

# CANopen Demo tool – User manual

Software version 1.0.0.0

## Revision history

Version	Revised Date	Author	Description
1.0	2015/09/30	Rocky	- 1 <sup>st</sup> release

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# 1. Introduction

## 1.1. Basic specifications

CiA301 CANopen application layer and communication profile

## 1.2. Support CANbus board (see Table 1)

Board	Interface	Note
AX93700-CS	COM to CAN	Module
AX93700-CU	USB to CAN	Module
iCON101-CS	COM to CAN	Device
iCON101-CU	USB to CAN	Device
AX92903	USB to CAN	Mini-card

Table 1

## 1.3. Architecture (See Figure 1)

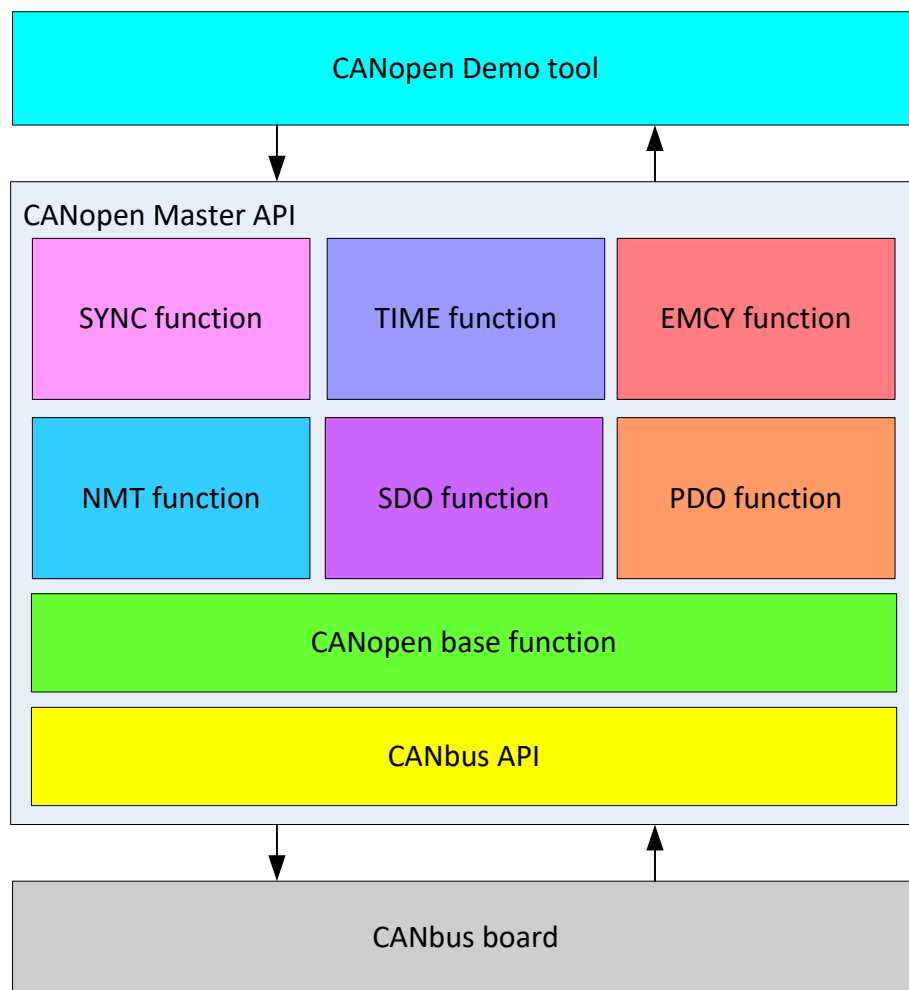


Figure 1

#### 1.4. Device states and communication objects

The below table specifies the relation between states and communication objects. Services on the listed communication objects may only be executed if the CANopen devices involved in the communication are in the appropriate states. (See Table 2)

	Pre-operational	Operational	Stopped
PDO function		X	
SDO function	X	X	
SYNC function	X	X	
TIME function	X	X	
EMCY function	X	X	
NMT control	X	X	X
NMT error control			

(X:Support)

Table 2

#### 1.5. Overview

CANopen Demo tool support NMT/SDO/PDO function and EMCY/Event/Error list. (See Figure 2)

