, the default value of the SYNC message on the CANopen network shall be used.
- Cycle: defines the cycle time of the SYNC message transmitted by the network master. If the communication cycle time is disabled the master will behave as a SYNC Consumer.

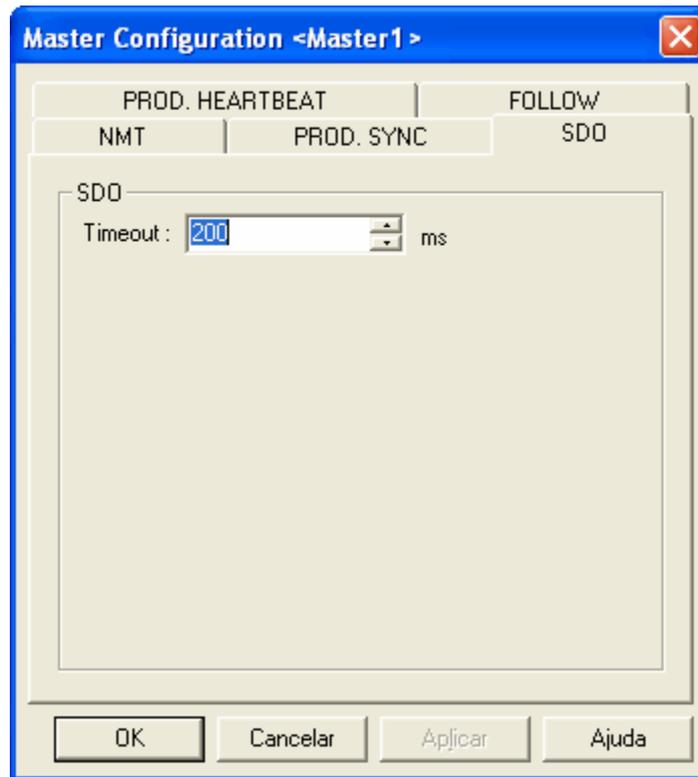
NOTE!

- Very short cycle times for the SYNC message will overload the network and cause communication errors of the various services.

3.9.4 SDO

Properties of the SDO server of the CANopen master.

This option configures the properties of the SDO server, which is used by the SDO ladder block in the WLP and also in the communication between master and slaves via Modbus protocol.

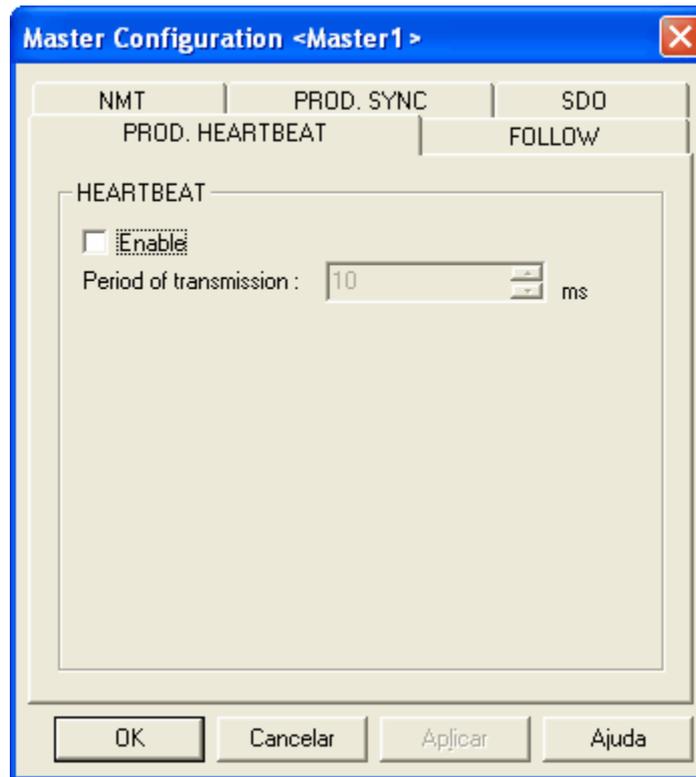


- Timeout: defines the time that the network master shall wait for an answer every time the SDO client of the master issues a request to the SDO server of any slave on the network. An error will be indicated in case the answer is not received within the programmed time.

3.9.5 HEARTBEAT PRODUCER

This option enables the heartbeat producer service of the CANopen master.

A slave with a configured heartbeat consumer uses this service to monitor the master communication with the CANopen network.

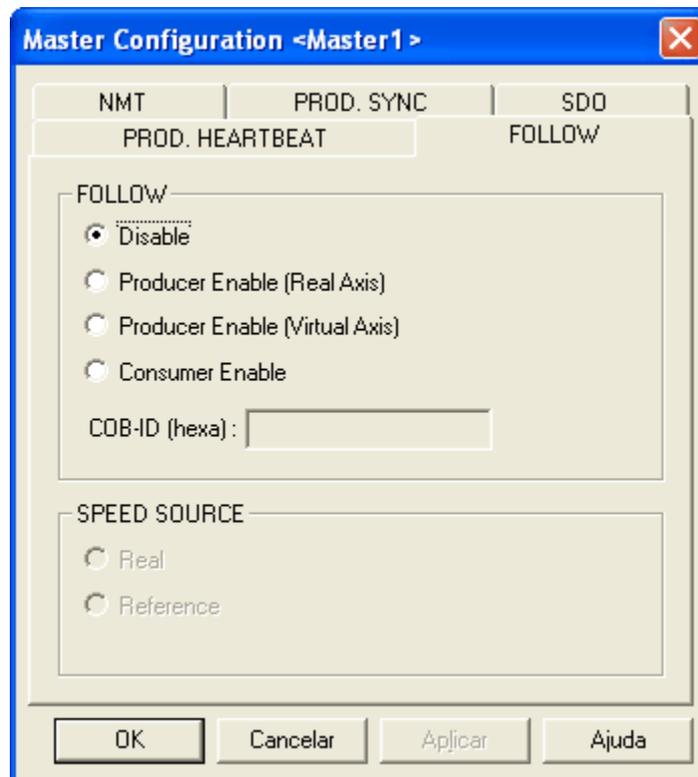


- Enable: it allows enabling or disabling the production of heartbeat messages by the network master.
- Period of transmission: in case it is enabled, this will be the transmission cycle of heartbeat messages. Once it is programmed, other network devices with heartbeat consumer can be programmed to monitor these messages and detect communication errors.

3.9.6 FOLLOW

It enables the Follow producer or consumer service via CANopen.

It is used to perform speed or position synchronism via the WLP Follow block [\(1\)](#)²⁴.



- Disable: It disables the Follow producer or consumer function.
- Producer Enabling (Real Axis): It enables the master to produce Follow data through the TPDO 01.
- Producer Enabling (Virtual Axis): It enables the master to produce Follow data through the TPDO 01 [\(2\)](#)²⁴.
- Consumer Enabling: It enables the master to consume Follow data through the RPDO 01.
- COB-ID (hexa): It is the TPDO 01 or RPDO 01 identifier in the CANopen network. In order that the Follow data produced in one equipment be consumed in another, the value of this parameter must be the same in both equipments.
- Speed Source: It selects which speed the follow producer (actual speed or speed reference) will transmit.

Refer to the [programming example of the Follow](#)⁶³ block via CANopen for more details.

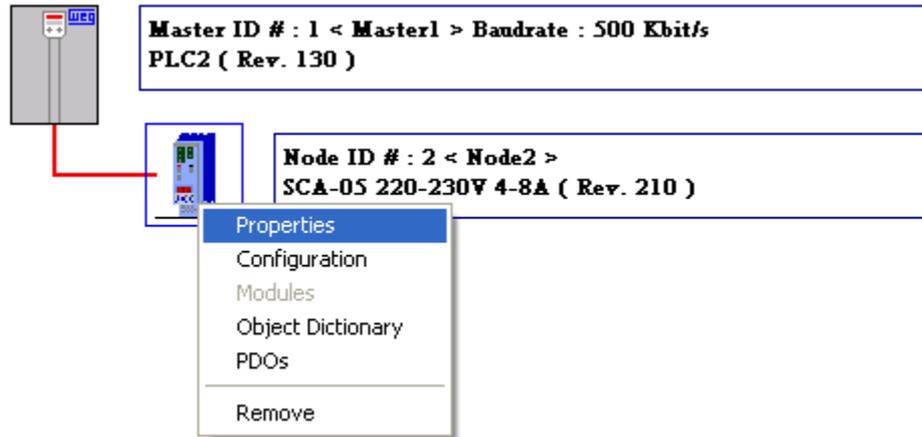
(1) Available only for the PLC11-01 and PLC11-02 with firmware \geq 1.20.

(2) Available only for the PLC11-01 and PLC11-02 with firmware \geq 1.30.

3.10 Configuring the slaves

3.10.1 Configuring the slaves

Click on the slave picture and select the option “Configuration” to access the slave configuration. Then, a dialog box appears with the options that are described in the next items.



Related topics :

[NMT](#) ²⁶

[NODE GUARDING](#) ²⁶

[HEARTBEAT PRODUCER](#) ²⁷

[EMCY](#) ²⁸

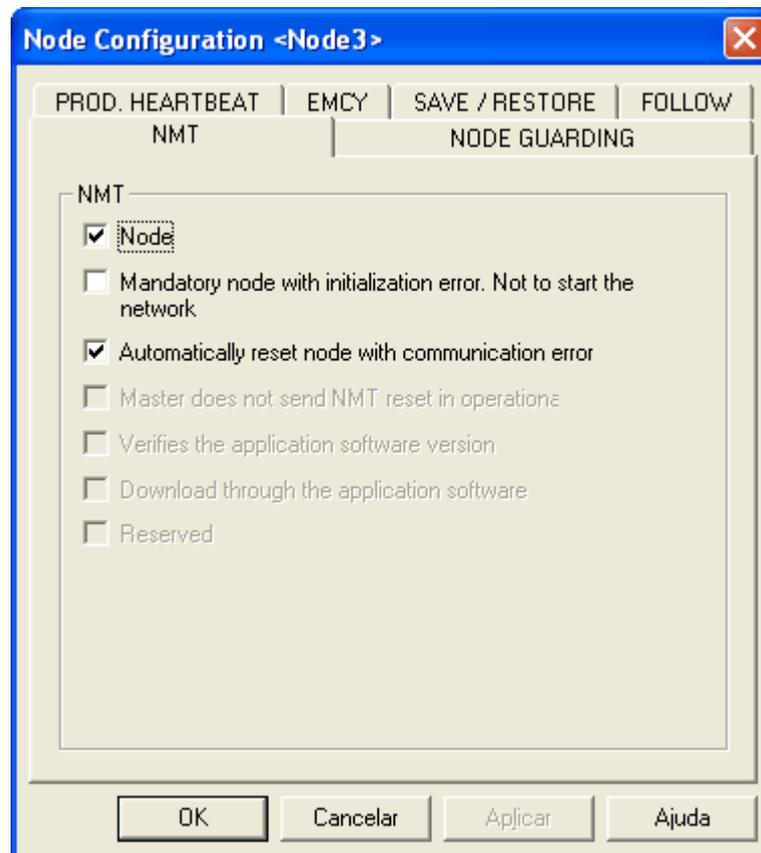
[SAVE/RESTORE](#) ³¹

[FOLLOW](#) ³²

3.10.2 NMT

This option configures the control and operation properties of the slave.

Defines the basic properties of the slave during the initialization and operation of the network:



- Slave: if this option is not selected, the device will be not configured and neither initialized by the network master.
- Mandatory node with initialization error do not initialize the network: it allows programming if the slave is mandatory or not to the network master. If the slave is programmed as mandatory and an initialization error is detected, the master will not try to initialize the remaining network slaves until the initialization of this slave is completed.
- Automatically reset node with communication error: if this option is selected and the master detects a communication error with this slave, then the master will reset and restart the slave. Otherwise, the master will only indicate de error in the status word and wait for the user to reset and restart the slave (this can be done by using the words for communication control).

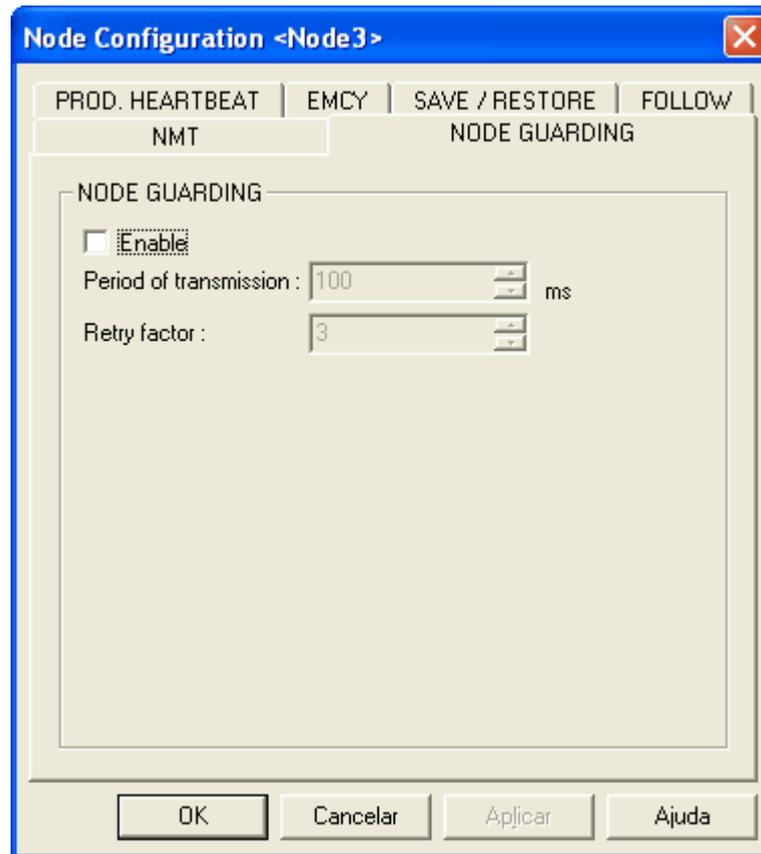
NOTE!

- It is necessary to enable any error control service (Node Guarding or Heartbeat).

3.10.3 NODE GUARDING

This option enables the node guarding service of the slave.

This service is used for monitoring the slave communication with the CANopen network. This monitoring is carried out by the master as well as by the slave.



- Enable: it allows enabling or disabling the Node Guarding error control service for the slave.
- Period of transmission: defines the time-interval within which the slave shall respond to the master request.
- Retry factor: defines the number of time-intervals that the slave or the master shall wait before indicating the communication error.