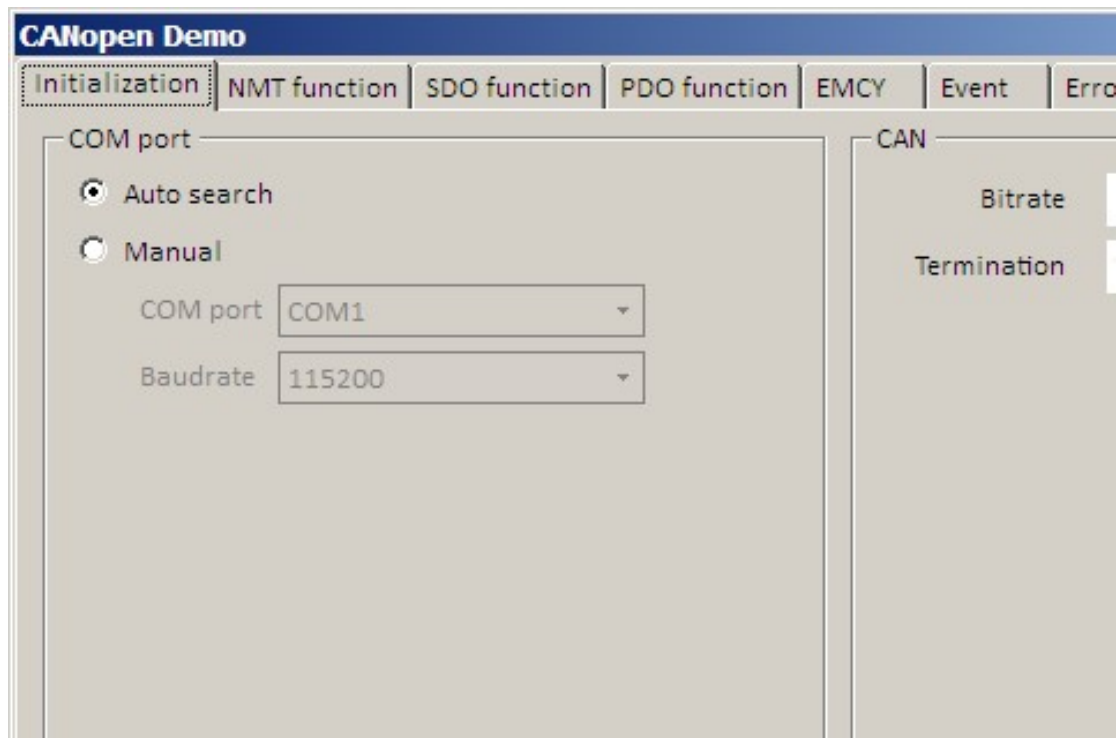


Figure 2

## 2. Initial CANopen

- Select Auto-search or Manual and press “Connect” button. (See Figure 3)
- After the connection is completed, select Bitrate and Termination and press “Initial CANopen” button. (See Figure 4)

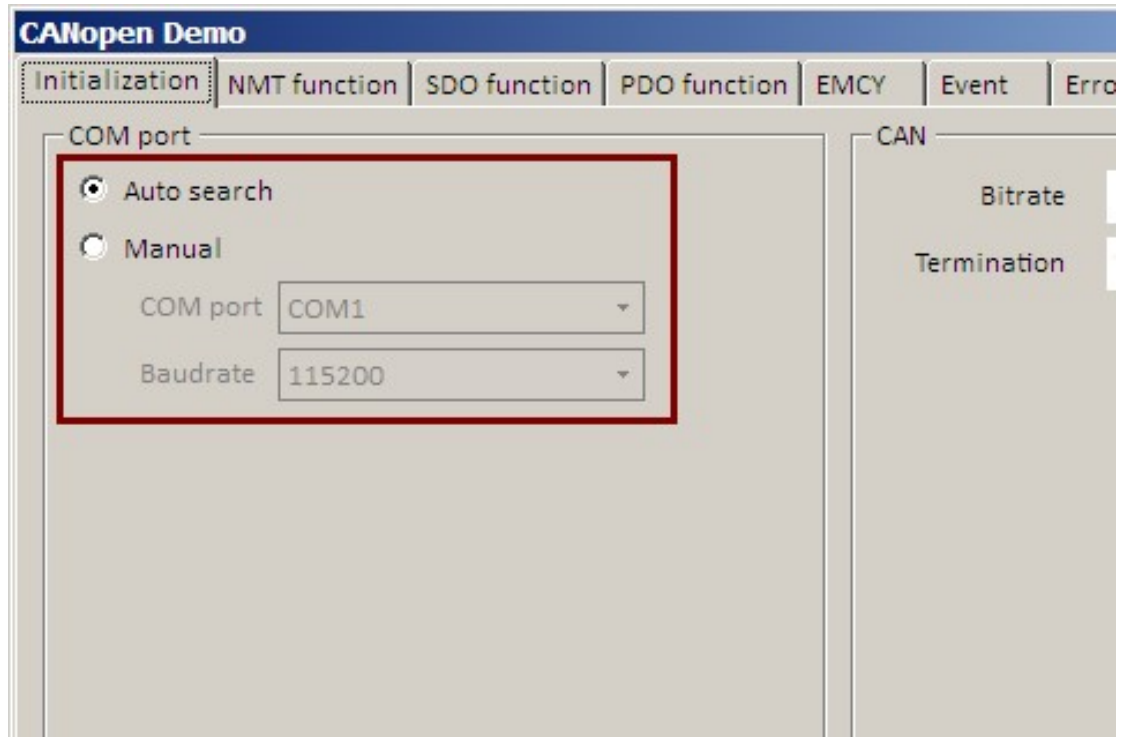


Figure 3

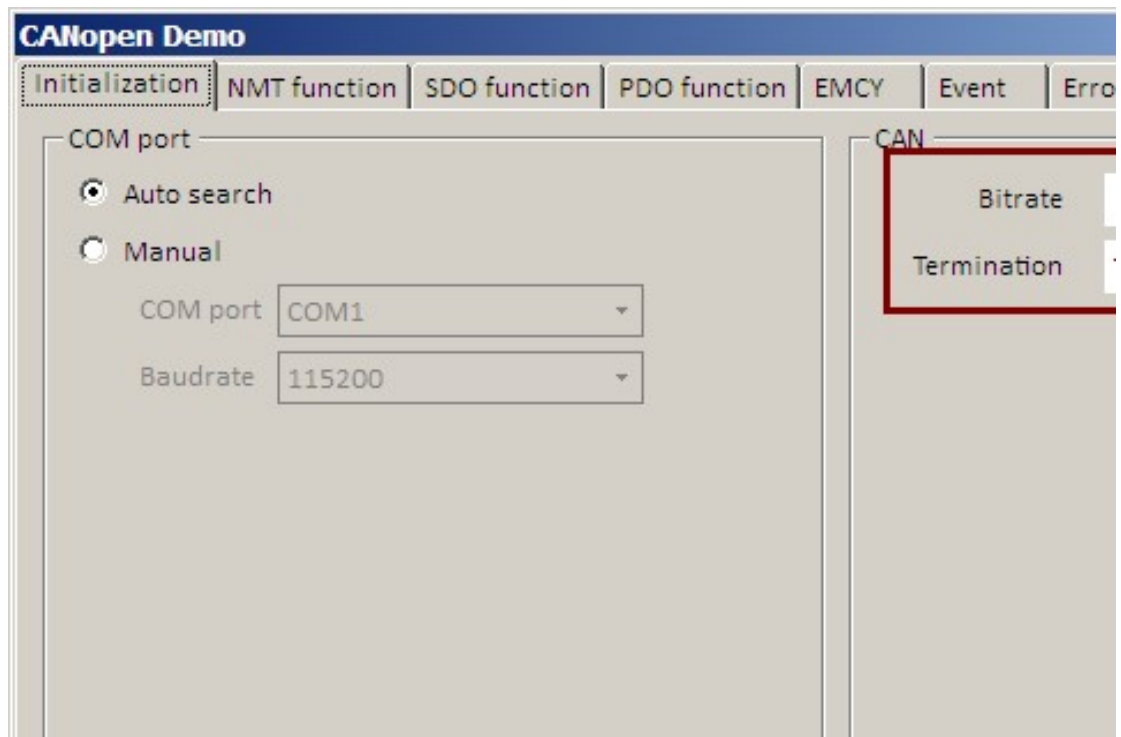
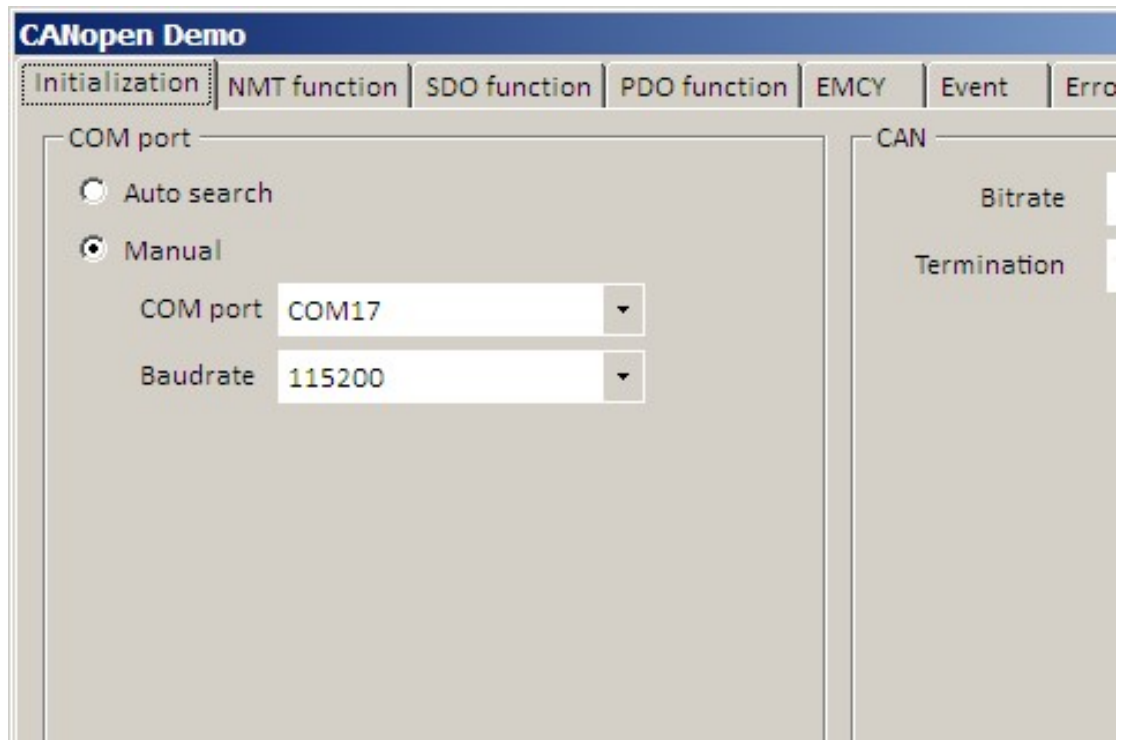


Figure 4

### 3. Release CANopen

- Press “Release CANopen” button. (See Figure 5)



*Figure 5*

#### 4. Network management (NMT)

- NMT function support Add/Delete node function and support Start node/Stop node/Enter Pre-operational/Reset Communication/Reset node function and Get state. (See Figure 6)