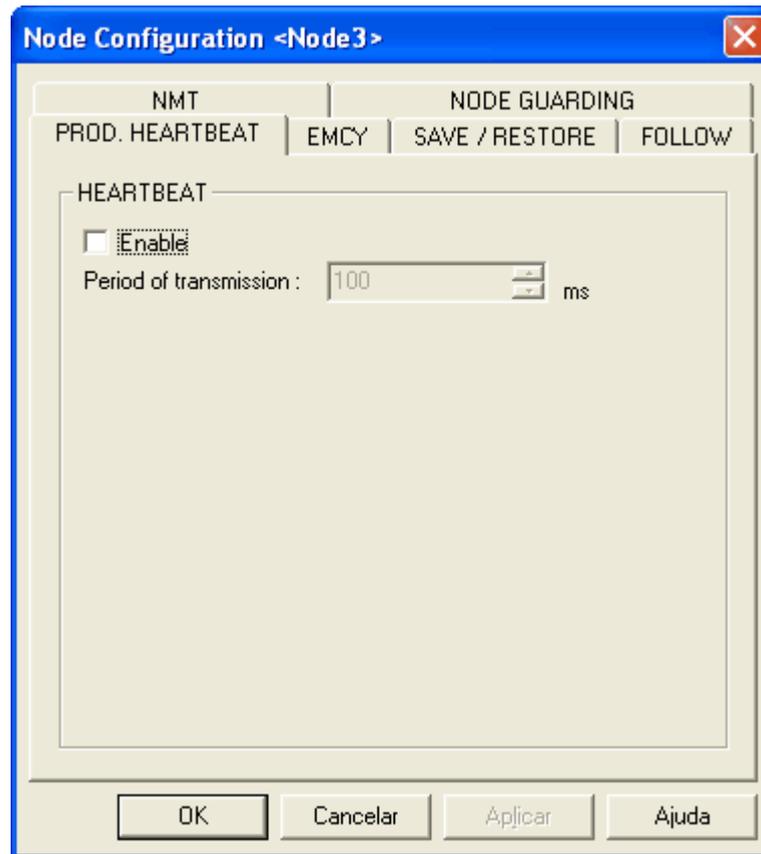
NOTE!

- This service will only be available if the slave has the objects need for its execution that are described in the EDS file (100Ch and 100Dh).
- Only one error control service, either Node Guarding or Heartbeat, can be enabled in the slave.

3.10.4 HEARTBEAT PRODUCER

This option enables the heartbeat producer service of the slave.

This service is used for monitoring the slave communication with the CANopen network. This monitoring is carried out only by the master.



- Enable: it allows enabling or disabling the Heartbeat control error service for this slave.
- Period of transmission: defines the time-interval within which the slave shall transmit heartbeat messages to the network. A communication error is indicated if the network master does not receive any of these messages from the slave within the heartbeat time.

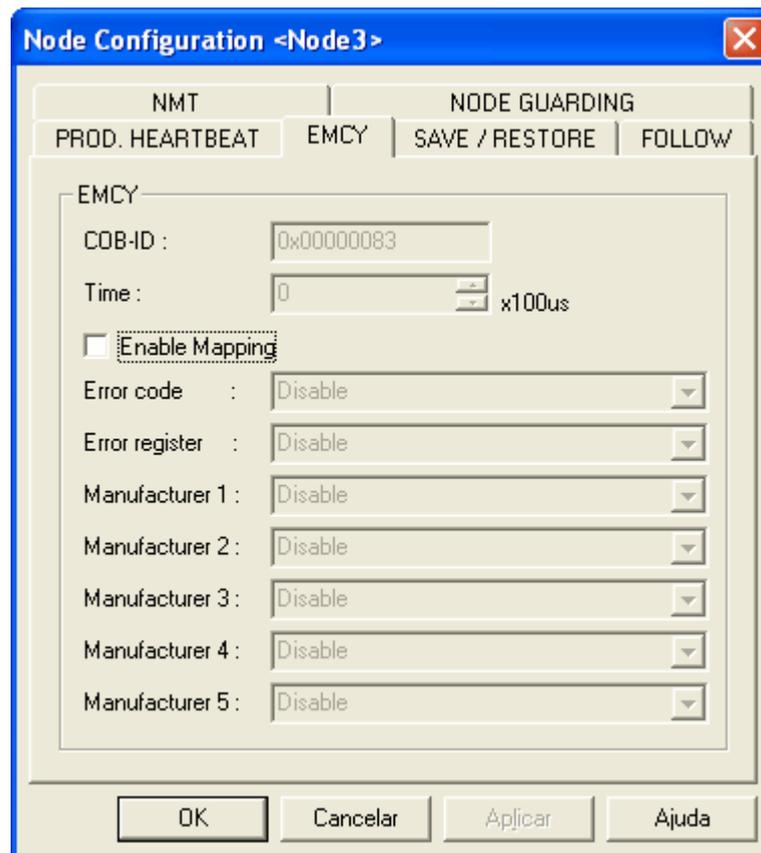
NOTE!

- This service will only be available if the slave has the objects need for its execution that are described in the EDS file (1017h).
- Only one error control service, either Node Guarding or Heartbeat, can be enabled in the slave.

3.10.5 EMCY

This option enables the EMCY service of the slave.

This service is used for indicating a device error. These error messages will be stored in up to 8 status words that can be accessed in the ladder program developed through the WLP to the CANopen master.



- Enable Mapping: it allows enabling or disabling the master mapping of EMCY messages transmitted by the slave.
- Time: defines the time-interval that the slave shall wait before transmitting a new EMCY message to the network.
- Status: defines which master register will store the data transmitted in the EMCY message. The content of this data identify the type of error occurred in the slave. Each data represents one of the 7 existent fields in a EMCY message:
 - Word 1 : Error code (CiA)
 - Word 2 : Error register (object 1001h)
 - Word 3 to 7 : Manufacturer specific error field (1 to 5).

Error Code (hex)	Meaning
00xx	Error Reset or No Error
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 (Objects lost)
8120	CAN in Error Passive Mode
8130	Life Guard Error or Heartbeat Error
8140	recovered from bus off
8150	Transmit COB-ID collision
82xx	Protocol Error
8210	PDO not processed due to length error
8220	PDO length exceeded
90xx	External Error
F0xx	Additional Functions
FFxx	Device specific

Error code CiA - Word 1 EMCY.

Bit	M/O	Meaning
0	M	generic error
1	O	current
2	O	voltage
3	O	temperature
4	O	communication error (overrun, error state)
5	O	device profile specific
6	O	Reserved (always 0)
7	O	manufacturer specific

Object 1001h - Word 2 EMCY.

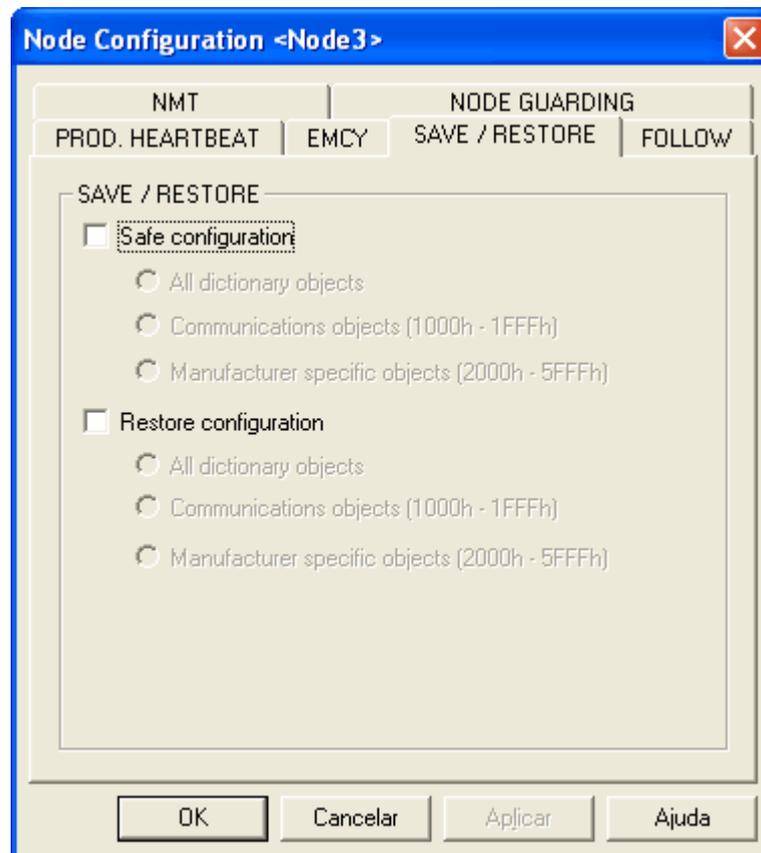
NOTE!

- EMCY : This service will only be available if the slave has the objects need for its execution that are described in the EDS file (1014h).

- Inhibit Time: This service will only be available if the slave has the objects need for its execution that are described in the EDS file (1015h).

3.10.6 SAVE/RESTORE

This service is used to save or restore the default values of the parameters in the slave object dictionary.



- Save configuration: at the end of the slave configuration, the master requests the slave to save its configurations in a non-volatile local memory.
- Restore configuration: before configuring the slave, the master requests the slave to restore its configurations to the default values.

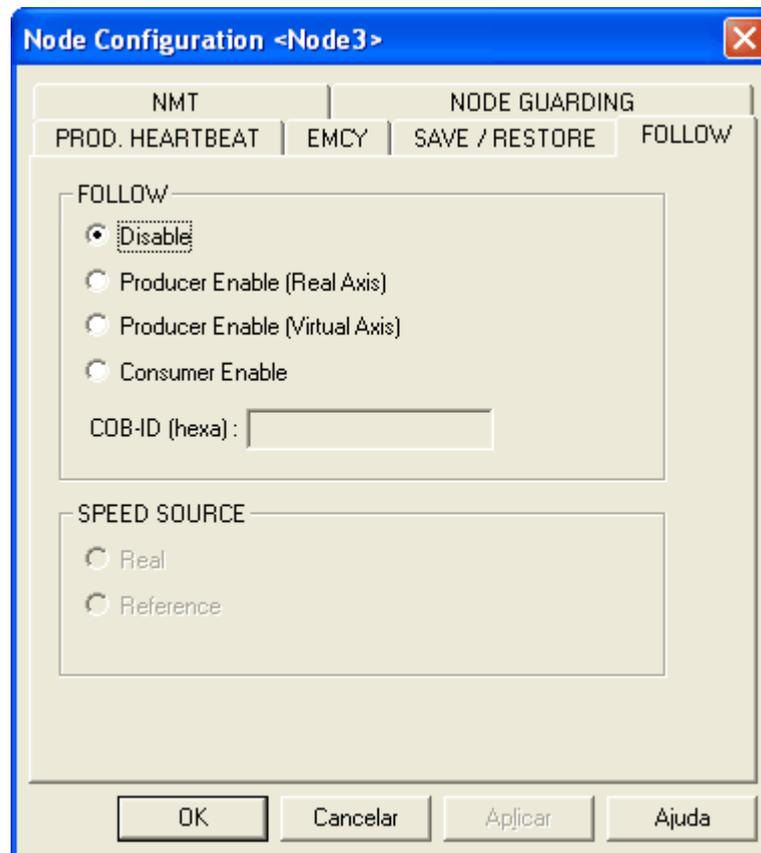
NOTE!

- This service will only be available if the slave has the objects need for its execution that are described in the EDS file (1010h or 1011h).
- The use of these services consume quite some time from the slaves, therefore timeout errors may happen during the communication. In order to avoid these communication errors it is necessary to increase the SDOs timeout in the master configuration.

3.10.7 FOLLOW

It enables the Follow producer or consumer service via CANopen.

It is used to perform speed or position synchronism via the WLP Follow block [\(1\)](#)³².



- Disable: It disables the Follow producer or consumer function.
- Producer Enabling (Real Axis): It enables the master to produce Follow data through the TPDO 01.
- Producer Enabling (Virtual Axis): It enables the master to produce Follow data through the TPDO 01 [\(2\)](#)³².
- Consumer Enabling: It enables the master to consume Follow data through the RPDO 01.
- COB-ID (hexa): It is the TPDO 01 or RPDO 01 identifier in the CANopen network. In order that the Follow data produced in one equipment be consumed in another, the value of this parameter must be the same in both equipments.
- Speed Source: It selects which speed the follow producer (actual speed or speed reference) will transmit.

Refer to the [programming example of the Follow](#)⁶³ block via CANopen for more details.

(1) Available only for the PLC11-01 and PLC11-02 with firmware \geq 1.20.

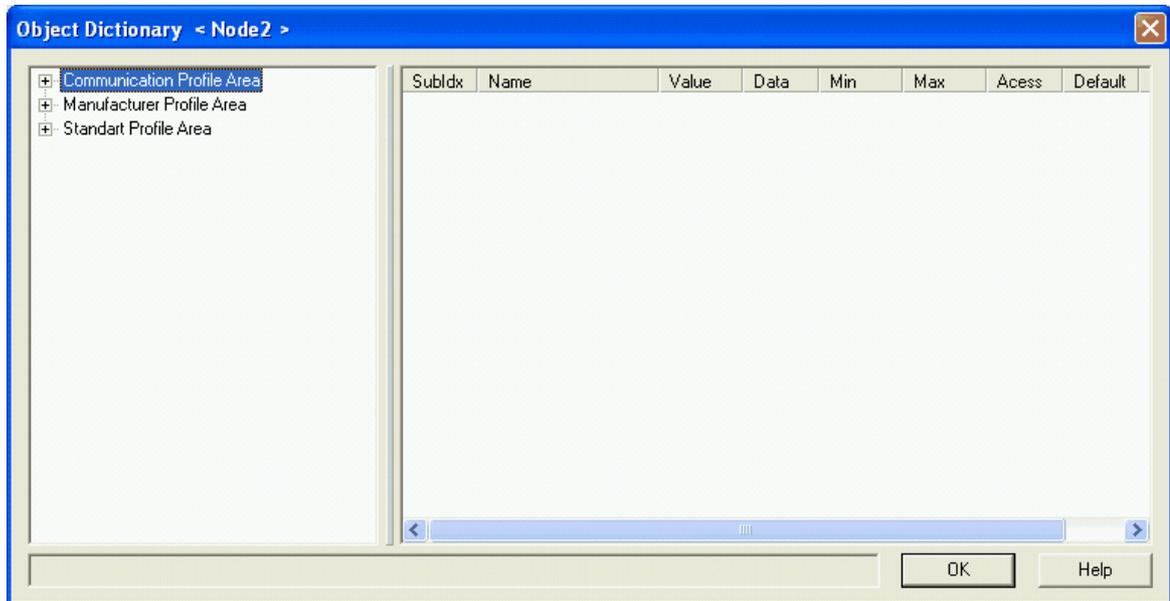
(2) Available only for the PLC11-01 and PLC11-02 with firmware \geq 1.30.