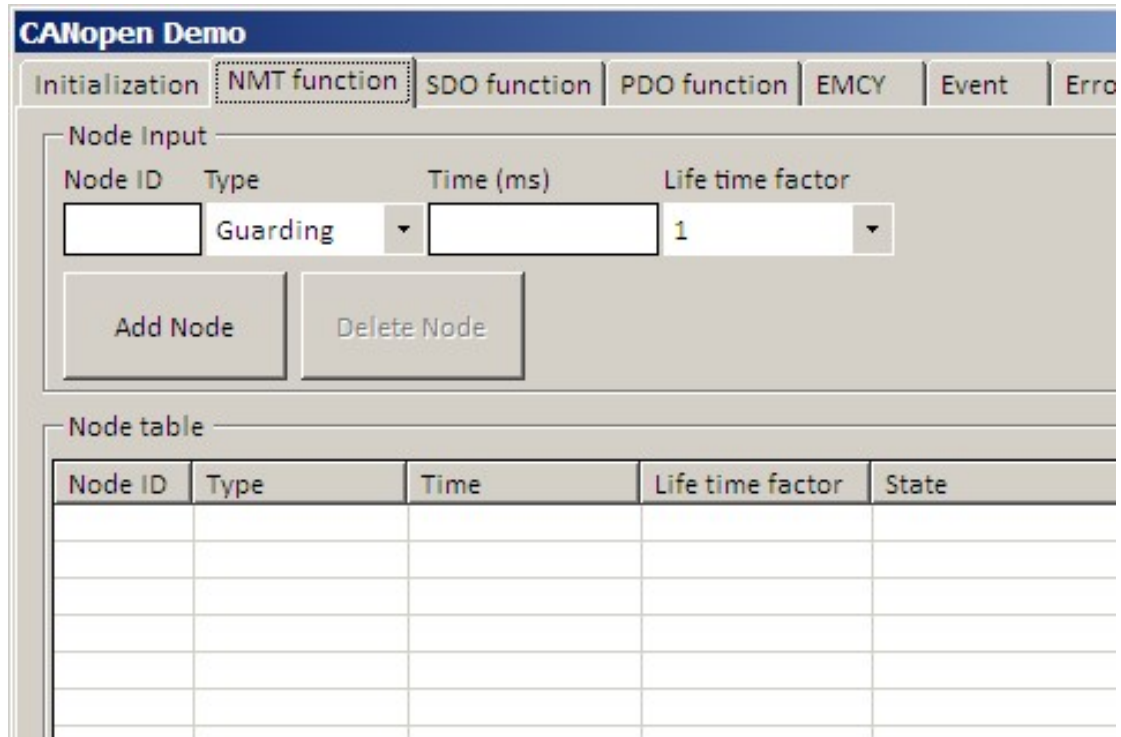


Figure 6

#### 4.1. Add node

- Input Node-ID/Type/Time/Life time factor data and press “Add Node” button.  
(See Figure 7)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Node Input' section is active, featuring a table with four columns: 'Node ID', 'Type', 'Time (ms)', and 'Life time factor'. The values entered are 2, Guarding, 1000, and 1, respectively. Below this table are two buttons: 'Add Node' and 'Delete Node'. The 'Add Node' button is highlighted with a red box. Below the 'Node Input' section is a 'Node table' with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The table is currently empty.

Node ID	Type	Time (ms)	Life time factor
2	Guarding	1000	1

Node ID	Type	Time	Life time factor	State

Figure 7



#### 4.2. Delete node

- Select a node from node table and press “Delete Node” button. (See Figure 8)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Initialization' tab is currently selected. Below the tabs, there is a 'Node Input' section with four input fields: 'Node ID' (containing '2'), 'Type' (a dropdown menu showing 'Guarding'), 'Time (ms)' (containing '1000'), and 'Life time factor' (a dropdown menu showing '1'). Below these fields are two buttons: 'Add Node' and 'Delete Node'. The 'Delete Node' button is highlighted with a red rectangular border. Below the 'Node Input' section is a 'Node table' section containing a table with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The first row of the table is highlighted in blue and contains the values: '2', 'Guarding', '1000', '1', and 'Pre-operational'. The rest of the table is empty.

Node ID	Type	Time	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 8

### 4.3. Get state

- Select a node from node table and press “Get State” button. (See Figure 9)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Initialization' tab is currently selected.

Below the tabs is the 'Node Input' section. It contains a table with four columns: 'Node ID', 'Type', 'Time (ms)', and 'Life time factor'. The first row has the following values: Node ID: 2, Type: Guarding, Time (ms): 1000, Life time factor: 1. Below this table are two buttons: 'Add Node' and 'Delete Node'.

Below the 'Node Input' section is the 'Node table'. It is a table with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The first row is highlighted in blue and contains the following values: Node ID: 2, Type: Guarding, Time: 1000, Life time factor: 1, State: Pre-operational. There are four empty rows below the first row.

Node ID	Type	Time (ms)	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 9

#### 4.4. Start node

- Select a node from node table and press “Start node” button. (See Figure 10)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Initialization' tab is currently selected. Below the tabs, there is a 'Node Input' section with a table for defining nodes. The table has four columns: 'Node ID', 'Type', 'Time (ms)', and 'Life time factor'. The first row contains the values '2', 'Guarding', '1000', and '1'. Below the table are two buttons: 'Add Node' and 'Delete Node'. Below the 'Node Input' section is a 'Node table' section, which is a table with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The first row of the 'Node table' contains the values '2', 'Guarding', '1000', '1', and 'Pre-operational'. The other rows in the 'Node table' are empty.

Node ID	Type	Time (ms)	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 10

#### 4.5. Enter pre-operational

- Select a node from node table and press “Enter pre-operational” button.  
(See Figure 11)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'NMT function' tab is currently selected. Below the tabs, there is a 'Node Input' section with four input fields: 'Node ID' (containing '2'), 'Type' (a dropdown menu showing 'Guarding'), 'Time (ms)' (containing '1000'), and 'Life time factor' (a dropdown menu showing '1'). Below these fields are two buttons: 'Add Node' and 'Delete Node'. Below the 'Node Input' section is a 'Node table' section, which is a table with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The first row of the table is highlighted in blue and contains the values: '2', 'Guarding', '1000', '1', and 'Pre-operational'. The rest of the table is empty.

Node ID	Type	Time	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 11

#### 4.6. Stop node

- Select a node from node table and press “Stop node” button. (See Figure 12)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Initialization' tab is currently selected.

Below the tabs is the 'Node Input' section, which contains a form with the following fields:

- Node ID:** A text input field containing the value '2'.
- Type:** A dropdown menu with 'Guarding' selected.
- Time (ms):** A text input field containing the value '1000'.
- Life time factor:** A dropdown menu with '1' selected.

Below the form are two buttons: 'Add Node' and 'Delete Node'.

Below the buttons is the 'Node table' section, which contains a table with the following data:

Node ID	Type	Time	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 12

#### 4.7. Reset communication

- Select a node from node table and press “Reset communication” button.  
(See Figure 13)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Initialization' tab is currently selected. Below the tabs, there is a 'Node Input' section with four input fields: 'Node ID' (containing '2'), 'Type' (a dropdown menu showing 'Guarding'), 'Time (ms)' (containing '1000'), and 'Life time factor' (a dropdown menu showing '1'). Below these fields are two buttons: 'Add Node' and 'Delete Node'. Below the 'Node Input' section is a 'Node table' section, which is a table with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The first row of the table is highlighted in blue and contains the values: '2', 'Guarding', '1000', '1', and 'Pre-operational'. The rest of the table is empty.

Node ID	Type	Time	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 13

#### 4.8. Reset node

- Select a node from node table and press “Reset node” button. (See Figure 14)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Initialization' tab is currently selected.

Below the tabs is the 'Node Input' section, which contains a table for adding nodes. The table has four columns: 'Node ID', 'Type', 'Time (ms)', and 'Life time factor'. The values entered are: Node ID: 2, Type: Guarding, Time (ms): 1000, and Life time factor: 1. Below this table are two buttons: 'Add Node' and 'Delete Node'.

Below the 'Node Input' section is the 'Node table' section, which contains a table with five columns: 'Node ID', 'Type', 'Time', 'Life time factor', and 'State'. The first row of the table is highlighted in blue and contains the following data: Node ID: 2, Type: Guarding, Time: 1000, Life time factor: 1, and State: Pre-operational. The rest of the table is empty.

Node ID	Type	Time (ms)	Life time factor	State
2	Guarding	1000	1	Pre-operational

Figure 14

## 5. Service data object (SDO)

SDO function support Add/Delete SDO function and support Get/Set SDO function.

(See Figure 15)

The screenshot shows the 'CANopen Demo' software interface. The 'SDO function' tab is selected and highlighted with a dashed border. The interface is divided into two main sections: 'SDO input' and 'SDO list'.

**SDO input section:**

Node ID	Index	Sub-Index	Len	Byte0	Byte1	Byte2	Byte3
<input type="text"/>	<input type="text"/>	<input type="text"/>	1 ▾	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Below the input fields are three buttons: 'Add SDO Object', 'Delete SDO Object', and 'Update data byte'.

**SDO list section:**

Node ID	Index	Sub-Index	Len	Byte0	Byte1	Byte2	Byte3

Figure 15



### 5.1. Add SDO

- Input Node-ID/Index/Sub-Index/Len/Byte data and press “Add SDO Object” button. (See Figure 16)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'SDO function' tab is currently selected. Below the tabs, there is a section titled 'SDO input' which contains a form with the following fields:

Node ID	Index	Sub-Index	Len	Byte0	Byte1	Byte2	Byte3
	2	1000	4				

Below the form, there are three buttons: 'Add SDO Object', 'Delete SDO Object', and 'Update data byte'. The 'Add SDO Object' button is highlighted with a red border. Below the buttons, there is a section titled 'SDO list' which contains a table with the following columns:

Node ID	Index	Sub-Index	Len	Byte0	Byte1	Byte2	Byte3

Figure 16

## 5.2. Delete SDO

- Select a object from SDO list and press “Delete SDO Object” button.  
(See Figure 17)

The screenshot shows the CANopen Demo software interface. The 'SDO function' tab is selected. The 'SDO input' section contains a table with the following data:

Node ID	Index	Sub-Index	Len	Byte0	Byte1	Byte2	Byte3
2	1000	00	4	00	00	00	00

Below the table are three buttons: 'Add SDO Object', 'Delete SDO Object' (highlighted with a red box), and 'Update data byte'.

The 'SDO list' section contains a table with the following data:

Node ID	Index	Sub-Index	Len	Byte0	Byte1	Byte2	Byte3
2	1000	00	4	00	00	00	00

Figure 17

### 5.3. Update SDO data byte

- Select a object from SDO list and update data byte of PDO then press “Update data byte” button. (See Figure 18)

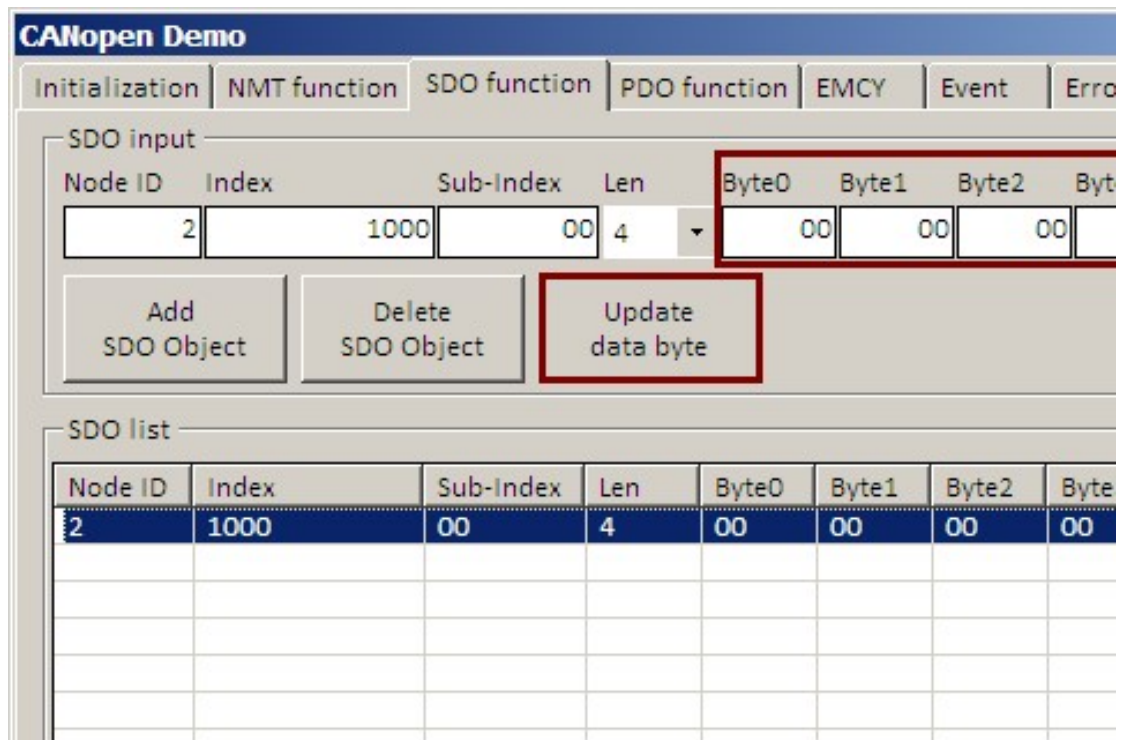


Figure 18

#### 5.4. Get SDO

- Select a object from SDO list and press “Get SDO” button. (See Figure 19)
- Get data will be show in list