3.11 Slave Object Dictionary

3.11.1 Slave Object Dictionary

As previously mentioned, all the objects accessible via the network are listed on the object dictionary inside the “EDS” file, and sometimes it may be interesting to access the content of these objects.

In order to access the slave object dictionary click on the slave picture and select the option “Object Dictionary”. The following dialog box appears:



Related topics :

[List of Objects](#) ³³

[Object Data](#) ³⁴

[Changing the numerical base](#) ³⁵

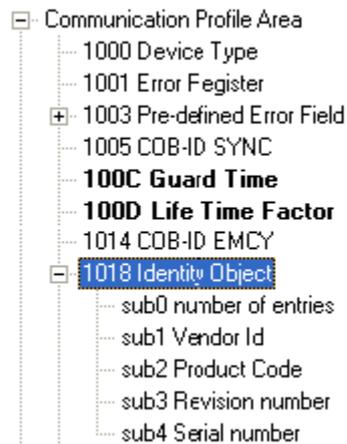
[Changing the object value](#) ³⁶

3.11.2 List of Objects

The object dictionary is divided into three groups: “Communication Profile Area” that contains the communication specific objects, “Manufacturer Profile Area” that contains the manufacturer specific objects, and “Standard Profile Area” that contains the standard objects common to a class of devices.

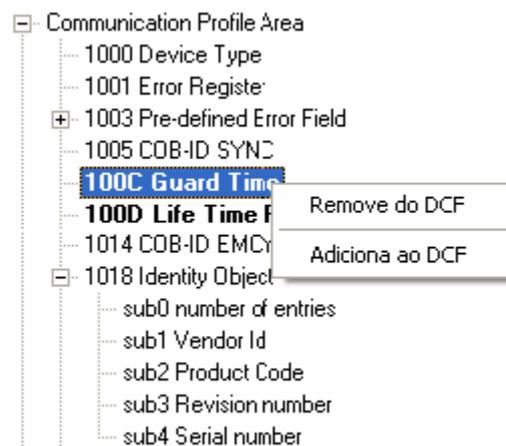
- Communication Profile Area
- Manufacturer Profile Area
- Standart Profile Area

The objects are always identified by its index and sub-index (when it exists), which have a hexadecimal representation. For example, the object “Device Type” has an index = 1000h and a sub-index = 0h (as it does not exist), while the object “Vendor Id” has an index = 1018h and a sub-index = 1h.



The bolded objects in this list belong to the DCF file, which is a specific list used by the CANopen master during the slave initialization. If an object belongs to the DCF file, it means that the master will be responsible for defining the object value during the initialization.

It is possible to add objects to or remove objects from the DCF file by right-clicking the intended object. Then, the following menu appears:



Only add or remove objects from the DCF file if you know specifically the object function.

3.11.3 Object Data

When an object is selected from the list of objects, its information is presented on the screen. When the selected object has sub-objects then the whole list of sub-objects will be also presented.

SubIdx	Name	Value	Data	Min	Max	Acess	Default	PDO
1	Vendor Id	0x00000123	UNSIGNED32	0x00000000	0xFFFFFFFF	ro	0x00000123	no

The following object information is listed on the screen:

- SubIdx: Object sub-index.
- Name: Object name.
- Value: Object current value.
- Data: Object numerical type.
- Min: Object minimum value.
- Max: Object maximum value.

- Access: Object access rights.
- Default: Object default value.
- PDO: PDOs mapping.

Data types:

- BOOLEAN
- INTEGER8
- INTEGER16
- INTEGER32
- UNSIGNED8
- UNSIGNED16
- UNSIGNED32
- REAL32
- VISIBLE_STRING
- OCTET_STRING
- UNICODE_STRING
- TIME_OF_DAY
- TIME_DIFFERENCE
- DOMAIN
- INTEGER24
- REAL64
- INTEGER40
- INTEGER48
- INTEGER56
- INTEGER64
- UNSIGNED24
- UNSIGNED40
- UNSIGNED48
- UNSIGNED56
- UNSIGNED64

Access type:

- rw: read and write access
- wo: write-only access
- ro: read-only access
- const: value is constant, read only access

3.11.4 Changing the numerical base

In order to change the numerical base of an object right-click the intended object, choose the option "Format" and then, select the new numerical base.

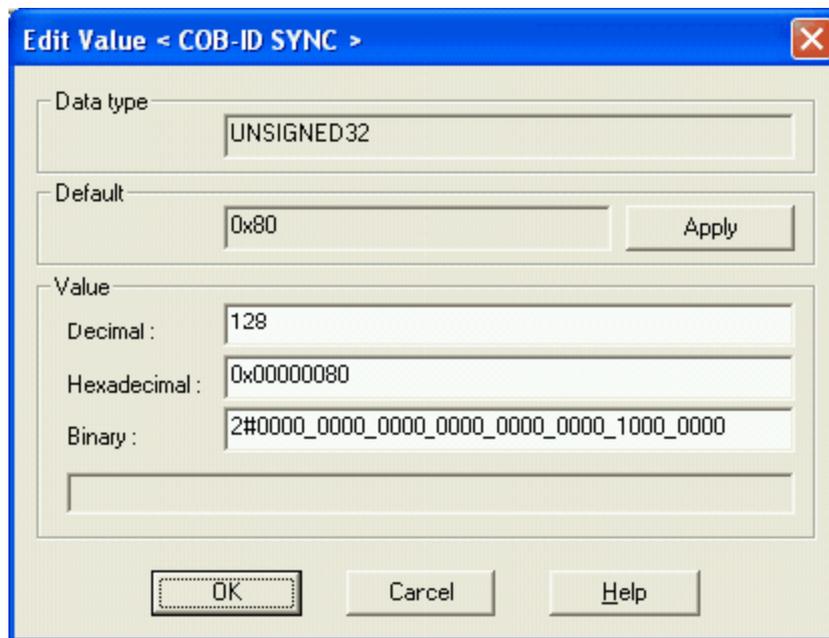
SubIdx	Name	Value	Data	Min	Max	Access	Default	PDO
1	Vendor Id	0x00000123	UNSIGNED32	0x00000000	0xFFFFFFFF	ro	0x00000123	no

Edit Value
Format
Decimal
<input checked="" type="checkbox"/> Hexadecimal
Binary

3.11.5 Changing the object value

Objects that have access type “rw” and “wo” can have their values modified. When the object value changes, it is automatically added to the DCF file.

In order to change the object value, double-click the object or right-click the object information that you want to change and choose the option “Edit Value”. Then, the following dialog box appears:



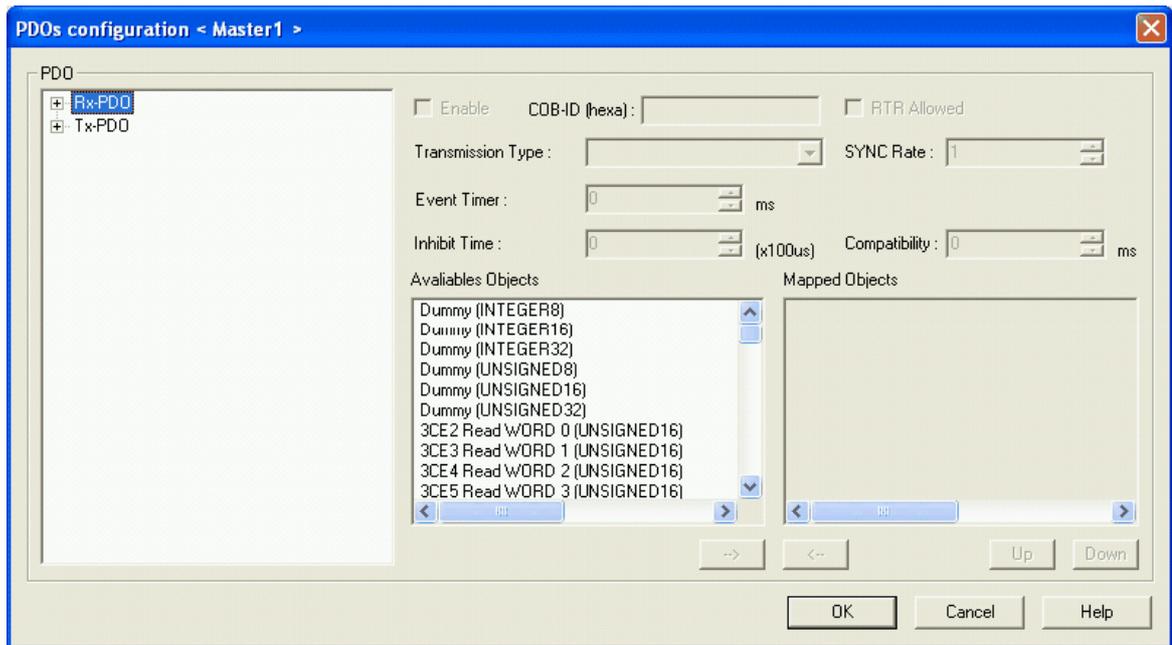
Use this dialog box to change the object value in one of the three numerical bases (the conversion to the other bases is automatic) or apply the default value. When the default value is applied, the object is removed from the DCF file.

3.12 Master/Slave PDOs Configuration

3.12.1 Master/Slave PDOs Configuration

As previously mentioned, the PDOs are generally used for transmission and reception of real-time data that is needed during the device operation and, therefore, they shall be configured.

In order to access the configuration of the master/slave PDOs click on the master/slave picture and choose the option “PDOs”. Then, the following dialog box appears:



Related topics :

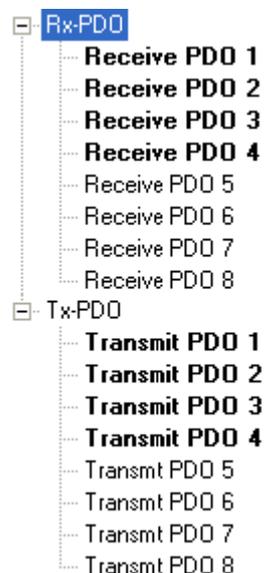
[PDOs List](#) ³⁷

[PDO communication parameters](#) ³⁸

[PDO Mapping](#) ³⁹

3.12.2 PDOs List

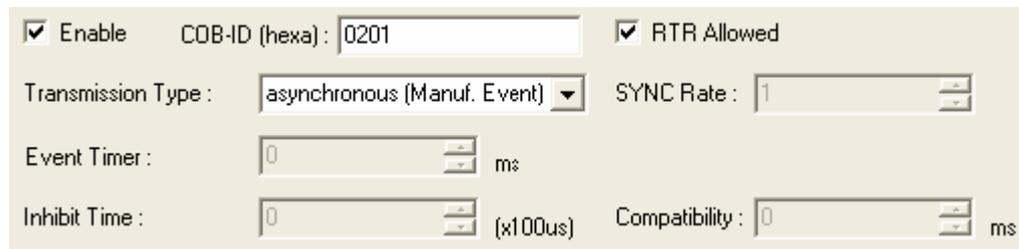
The PDOs are divided into two groups: “RxPDO” and “TxPDO”, where the “RxPDO” are the Receive-PDOs and the “TxPDO” are the Transmit- PDOs.



The bolded PDOs in this list are enabled.

3.12.3 PDO communication parameters

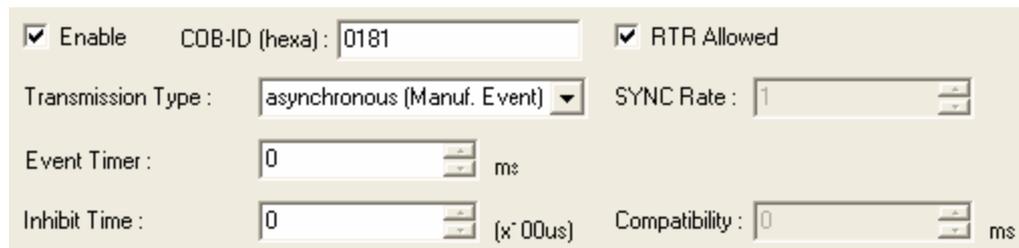
When a PDO is selected from the list of PDOs, its communication parameters are shown in the dialog box as presented in the following figures:



The screenshot shows a dialog box for RxPDO communication parameters. It includes the following fields and controls:

- Enable
- COB-ID (hexa):
- RTR Allowed
- Transmission Type:
- SYNC Rate:
- Event Timer: ms
- Inhibit Time: (x100us)
- Compatibility: ms

RxPDO communication parameters.



The screenshot shows a dialog box for TxPDO communication parameters. It includes the following fields and controls:

- Enable
- COB-ID (hexa):
- RTR Allowed
- Transmission Type:
- SYNC Rate:
- Event Timer: ms
- Inhibit Time: (x100us)
- Compatibility: ms

TxPDO communication parameters.

Description of the communication parameters:

- Enable: enables/disables the PDO.
- COB-ID (hexadecimal): this is the PDO identification number in the CANopen network. The COB-ID range is from 0181h to 057Fh. This identifier is used to connect TxPDOs to RxPDOs, i.e., if we want a data produced by a TxPDO to be consumed by a specific RxPDO then, they shall have the same COB-ID.
- RTR Allowed: RTR allowed/not allowed (remote frame).
- Transmission Type: Mode of receiving/transmitting messages.

The following transmission modes are supported:

Description	RxPDO	TxPDO
Synchronous acyclic	Upon reception of a PDO, the device will only update the mapped data at the next reception of a SYNC object.	The PDO transmission is triggered upon reception of a SYNC object (acyclic), but not periodically. The transmission also depends on an event, according to the device configuration.
Synchronous cyclic	Upon reception of a PDO, the device will only update the mapped data at the next reception of a SYNC object.	The PDO transmission is triggered upon reception of a SYNC object. The value set in "SYNC Rate" (from 1 to 240) indicates the number of SYNC objects that are necessary to trigger the PDO transmission.
Synchronous RTR only	This transmission mode is not supported by the RxPDOs.	The mapped data is updated at the reception of a remote frame. However, only the following SYNC object triggers the PDO transmission.
Asynchronous RTR only	This transmission mode is not supported by the RxPDOs.	The PDO is transmitted immediately after the reception of a remote frame.
Asynchronous manufacturer event	The mapped data is updated immediately after the reception of a PDO.	The PDO transmission is triggered by an event that is manufacturer specific. For example, it can be transmitted according to the "Event Timer" ¹¹ .
Asynchronous profile event	The mapped data is updated immediately after the reception of a PDO.	The PDO transmission is triggered by an event defined in the device profile. It can also be set to trigger according to the "Event Timer" ¹¹ .

- Sync Rate: used to define the number of SYNC objects that are necessary to the transmission of "Synchronous cyclic" TxPDOs.
- Event Timer: used to define a temporized event. It can or cannot be used as an event to trigger the TxPDOs (depends on the device configuration).
- Inhibit time: TxPDOs inhibition time, that is, the device may not transmit the PDO again before expiry of the inhibit time.
- Compatibility: reserved.

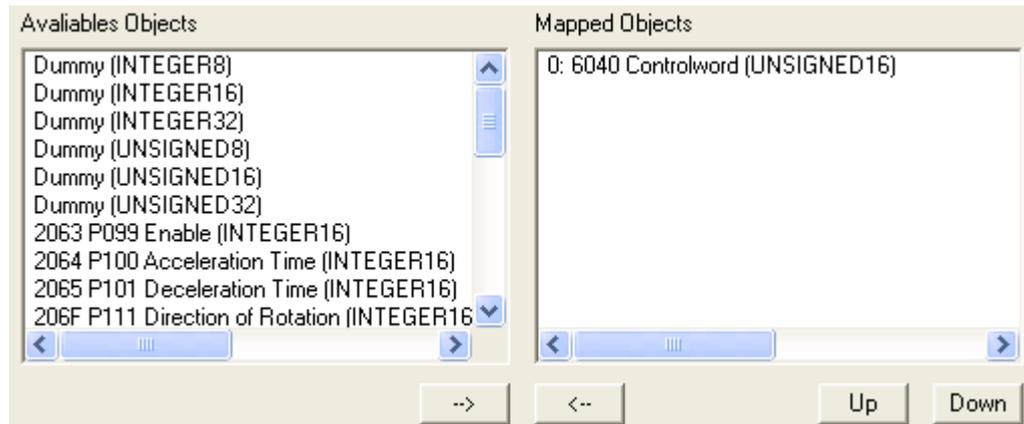
NOTE!

On master, the "Asynchronous manufactures event" transmission type is only by "Event Timer" programing.

3.12.4 PDO Mapping

Every PDO can transmit or receive up to 64-bits of data. These data shall be configured through the PDO Mapping that basically defines which application objects will be transmitted within a TxPDO and which objects will receive an RxPDO. There will be a list of objects that can be mapped for each device, as well as the maximum number of mapped objects by TxPDO or RxPDO.

As previously described, the TxPDO and the RxPDO must have the same COB-ID so that they can be connected. In the same way, the total size of mapped bits in these PDOs must be the same. The TxPDO can transmit more data than the RxPDO is programmed to receive, but never the inverse.



The dialog box contains a list of objects available for mapping in the RxPDO or in the TxPDO. “rw” and “wo” will be available, and for the TxPDOs the objects with access type “rw” and “ro” will be available. The dialog also contains a list of mapped objects in the PDO, a button to add a mapped object (“?”), a button to remove a mapped object (“?”), a button to move the mapped object up (“Up”) and a button to move the mapped object down (“Down”).

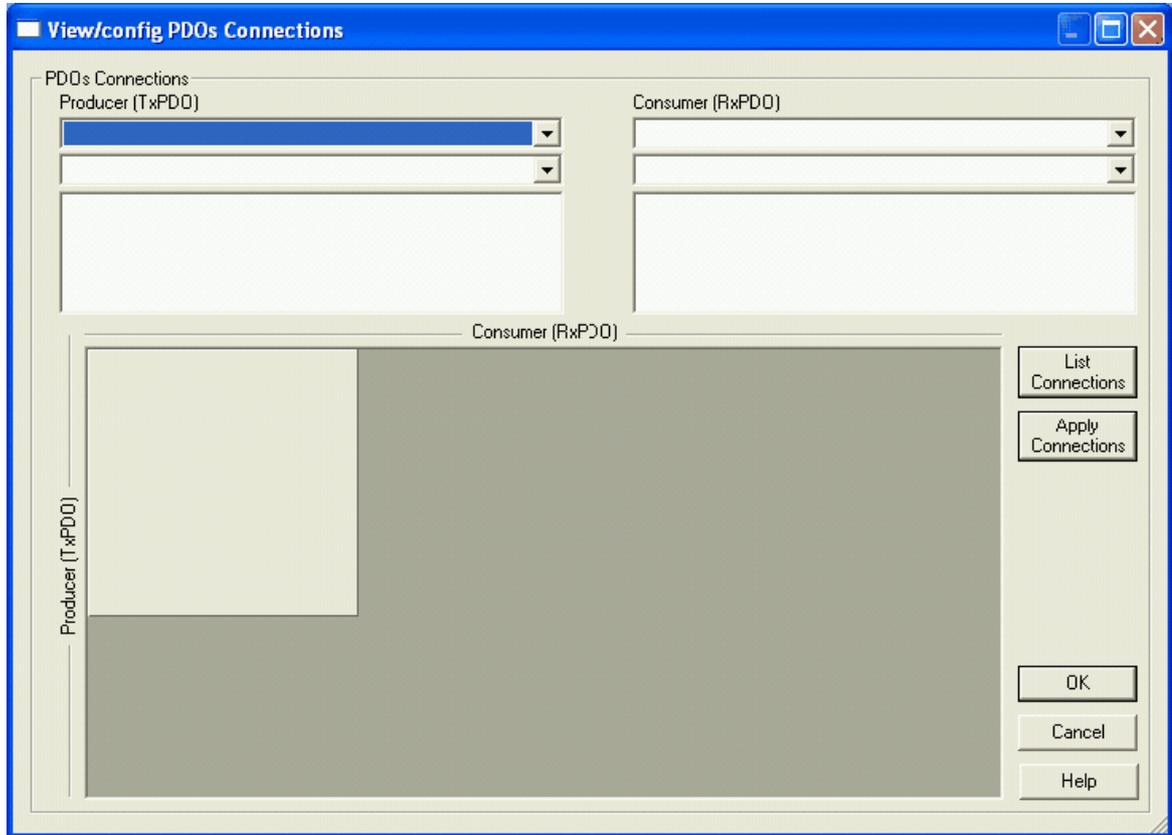
NOTE!

- For the RxPDOs the object with access type “rw” and “wo” will be available, and for the TxPDOs the objects with access type “rw” and “ro” will be available.

3.13 Viewer/Configuration of PDOs connections

3.13.1 Viewer/Configuration of PDOs connections

This window is used to connect Transmit-PDOs (TxPDO) to Receipt-PDOs (RxPDO) in different devices.



Related topics :

[Procedure for connecting PDOs](#) ⁴¹

[Listing the connections](#) ⁴⁸

3.13.2 Procedure for connecting PDOs

3.13.2.1 Procedure for connecting PDOs

The procedure for connecting PDOs consists basically on selecting a device that produces determined information (Producer) and a device that consumes this information (Consumer).

The example presented here is based on the network configuration created in item 9 of this manual.

Related topics :

[Selecting the producer \(TxPDO\)](#) ⁴²

[Selecting the consumer \(RxPDO\)](#) ⁴³

[Connecting the producer \(TxPDO\) to the consumer \(RxPDO\)](#) ⁴⁵

[Connecting objects of different sizes](#) ⁴⁶

3.13.2.2 Selecting the producer (TxPDO)

The producer is the device responsible for transmitting the data to the network. Use the following selection box to select the producer.

Producer (TxPDO)

Master ID #: 1 < Master1 >

Master ID #: 1 < Master1 >

Node ID #: 2 < Node2 >

After the producer device was selected, a list with the available TxPDOs and their basic information is presented.

Producer (TxPDO)

Master ID #: 1 < Master1 >

TxPDO 1 : COB-ID 0x0181 (Enable) (rw)

TxPDO 1 : COB-ID 0x0181 (Enable) (rw)

TxPDO 2 : COB-ID 0x0281 (Enable) (rw)

TxPDO 3 : COB-ID 0x0381 (Enable) (rw)

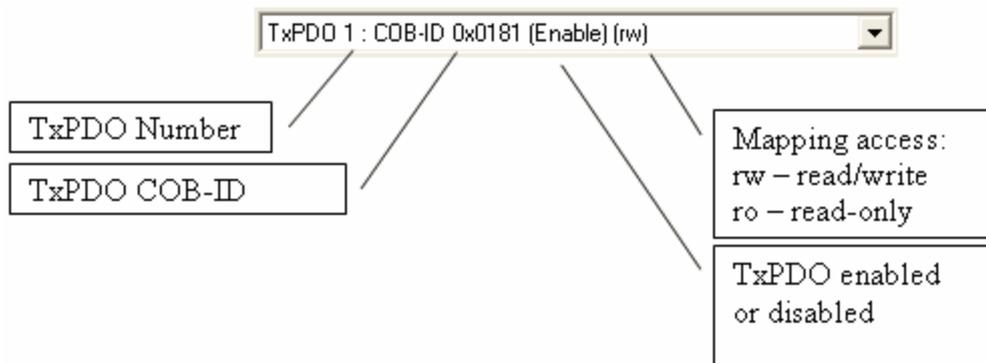
TxPDO 4 : COB-ID 0x0481 (Enable) (rw)

TxPDO 5 : COB-ID 0x0000 (Disable) (rw)

TxPDO 6 : COB-ID 0x0000 (Disable) (rw)

TxPDO 7 : COB-ID 0x0000 (Disable) (rw)

TxPDO 8 : COB-ID 0x0000 (Disable) (rw)



When a TxPDO is selected, its current mappings and its respective connections are listed.

Producer (TxPDO)

Master ID #: 1 < Master1 >

TxPDO 1 : COB-ID 0x0181 (Enable) (rw)

Mapped 0 : Write WORD 0 (UNSIGNED16)

Mapped 1 : Write WORD 1 (UNSIGNED16)

Mapped 2 : Write WORD 2 (UNSIGNED16)

Mapped 3 : Write WORD 3 (UNSIGNED16)

The producer table moves to the position of the first mapped object when the mapping information is double-clicked.

The data related to the TxPDO connections, if any, will be presented according to the following example:

```
Connected to Node ID #: 2 < Node2 > RxPDO 1  
Mapped 0 : Write WORD 0 (UNSIGNED16)  
Mapped 1 : Write WORD 1 (UNSIGNED16)  
Mapped 2 : Write WORD 2 (UNSIGNED16)  
Mapped 3 : Write WORD 3 (UNSIGNED16)
```

This figure shows that the TxPDO is connected to the RxPDO#1 of the Node-ID#2. By double clicking the connection data, the device and its respective RxPDO will be selected in the consumer configuration.

If there are no connections for that TxPDO and it is enabled, it means that the TxPDO is configured to produce data to the network, but that no other device is configured to consume this data.

3.13.2.3 Selecting the consumer (RxPDO)

The consumer is the device responsible for receiving the data from the network. Use the following selection box to select the consumer.

Consumer (RxPDO)

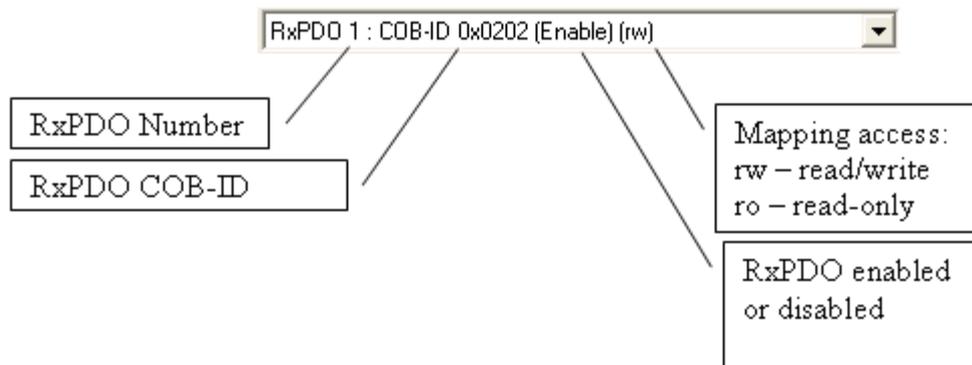
Master ID #: 1 < Master1 >
Node ID #: 2 < Node2 >

After the consumer device was selected, a list with the available RxPDOs and their basic information is presented.

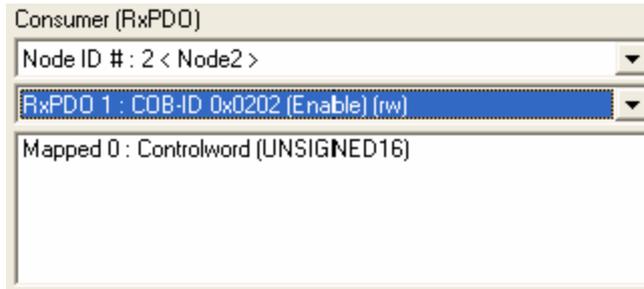
Consumer (RxPDO)

Node ID #: 2 < Node2 >

RxPDO 1 : COB-ID 0x0202 (Enable) (rw)
RxPDO 2 : COB-ID 0x0302 (Enable) (rw)
RxPDO 3 : COB-ID 0x0402 (Enable) (rw)
RxPDO 4 : COB-ID 0x0502 (Enable) (rw)

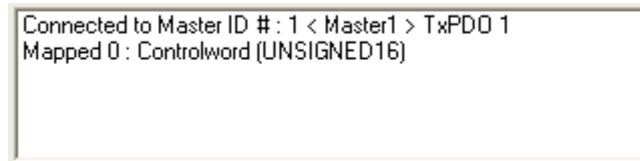


When an RxPDO is selected, its current mappings and its respective connections are listed.



The consumer table moves to the position of the first mapped object when the mapping information is double-clicked.

The data related to the RxPDO connections, if any, will be presented according to the following example:



This figure shows that the RxPDO is connected to the TxPDO#1 of the Master-ID#1. By double clicking the connection data, the device and its respective TxPDO will be selected in the producer configuration.

If there are no connections for that RxPDO and it is enabled, it means that the RxPDO is configured to consume data from the network, but that no other device is configured to produce data.

Besides, after selecting a certain producer and consumer, all its mapped transmission and reception objects will be listed on a table. This table contains all objects that can be used by the producer for transmission and consumer for reception.

The producer objects will be always in the left side of the table, that is, they correspond to the table rows. The consumer objects will be always on the top of the table, that is, they correspond to the table columns.