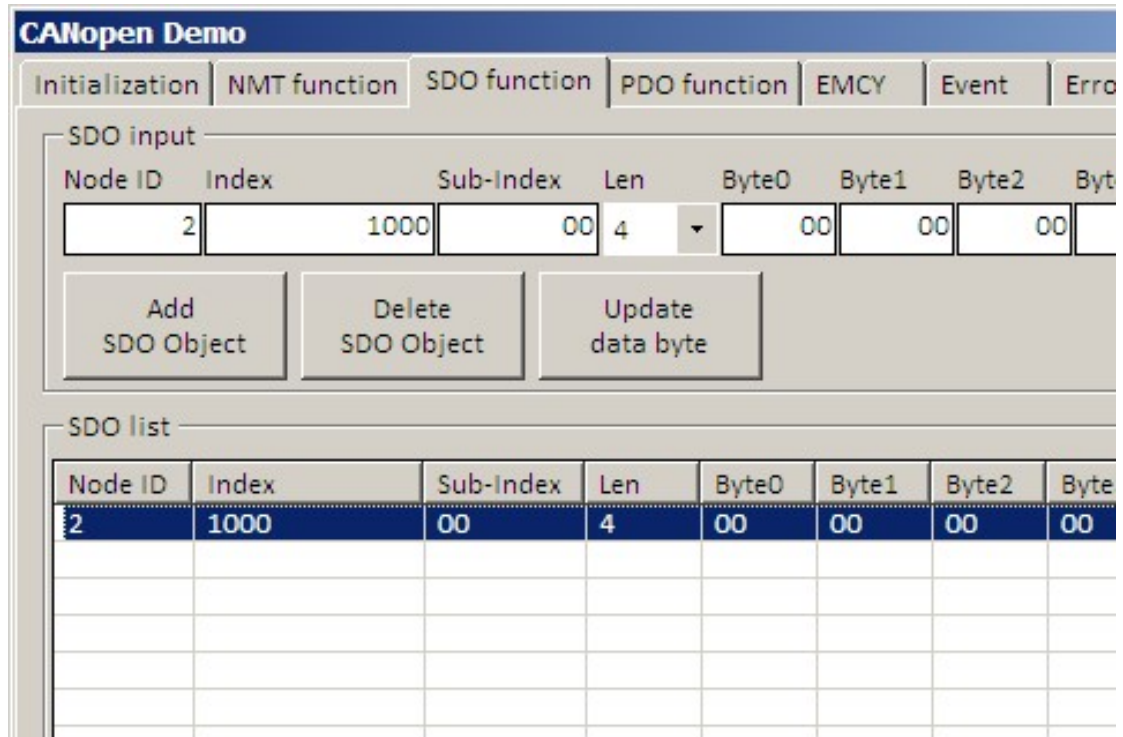


Figure 19

- If it fail to get SDO will be switch to Error page. (Figure 20)

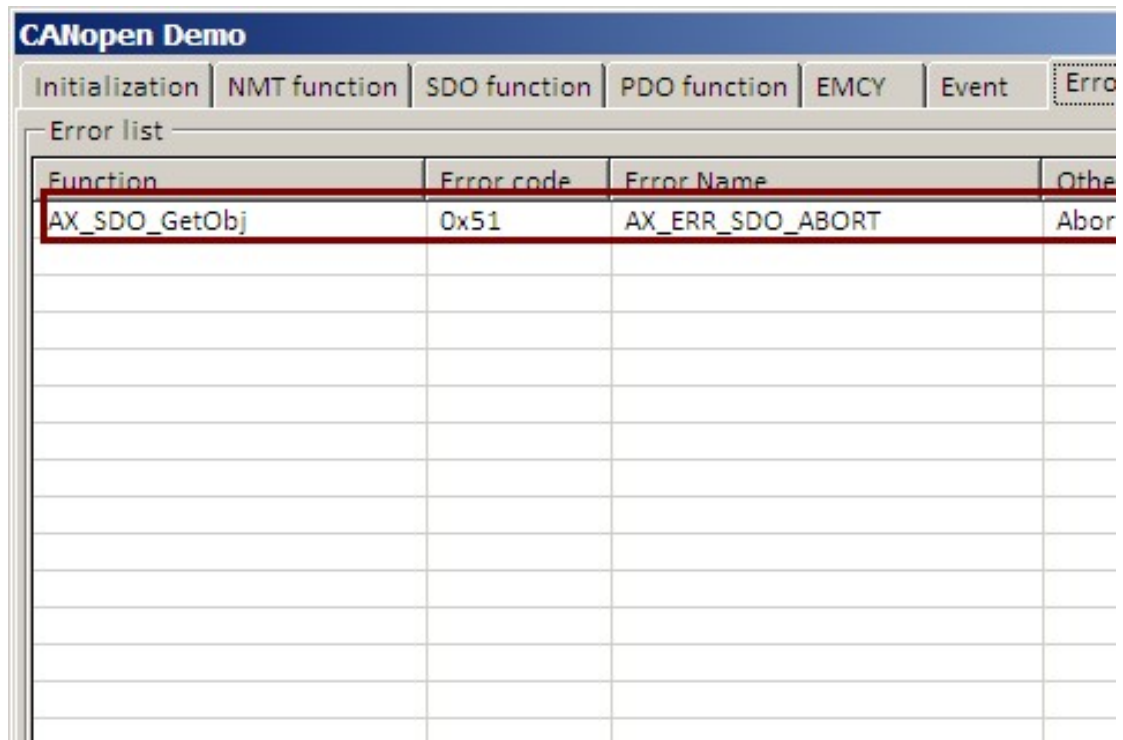


Figure 20

### 5.5. Set SDO

- Select a object from SDO list and press “Set SDO” button. (See Figure 21)

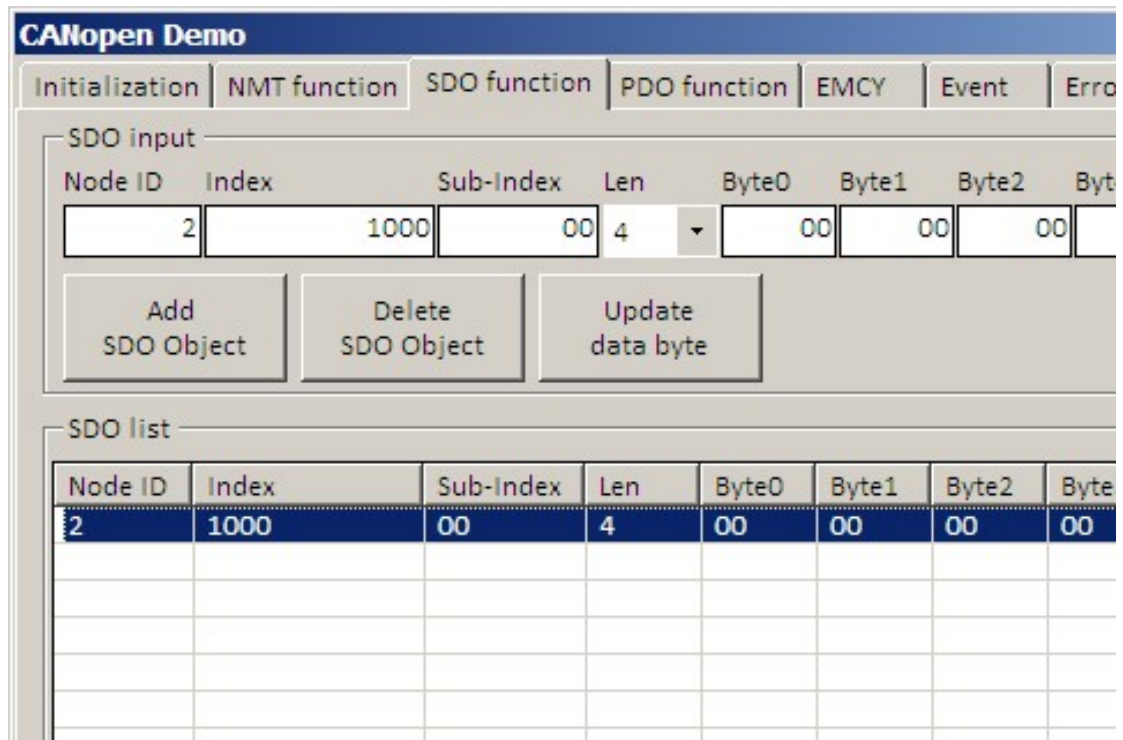


Figure 21

- If it fail to set SDO will be switch to Error page. (Figure 22)

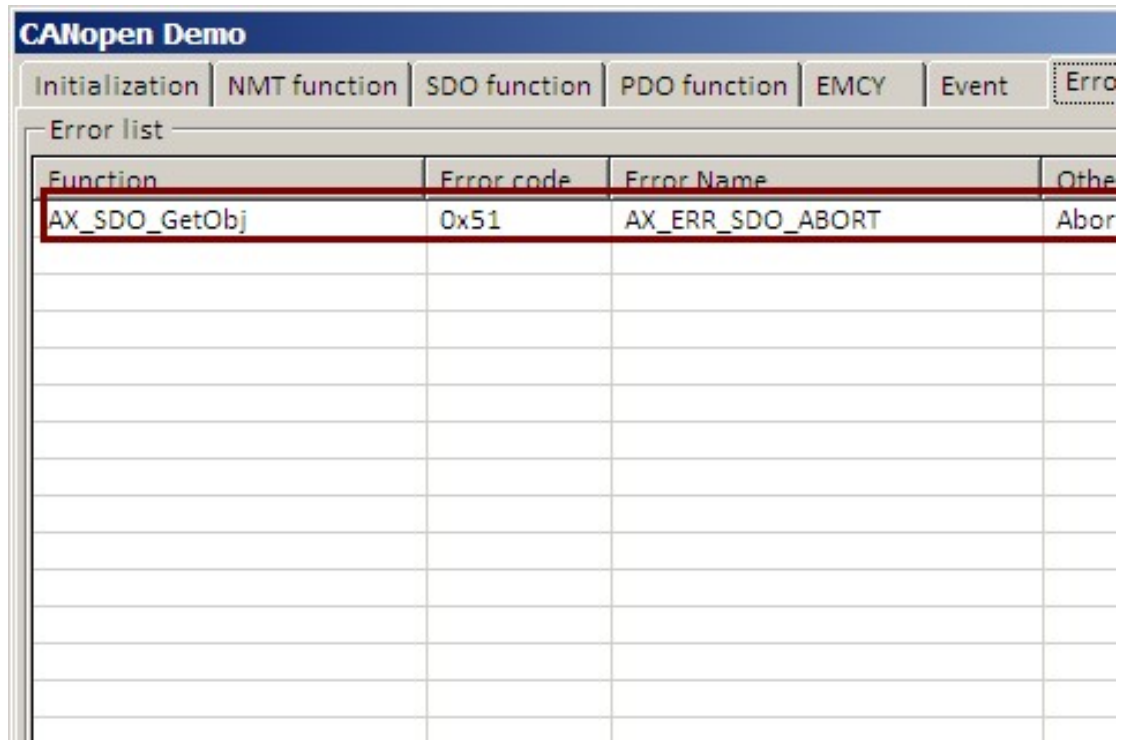


Figure 22

## 6. Process data object (PDO)

PDO function support Add/Delete PDO function and support Get/Set PDO function.