		Consumer (RxPDO)															
		P099 Enable (INTEGER16)	P100 Acceleration Time (INTEC)	P101 Deceleration Time (INTEC)	P111 Direction of Rotation (INT)	P117 Position Reference (INTEC)	P119 Current Reference (Torq)	P121 Speed Reference (INTEC)	P202 Operation Mode (INTEG)	P432 Starts STOP Function (INTEG)	P435 Starts MOVE Function (INTEG)	Controlword (UNSIGNED16)	Modes of Operation (INTEGER)	Target Torque (INTEGER16)	Target Position (INTEGER32)	Profile Acceleration (UNSIGNED)	Profile Deceleration (UNSIGNED)
Producer (TxPDO)	Write WORD 0 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Write WORD 1 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Write WORD 2 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Write WORD 3 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

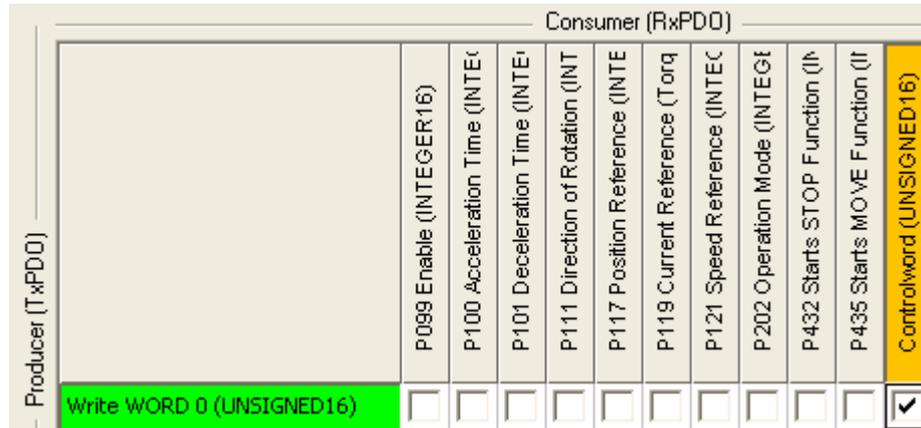
The green objects correspond to the currently mapped objects. The TxPDOs with access type “rw”

can be changed, while the TxPDOs with access type “ro” cannot be changed.

The orange objects correspond to the currently mapped objects. The RxPDOs with access type “rw” can be changed, while the TxPDOs with access type “ro” cannot be changed.

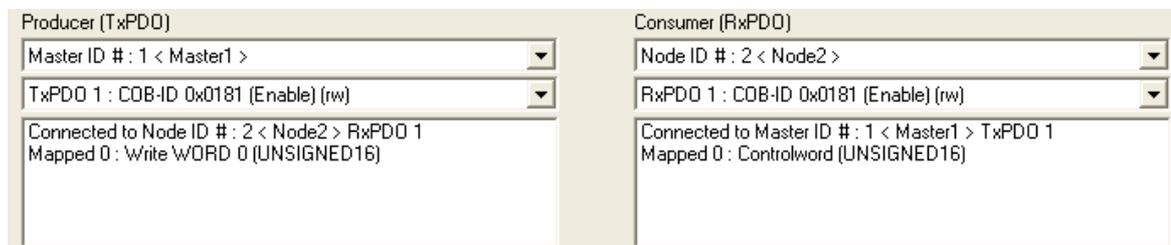
3.13.2.4 Connecting the producer (TxPDO) to the consumer (RxPDO)

The connection procedure consists basically on selecting, via check boxes, the producer object and its respective consumer object, as shown in the following figure:



After connecting all producer objects to their respective consumer objects, click on the “Apply Connections” button so that the connections can be created.

Several verification procedures are performed during the creation process of the connections. Depending on the number of producer and consumer objects, the creation time may vary and take a few seconds. After this procedure is completed, the window the list of connections shows the following data:



It is possible to observe that now the TxPDO and the RxPDO have the same COB-ID, which means that they are connected (this is also confirmed from the connection data).

The “Apply Connections” procedure does not save the new PDO configurations directly on the object dictionary. Press the “OK” button to confirm that the new PDO configuration is valid and, consequently, save it on the object dictionary.

In certain situations it is necessary to preserve the TxPDO mapping. In this case it is possible to use “Dummy” objects in the consumer, which are virtual objects that can be used to consume unnecessary data during the device operation.

In this example, the producer objects “Write WORD 1” and “Write WORD 2”, which have 16-bits each, will be consumed by the object “Target Velocity”, which has 32-bits. In other words, 16 bits + 16 bits = 32 bits.

This will be the resulting mapping after the connections are applied:

Producer (TxPDO)	Consumer (RxPDO)
Master ID #: 1 < Master1 >	Node ID #: 2 < Node2 >
TxPDO 1 : COB-ID 0x0181 (Enable) (rw)	RxPDO 1 : COB-ID 0x0181 (Enable) (rw)
Connected to Node ID #: 2 < Node2 > RxPDO 1 Mapped 0 : Write WORD 0 (UNSIGNED16) Mapped 1 : Write WORD 1 (UNSIGNED16) Mapped 2 : Write WORD 2 (UNSIGNED16)	Connected to Master ID #: 1 < Master1 > TxPDO 1 Mapped 0 : Controlword (UNSIGNED16) Mapped 1 : Target Velocity (INTEGER32)

Another example:

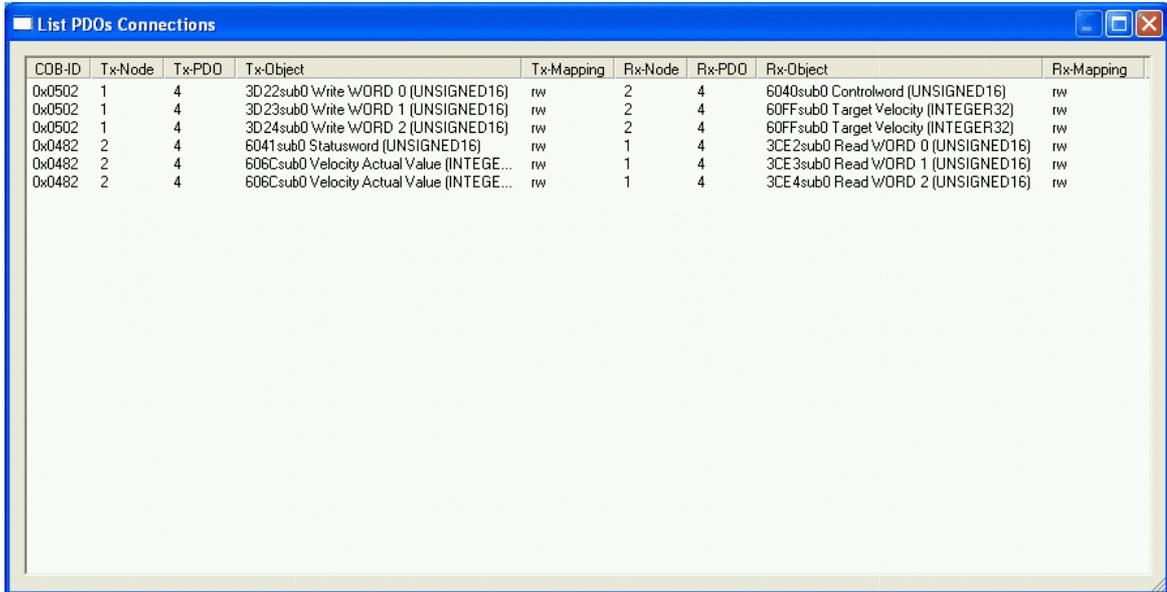
Consumer (RxPDO)	
Producer (TxPDO)	Read WORD 28 (UNSIGNED16)
	Read WORD 29 (UNSIGNED16)
	Read WORD 30 (UNSIGNED16)
	Read WORD 31 (UNSIGNED16)
	Read BYTE 0 (UNSIGNED8)
	Read BYTE 1 (UNSIGNED8)
	Read BYTE 2 (UNSIGNED8)
	Read BYTE 3 (UNSIGNED8)
	Read BYTE 4 (UNSIGNED8)
	Read BYTE 5 (UNSIGNED8)
	Read BYTE 6 (UNSIGNED8)
	Read BYTE 7 (UNSIGNED8)
Read BYTE 8 (UNSIGNED8)	
Read BYTE 9 (UNSIGNED8)	
Read BYTE 10 (UNSIGNED8)	
Read BYTE 11 (UNSIGNED8)	

Statusword (UNSIGNED16)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>															
Modes of Operation Display (INTE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Position Actual Value (INTEGER32)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Position Actual Value in User Unit (<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Producer (TxPDO)	Consumer (RxPDO)
Node ID #: 2 < Node2 >	Master ID #: 1 < Master1 >
TxPDO 1 : COB-ID 0x0182 (Enable) (rw)	RxPDO 1 : COB-ID 0x0182 (Enable) (rw)
Connected to Master ID #: 1 < Master1 > RxPDO 1 Mapped 0 : Statusword (UNSIGNED16)	Connected to Node ID #: 2 < Node2 > TxPDO 1 Mapped 0 : Read BYTE 0 (UNSIGNED8) Mapped 1 : Read BYTE 1 (UNSIGNED8)

3.13.3 Listing the connections

Click on the “List Connection” button to list the available connections between PDOs:



COB-ID	Tx-Node	Tx-PDO	Tx-Object	Tx-Mapping	Rx-Node	Rx-PDO	Rx-Object	Rx-Mapping
0x0502	1	4	3D22sub0 Write WORD 0 (UNSIGNED16)	rw	2	4	6D40sub0 Controlword (UNSIGNED16)	rw
0x0502	1	4	3D23sub0 Write WORD 1 (UNSIGNED16)	rw	2	4	6DFFsub0 Target Velocity (INTEGER32)	rw
0x0502	1	4	3D24sub0 Write WORD 2 (UNSIGNED16)	rw	2	4	6DFFsub0 Target Velocity (INTEGER32)	rw
0x0482	2	4	6D41sub0 Statusword (UNSIGNED16)	rw	1	4	3CE2sub0 Read WORD 0 (UNSIGNED16)	rw
0x0482	2	4	6D6Csub0 Velocity Actual Value (INTEGE...	rw	1	4	3CE3sub0 Read WORD 1 (UNSIGNED16)	rw
0x0482	2	4	6D6Csub0 Velocity Actual Value (INTEGE...	rw	1	4	3CE4sub0 Read WORD 2 (UNSIGNED16)	rw

This window shows all available connections listed by object. The following connection data are presented:

- COB-ID: TxPDO and RxPDO Identifier.
- Tx-Node: TxPDO node.
- Tx-PDO: TxPDO number.
- Tx-Object: TxPDO object mapping.
- Tx-Mapping: TxPDO access type (“ro” or “rw”).
- Rx-Node: RxPDO node.
- Rx-PDO: RxPDO number.
- Rx-Object: RxPDO object mapping.
- Rx-Mapping: RxPDO access type (“ro” or “rw”).

3.14 Network configuration

3.14.1 Create configuration

To create the master configuration, go to the “Create” option under “Configuration” menu, press the “F7” key, or click on the  button.

Once the configuration is created, it can be transferred.

Related topics :

[Transfer configuration](#) ⁴⁹

[Online monitoring](#) ⁴⁹

3.14.2 Transfer configuration

To transfer the master configuration, go to the “Transfer” option under “Configuration” menu, press the “F8” key, or click on the button.

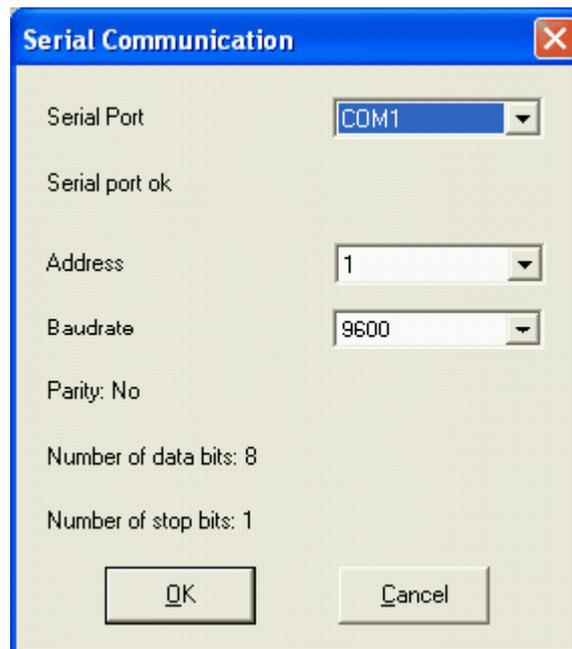
During the transmission of the master configuration, the ladder program developed by the user as well as the CANopen communication will be interrupted. After the transmission is completed, the ladder program is executed again and the master reinitializes the CANopen network (runs the initialization services and configures all slaves).

The following window appears in case the communication with the CANopen master via Modbus is not available:



In this case, check the serial cable connection between the serial port on the PC and the board serial connector. Besides that, verify the serial configuration set in the WSCAN software as well as the board configuration.

To access the serial configuration (see Figure 67) go to the “Configure Serial” option under “Communication” menu or press the “Shift + F8” keys at the same time.



3.14.3 Online monitoring

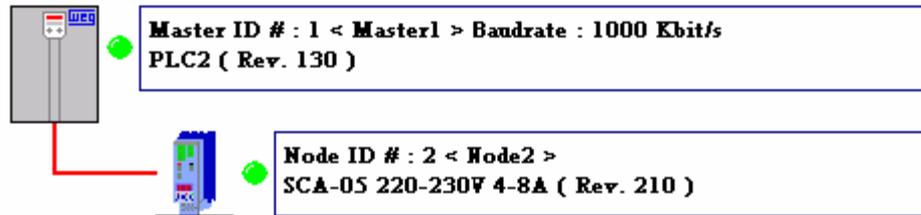
After transmitting the master configuration, may be necessary to monitor the devices to check if all configured devices are connected to the network and effectively communicating. To monitor the network devices go to the “Online Monitoring” option under “Communication” menu, press the “F9” key, or click on the button.

At this moment, the WSCAN will attempt to establish the communication with the board by testing the serial communication. If the communication is properly working, the following message is displayed in the status bar at the bottom of the WSCAN software.

 Serial port 1 open successful.

A flashing blue LED , also located in the status bar, will indicate that the communication is properly working.

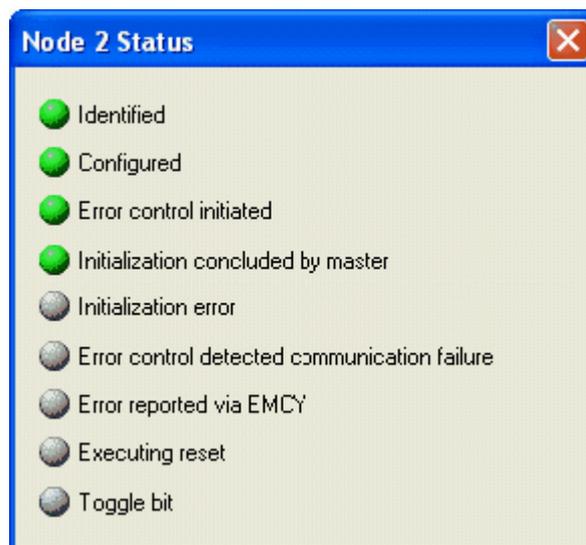
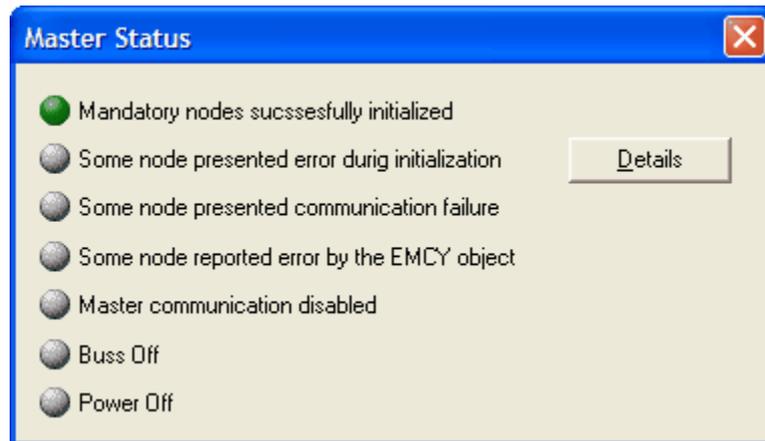
After the online monitoring is effectively operating, the network will be represented as shown in the following figure:



The status of each device is represented by its LED color. The following table describes the LED colors and their respective state:

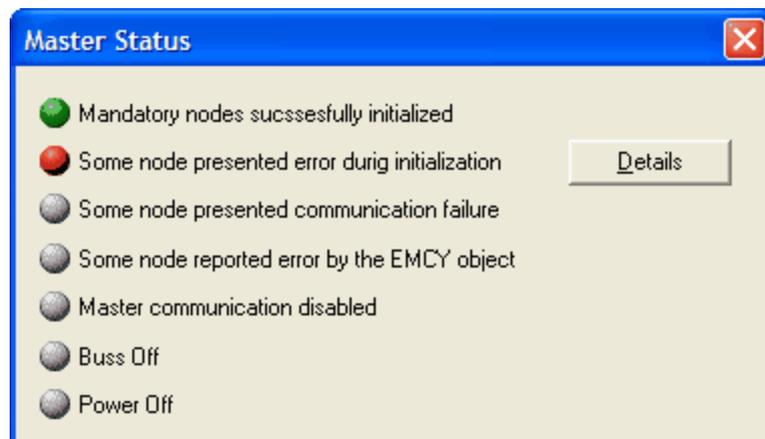
LED Color	Master Status	Slave Status
Green	<ul style="list-style-type: none"> - Communication is enabled. - All slaves were initialized successfully. - No communication error was detected in a slave. - No slave reported an EMCY error. 	<ul style="list-style-type: none"> - Identified. - Configured. - Error control initialized when necessary. - Master completed the initialization. - No initialization error. - No communication error. - No EMCY error was reported. - Not executing reset.
Yellow (flashing)	<ul style="list-style-type: none"> - Initialization error was detected in a slave. - Communication error was detected in a slave. - Slave reported an EMCY error. 	<ul style="list-style-type: none"> - EMCY error reported. - Executing reset. - Error control not initialized when necessary.
Red (flashing)	<ul style="list-style-type: none"> - Communication is disabled. 	<ul style="list-style-type: none"> - Not initialized. - Communication error detected.

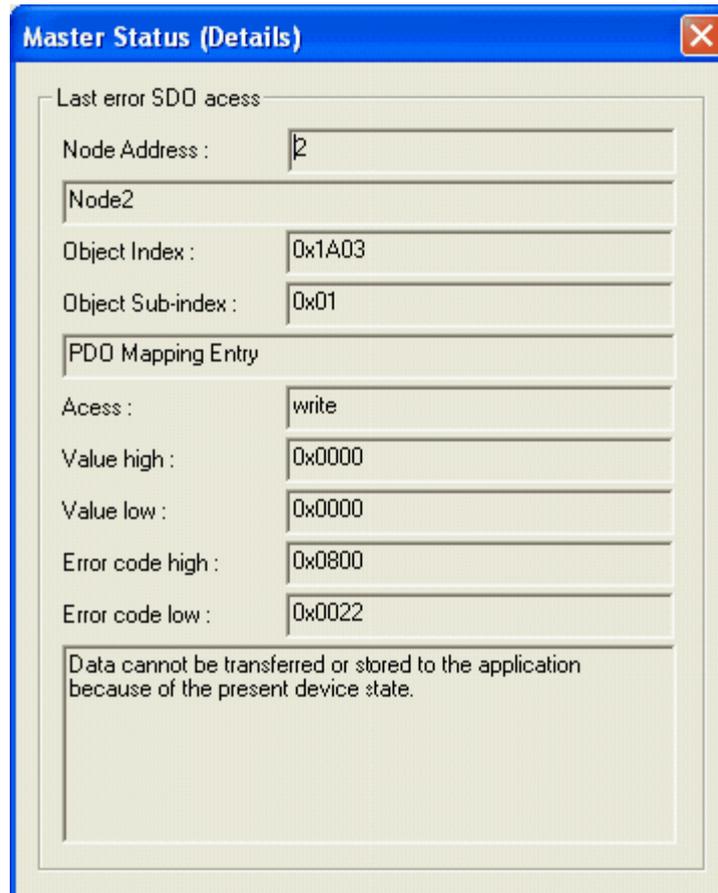
The detailed status of each device can also be accessed during the online monitoring. To monitor the device status, click on the picture of any network node and the following dialog box appears [\(1\)](#)⁵¹:



(1) "Bus Off" and "Power Off" indications only for PLC11-01 board.

When an initialization error is detected in a slave, it is possible to identify in which stage of the initialization process the error took place. Click on the "Details" button (see figure below) in the master status window to view more error details:





In the example above, when the master attempted to write to the object with index = 1A03h and sub-index = 1 the slave#2 reported an error that is described in the text box. Now, using the error description, it is possible to verify the Object Dictionary and the User Manual of the device and solve the problem.

The information in this dialog is only valid when an initialization error takes place in a slave.

3.15 Interface with the ladder programming

3.15.1 Interface with the ladder programming

Once configured, the network master is responsible for managing the whole communication. However, it must be possible to access received and transmitted data, as well as, program the desired logic of operation in ladder language. With this purpose, some interfaces were defined: data that are available on the network, ladder blocks, and status and control data of the communication.

Related topics :

[I/O memory mapping](#) ⁵³

[Control Word and Status Word](#) ⁵³

[Ladder Block \(SDO\)](#) ⁵⁶

3.15.2 I/O memory mapping

Read words, write words, read bytes and write bytes are made available for data mapping in the CANopen network. They are organized in the following way:

- PLC2 :

Address	Name	Ladder Access	Mapping
%RW0 ... %RW31	Read Words	Read (Input: escravo → mestre)	Master RPDOs
%WW0 ... %WW31	Write Words	Write (Output: mestre → escravo)	Master TPDOs
%RB0 ... %RB31	Read Bytes	Read (Input: escravo → mestre)	Master RPDOs
%WB0 ... %WB31	Write Bytes	Write (Output: mestre → escravo)	Master TPDOs

- PLC11-01 :

Address	Name	Ladder Access	Mapping
%RW4200 ... %RW4299	Read Words	Read (Input: escravo → mestre)	Master RPDOs
%WW4600 ... %WW4699	Write Words	Write (Output: mestre → escravo)	Master TPDOs
%RB4400 ... %RB4499	Read Bytes	Read (Input: escravo → mestre)	Master RPDOs
%WB4800 ... %WB4899	Write Bytes	Write (Output: mestre → escravo)	Master TPDOs

These are volatile registers that store all data transmitted and received via PDO and EMCY.

3.15.3 Control Word and Status Word

3.15.3.1 Control Word and Status Word

Some words are available for monitoring the state and controlling the communication of a CANopen network. These words are organized in the following way:

- PLC2 :

Address	Name	Ladder Access
%RS0	Status of the CANopen communication	Read (Input: escravo → mestre)
%RS1 ... %RS63	Status of the CANopen slave	Read (Input: escravo → mestre)
%WC0	Control of the CANopen communication	Write (Output: mestre → escravo)
%WC1	Endereço do escravo destino	Write (Output: mestre → escravo)

- PLC11-01 :

Address	Name	Ladder Access
%RS4000	Status of the CANopen communication	Read (Input: escravo → mestre)
%RS4001 ... %RS4063	Status of the CANopen slave	Read (Input: escravo → mestre)
%WC4136	Control of the CANopen communication	Write (Output: mestre → escravo)
%WC4137	Control of the CANopen communication	Write (Output: mestre → escravo)

The next sections describe each one of these words.

Related topics :

[Status of the CANopen communication](#) ⁵⁴

[Status of the CANopen slave](#) ⁵⁵

[Control of the CANopen communication](#) ⁵⁶

[Address of the destination slave](#) ⁵⁶

3.15.3.2 Status of the CANopen communication

This word indicates the communication status of the CANopen master. Each bit has one specific purpose:

Bit	Description	Values
0...2	Reserved	-
3	Slaves initialization	0: Initialization procedure of the CANopen network is not concluded. 1: All slaves configured as mandatory were initialized successfully.
4	Error in the slaves initialization	0: Slaves were initialized successfully. 1: An initialization error was detected in a slave. If this is a mandatory slave, the initialization procedure cannot be concluded until the master is able to configure it.
5	Failure in the error control service of the slave	0: All the slaves with error control service (Node Guarding or Heartbeat) are correctly operating. 1: A failure was detected in the error control service of at least one slave.
6	Slave transmitted an EMCY object	0: No Emergency objects were detected. 1: At least one slave reported an error through the Emergency object.
7	Reserved	-
8	Toggle bit feedback	Indicates the value of the toggle bit that was written in the control word. The toggle bit alternates between two consecutive requests (first request has toggle bit set to 0). After executing the command, the slave copies the master toggle bit to inform that the action was successfully performed. An incorrect toggle bit value means communication error.
9...14	Reserved	-
13	Bus Off (1) ⁵⁵	0: Master OK.

		1: Master with communication disabled by bus off error.
14	Power Off 	0: Master OK. 1: Mestre without power supply on can interface.
15	Communication is disabled	0: Communication operating normally. 1: Master received a command for disabling the communication (through the control word) and the communication was disabled.

(1) "Bus Off" e "Power Off" indication only for PLC11-01.

3.15.3.3 Status of the CANopen slave

This is an ARRAY with 63 words where each array position represents the slave address on the network and each word indicates the slave status. Each bit of each slave has the following function:

Bit	Description	Values
0	Slave identified	0: Slave identification was not performed. 1: Slave identification (by reading the device type) was carried out successfully.
1	Slave configured	0: Slave configuration was not performed. 1: Procedure for slave configuration was carried out successfully.
2	Error control service started	0: Error control service was not started. 1: Slave error control service (node guarding or heartbeat) was started.
3	Initialization procedure concluded	0: Master did not initialize the slave. 1: Master concluded the slave initialization.
4	Initialization error	0: Slaves was initialized successfully. 1: Slave was not initialized. The initialization procedure cannot continue until this slave is initialized.
5	Failure in the error control service (node guarding or heartbeat)	0: Error control service is properly working. 1: Error control service of the slave (node guarding or heartbeat) reported an error.
6	Slave transmitted an EMCY object	0: Slave did not report errors via EMCY objects. 1: Slave reported errors via EMCY objects.
7	Slave reset	0: Performing no operation on the slave. 1: Performing slave reset due to a communication error or a command in the control word.
8...15	Reservado	-

NOTE!

In spite of the CANopen network supports addresses from 1 to 127, the maximum address of slave allowed is 63 because the other positions do not have correspondent status words.

3.15.3.4 Control of the CANopen communication

WORD that performs CANopen communication related functions in a specific device. Each bit of the word has a different function:

Bit	Description	Values
0...7	Command to the slave	Management command of the slave status. The following values can be used in these bits so that the master can command the slaves on the network: 1: Start Node 2: Stop Node 128: Enter pre-operational 129: Reset Node 130: Reset Communication The command set in these bits is transmitted to the device indicated in the word "address of the destination slave" always when the toggle bit value is modified.
8	<i>Toggle bit</i>	Bit that indicates when a new command can be transmitted to the slave. When this bit value changes (0 ? 1 or 1 ? 0), the master transmits the programmed command (in bits 0 to 7) to the device indicated in the word "address of the destination slave".
9 ... 14	Reserved	-
15	Disables CANopen communication	0: Master is operating normally. 1: Interrupts the communication and the processing of the CANopen master. When this bit is reset (set to zero), the CANopen interface is restarted and the master repeats the initialization procedure for all slaves.

3.15.3.5 Address of the destination slave

This WORD defines the slave address that shall receive a communication management command. The possible values for this WORD are:

- 0: Master transmits a broadcast command (all slaves on the network must execute the command).
- 1 ... 127: Specific slave address to which the command must be transmitted.

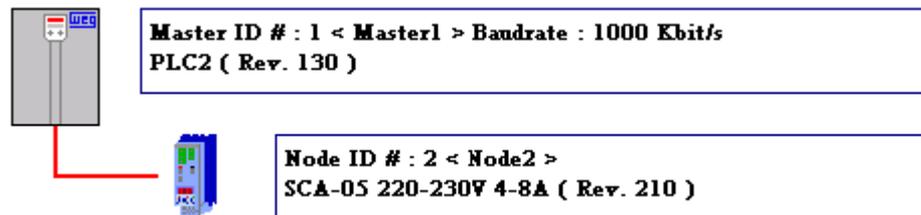
3.15.4 Ladder Block (SDO)

A SDO block was created in the ladder program (WLP) so that the slave objects can be accessed (reading and writing). Refer to the WLP manual for further details on the SDO block.

3.16 Example of network configuration

3.16.1 Introduction

Master: PLC2 Rev. 130, Address: 1, Baudrate: 1000 Kbit/s
 Slave: SCA-05 Rev. 210, Address: 2



Related topics :

[Master configuration \(PLC2\)](#) ⁵⁷

[Slave configuration \(SCA-05\)](#) ⁵⁷

[Master PDOs \(PLC2\)](#) ⁵⁷

[Slave PDOs \(SCA-05\)](#) ⁵⁸

[PDOs connections](#) ⁵⁹

[Reading slave status information from the ladder program](#) ⁶²

[Commanding the slave from the ladder program](#) ⁶³

3.16.2 Master configuration (PLC2)

Standard, no parameter was changed.

3.16.3 Slave configuration (SCA-05)

Standard, no parameter was changed.

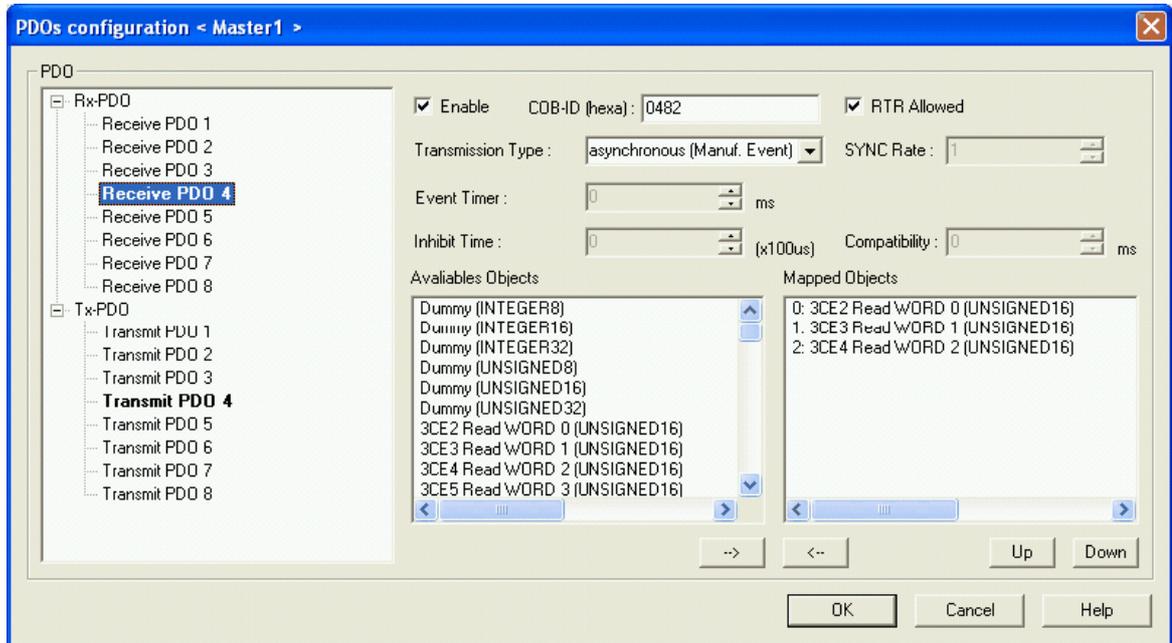
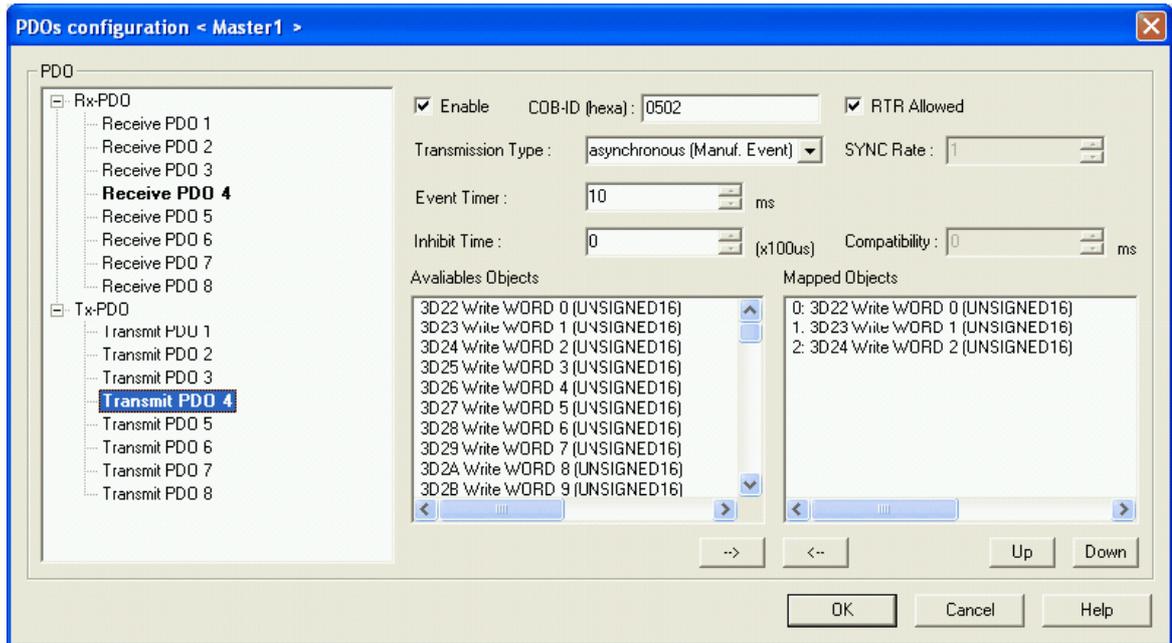
3.16.4 Master PDOs (PLC2)

A transmit-PDO (TxPDO) with COB-ID 0502h (same COB-ID of the slave RxPDO) was created for the master and the following objects were mapped: *Write Word 0, 1* and *2* (all of them are UNSIGNED16).

Also, a receive-PDO (RxPDO) with COB-ID 0482h (same COB-ID of the slave TxPDO) was created for the master and the following objects were mapped: *Read Word 0, 1* e *2* (all of them are UNSIGNED16).

It is possible to notice that an INTEGER32 data from the slave was connected to two INTEGER16 data from the master. This is a possible situation on the CANopen network since it considers the total number of mapped bits in the PDOs. This is also needed because the CANopen master does not have INTEGER32 objects for mapping. Besides, the SCA-05 objects - "*Target Velocity*" and "*Velocity Actual Value*" - only use the least significant bits, that is, the first 16-bits.

Only the enabled PDOs are listed. The other PDOs were disabled.

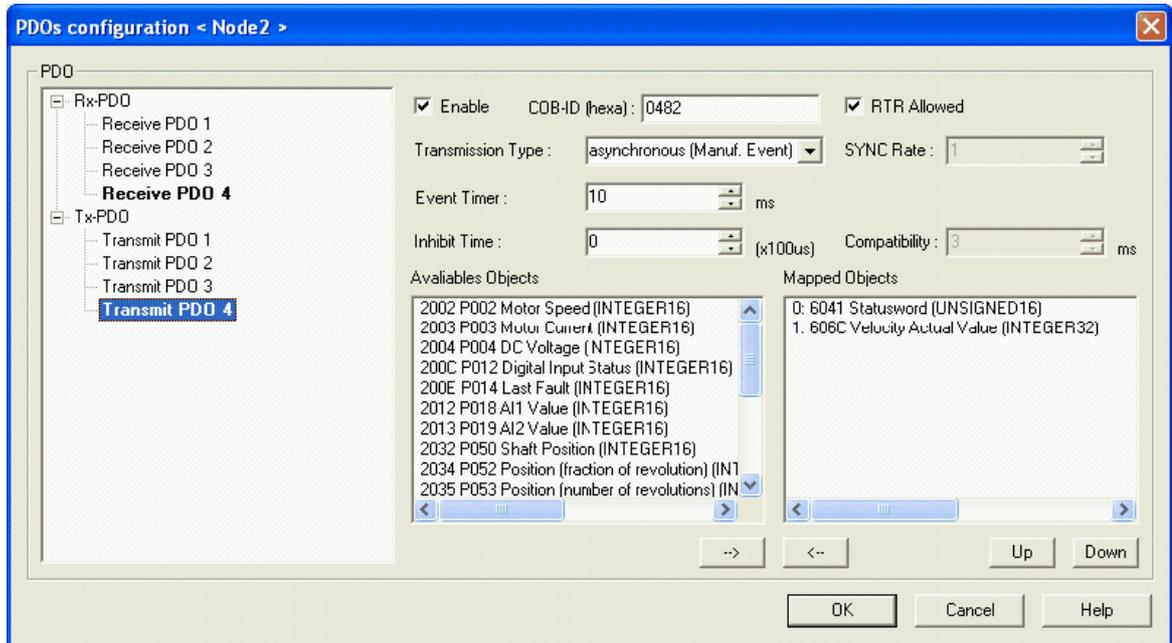
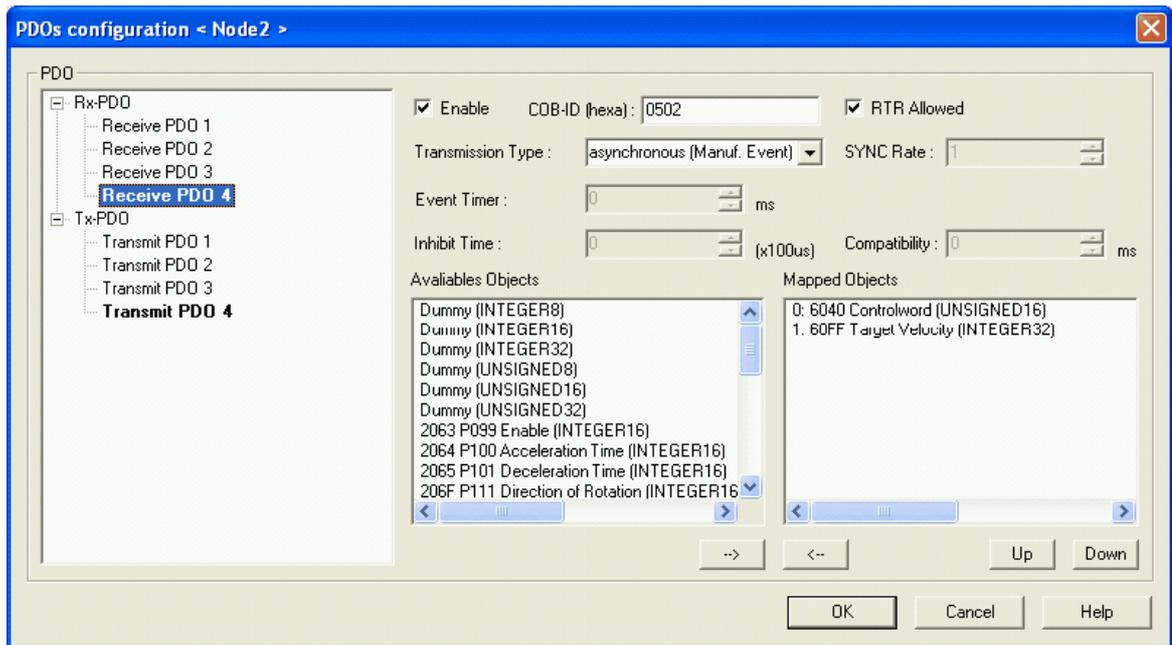


3.16.5 Slave PDOs (SCA-05)

A receive-PDO (RxPDO) with COB-ID 0502h was created for the slave and the following objects were mapped: “Controlword” (UNSIGNED16) and “Target Velocity” (INTEGER32).

Also, a transmit-PDO (TxPDO) with COB-ID 0482h was created for the slave and the following objects were mapped: “Statusword” (UNSIGNED16) and “Velocity Actual Value” (INTEGER32).

Only the enabled PDOs are listed. The other PDOs were disabled.



3.16.6 PDOs connections

The previous example presented how to configure the PDOs individually. However, it is also possible to configure the PDOs directly on the “PDOs Connections” window, as described in the following figures:

View/config PDOs Connections

PDOs Connections

Producer (TxPDO)
 Master ID #: 1 < Master1 >
 TxPDO 4: COB-ID 0x0502 (Enable) (rw)
 Connected to Node ID #: 2 < Node2 > RxPDO 4
 Mapped 0: Write WORD 0 (UNSIGNED16)
 Mapped 1: Write WORD 1 (UNSIGNED16)
 Mapped 2: Write WORD 2 (UNSIGNED16)

Consumer (RxPDO)
 Node ID #: 2 < Node2 >
 RxPDO 4: COB-ID 0x0502 (Enable) (rw)
 Connected to Master ID #: 1 < Master1 > TxPDO 4
 Mapped 0: Controlword (UNSIGNED16)
 Mapped 1: Target Velocity (INTEGER32)

Producer (TxPDO)	P117 Position Reference (INTEG16)	P119 Current Reference (Torg)	P121 Speed Reference (INTEG16)	P202 Operation Mode (INTEG16)	P432 Starts STOP Function (INTEG16)	P435 Starts MOVE Function (INTEG16)	Controlword (UNSIGNED16)	Modes of Operation (INTEGER16)	Target Torque (INTEGER16)	Target Position (INTEGER32)	Profile Acceleration (UNSIGNED16)	Profile Deceleration (UNSIGNED16)	Motion Profile Type (INTEGER16)	Torque Slope (UNSIGNED32)	Torque Profile Type (INTEGER16)	Target Velocity (INTEGER32)
Write WORD 0 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Write WORD 1 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Write WORD 2 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Write WORD 3 (UNSIGNED16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Buttons: List Connections, Apply Connections, OK, Cancel, Help

View/config PDOs Connections

PDOs Connections

Producer (TxPDO)

Node ID #: 2 < Node2 >

TxPDO 4: COB-ID 0x0482 (Enable) (rw)

Connected to Master ID #: 1 < Master1 > RxPDO 4

Mapped 0: Statusword (UNSIGNED16)

Mapped 1: Velocity Actual Value (INTEGER32)

Consumer (RxPDO)

Master ID #: 1 < Master1 >

RxPDO 4: COB-ID 0x0482 (Enable) (rw)

Connected to Node ID #: 2 < Node2 > TxPDO 4

Mapped 0: Read WORD 0 (UNSIGNED16)

Mapped 1: Read WORD 1 (UNSIGNED16)

Mapped 2: Read WORD 2 (UNSIGNED16)

Producer (TxPDO)	Consumer (RxPDO)	Read WORD 0 (UNSIGNED16)	Read WORD 1 (UNSIGNED16)	Read WORD 2 (UNSIGNED16)	Read WORD 3 (UNSIGNED16)	Read WORD 4 (UNSIGNED16)	Read WORD 5 (UNSIGNED16)	Read WORD 6 (UNSIGNED16)	Read WORD 7 (UNSIGNED16)	Read WORD 8 (UNSIGNED16)	Read WORD 9 (UNSIGNED16)	Read WORD 10 (UNSIGNED16)	Read WORD 11 (UNSIGNED16)	Read WORD 12 (UNSIGNED16)	Read WORD 13 (UNSIGNED16)	Read WORD 14 (UNSIGNED16)	Read WORD 15 (UNSIGNED16)
Statusword (UNSIGNED16)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modes of Operation Display (INTEGER32)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Position Actual Value (INTEGER32)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Position Actual Value in User Unit (INTEGER32)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Velocity Sensor Actual Value (INTEGER32)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Velocity Demand Value (INTEGER32)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Velocity Actual Value (INTEGER32)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>									

List Connections

Apply Connections

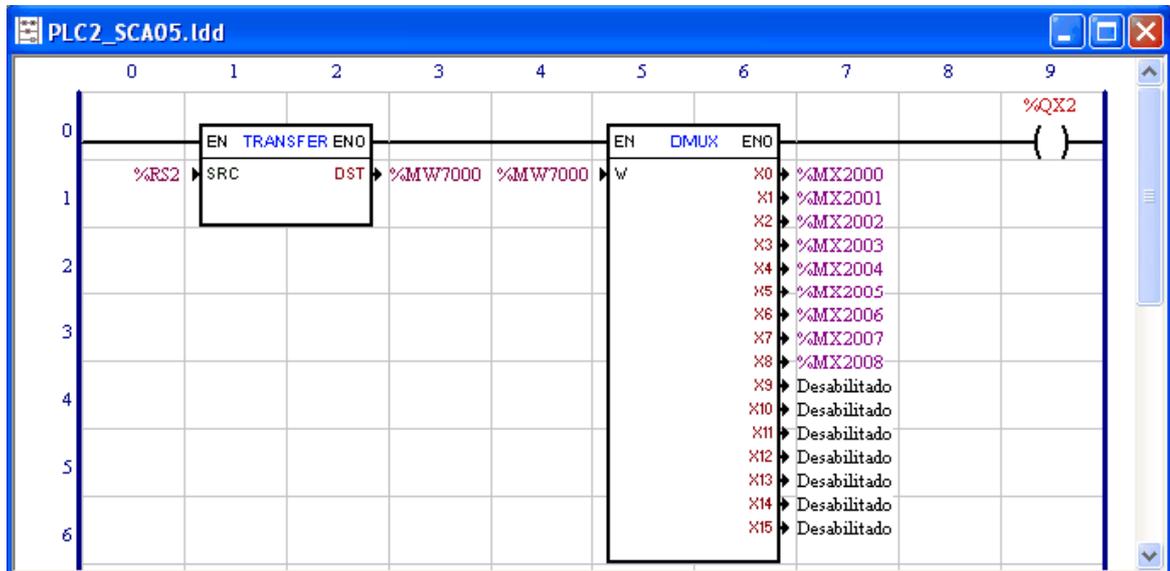
OK

Cancel

Help

3.16.7 Reading slave status information from the ladder program

The status information of Node 2 is obtained from the word “Read Status 2” (%RS2) and converted into bit registers through the “DMUX” block.



See also :

[WSCAN configuration](#) ⁶⁴

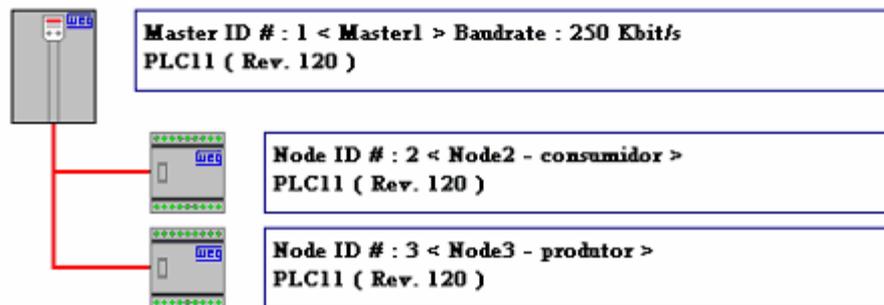
[WLP configuration](#) ⁶⁷

[CFW11 and PLC11 parameterization](#) ⁶⁷

3.17.2 WSCAN configuration

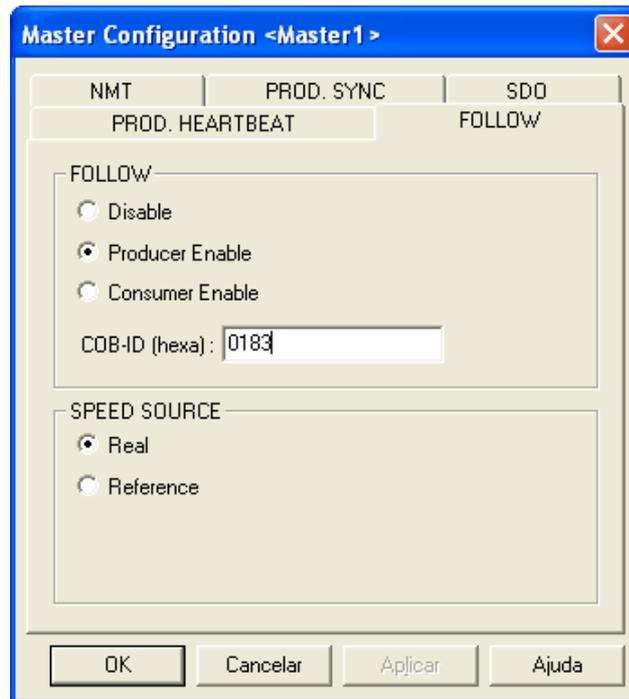
In the WSCAN the whole communication configuration is set up, and it is defined who is the Follow producer and who is the consumer.

The next figure shows a CANopen network configuration example with three equipments, one master and two slaves. The slave 2 is configured as Follow consumer and the slave 3 as Follow producer.

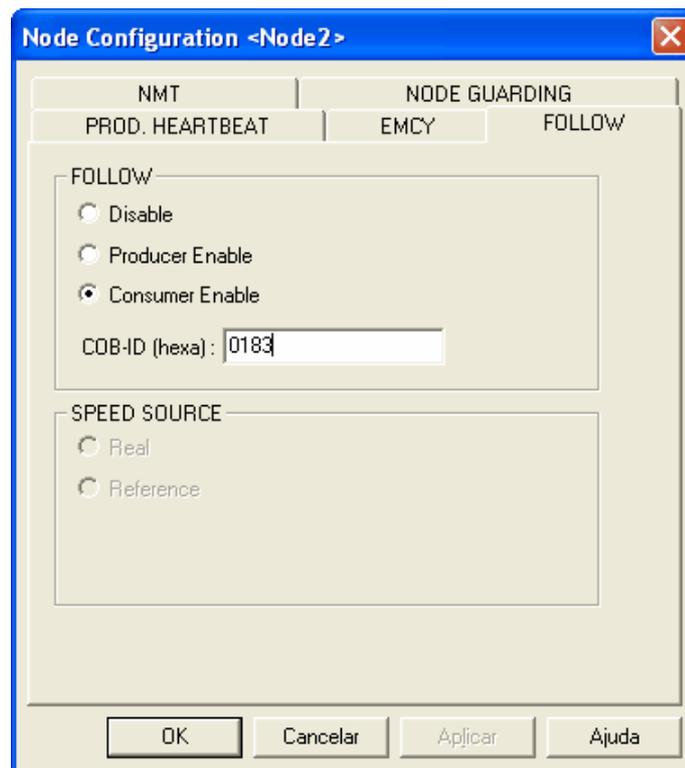


In the Configuration dialog box, at the FOLLOW tab, the whole configuration of the Follow function PDOs is performed.

The equipment that will be the producer must be initially defined, informing the PDO COB-Id. It is necessary to define whether the speed is theoretical or actual, as the next figure illustrates.



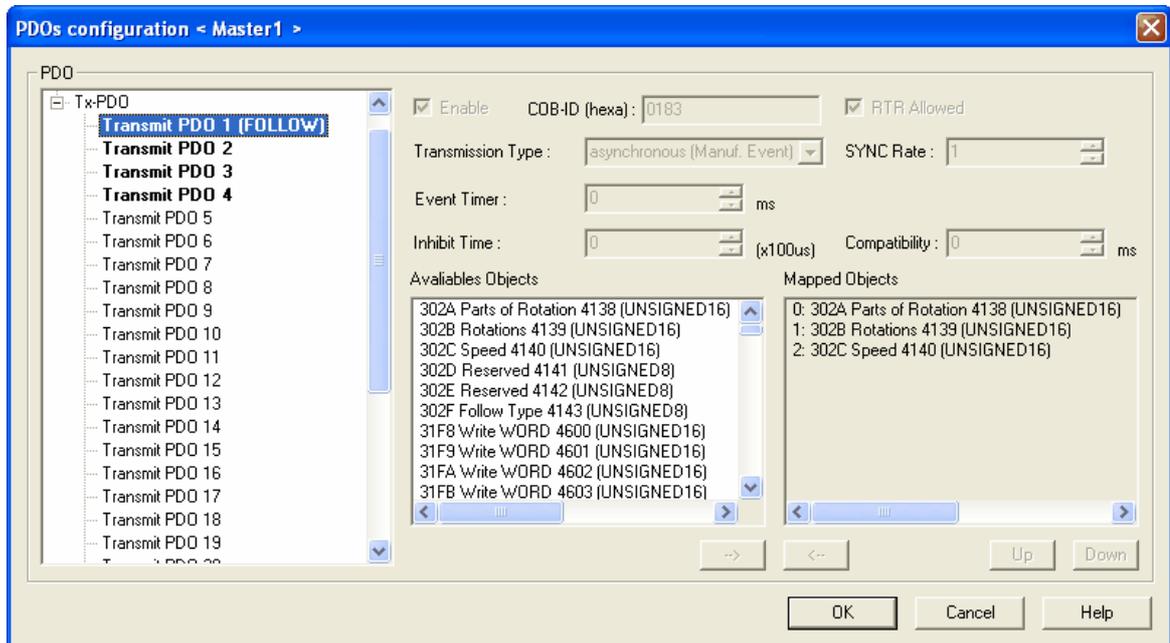
The next step is the consumer configuration, according to the next figure. The consumer COB-ID must be equal to the COB-ID defined for the producer.



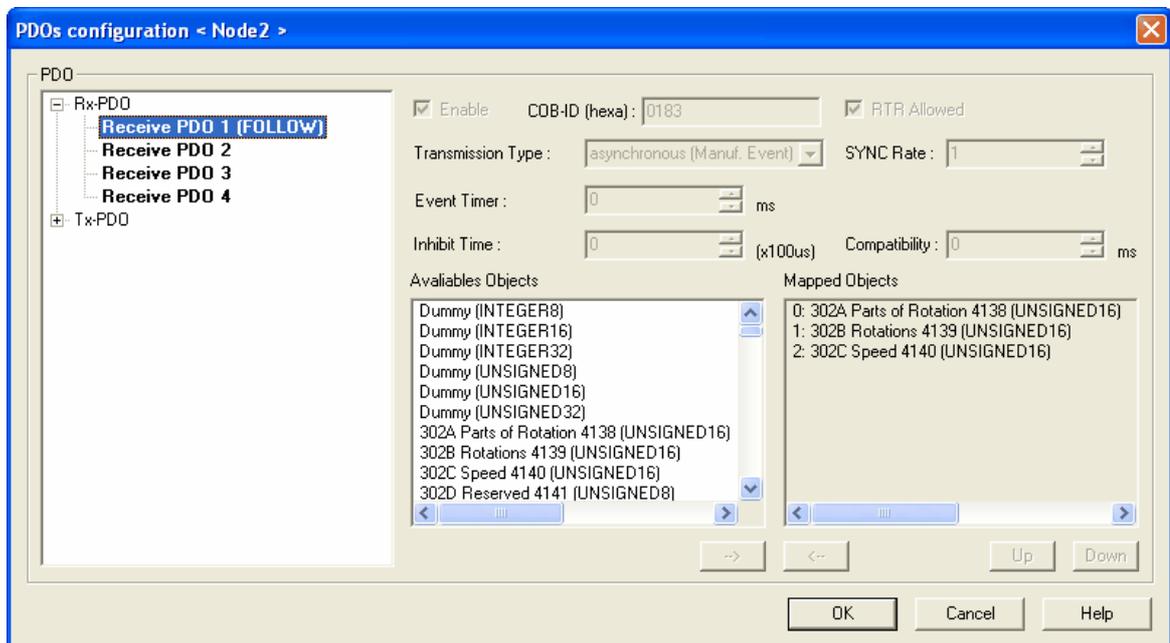
The definitions made through the Follow configuration dialog box can be observed at the

PDOs configuration dialog box.

The next figure illustrates the transmission PDO (TPDO 01) configuration at the Follow producer. All the TPDO 01 configuration options are locked, because the Follow function is enabled.



The next figure illustrates the reception PDO (RPDO 01) configuration at the Follow consumer. All the RPDO 01 configuration options are locked, because the Follow function is enabled.



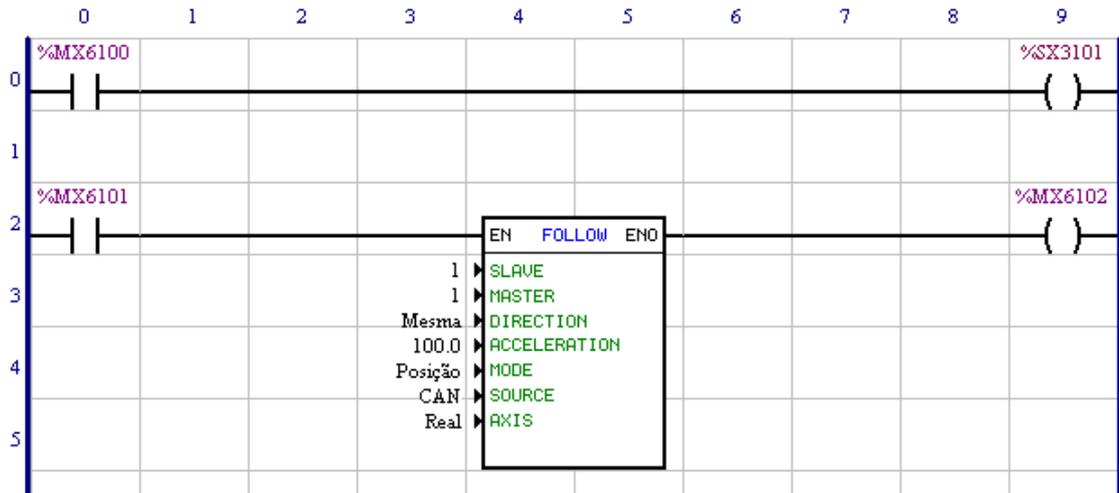
The baud rate and the number of telegrams in the CANopen network can influence the positioning precision. It is recommended to use the Follow function with a minimum baud rate of

250 bps.

When the Follow function is enabled at a PLC11 board that is operating as a CANopen master, the board must be initialized every time the Follow function is modified, from producer to consumer or from consumer to producer.

3.17.3 WLP configuration

The Follow block is used to configure the synchronism at the consumer. Refer to the WLP help for more details.



3.17.4 CFW11 and PLC11 parameterization

CFW11:

P0202 – Select the vector with encoder mode (4), (Producer and consumer).

P0221 or P0222 – Program one of these parameters for PLC11 reference, (Producer and consumer).

PLC11:

P1262 – Inform the main encoder resolution, (Producer and consumer).

P1285 – Enable the CANopen protocol (1), (Producer and consumer).

P1286 – CAN address, (Producer and consumer).

P1287 – Baud rate, (Producer and consumer).

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