(See Figure 23)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function' (which is selected and highlighted with a dotted border), 'EMCY', 'Event', and 'Error'. Below the tabs, the 'PDO Input' section contains a table with columns: Num, Node ID, Type, Mode, Len, CANID, B0, B1, B2, B3, B4. The first row is populated with: Num: 1, Node ID: (empty), Type: TX, Mode: ASy, Len: 1, CANID: RPDO1, B0: (empty), B1: (empty), B2: (empty), B3: (empty), B4: (empty). Below this table are three buttons: 'Add PDO Object', 'Delete PDO Object', and 'Update data byte'. Below the buttons is the 'PDO list' section, which is a table with columns: Num, Node ID, Type, Mode, Len, CANID, B0, B1, B2, B3, B4, E. The table is currently empty.

Num	Node ID	Type	Mode	Len	CANID	B0	B1	B2	B3	B4
1		TX	ASy	1	RPDO1					

Num	Node ID	Type	Mode	Len	CANID	B0	B1	B2	B3	B4	E

Figure 23

### 6.1. Add PDO

- Input Node-ID/PDO-No/Type/Mode/Len/CANID/Byte data and press “Add PDO Object” button. (See Figure 24)

The screenshot shows the 'CANopen Demo' software interface. At the top, there are several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function' (which is selected and highlighted with a dotted border), 'EMCY', 'Event', and 'Error'. Below the tabs is the 'PDO Input' section, which contains a table for configuring a PDO object. The table has columns for Node ID, No, Type, Mode, Len, CANID, and five data bytes (B0, B1, B2, B3, B4). The current configuration is: Node ID: 2, No: 1, Type: RX, Mode: ASy, Len: 1, CANID: RPDO1. Below the table are three buttons: 'Add PDO Object', 'Delete PDO Object', and 'Update data byte'. Below the 'PDO Input' section is the 'PDO list' section, which is a table with the same columns as the 'PDO Input' table. The 'PDO list' table is currently empty.

Node ID	No	Type	Mode	Len	CANID	B0	B1	B2	B3	B4
2	1	RX	ASy	1	RPDO1					

Node ID	No	Type	Mode	Len	CANID	B0	B1	B2	B3	B4

Figure 24

## 6.2. Delete PDO

- Select a object from PDO list and press “Delete PDO Object” button.  
(See Figure 25)

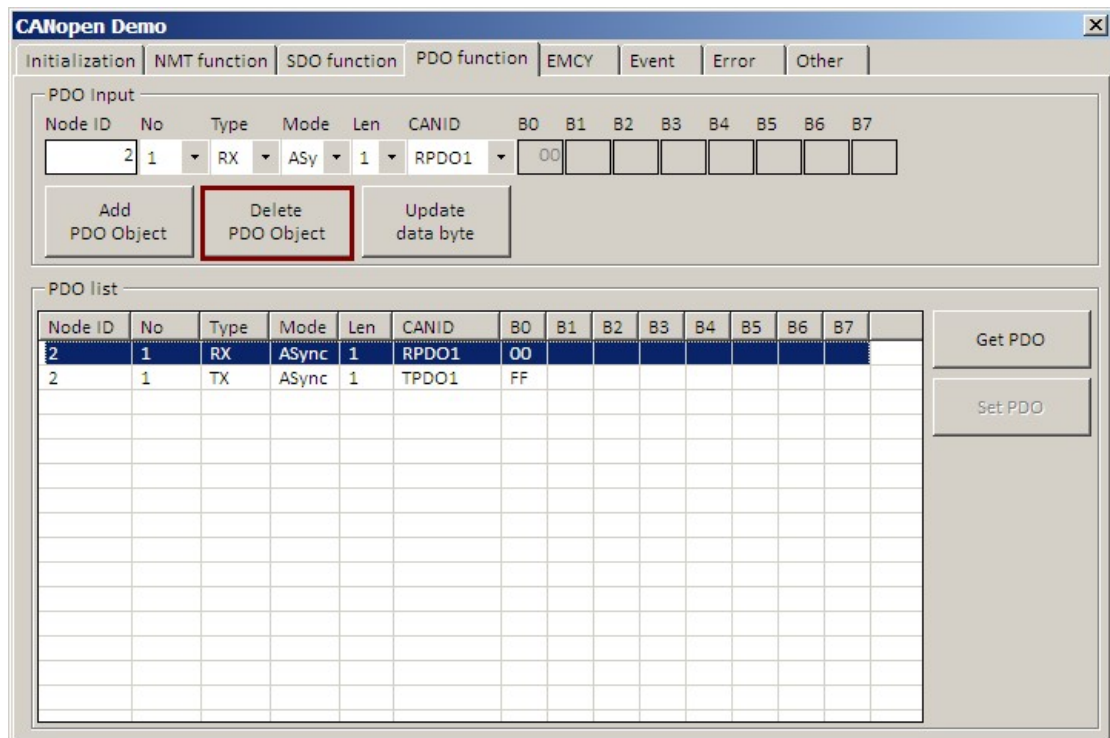


Figure 25



### 6.3. Update PDO data byte

- Select a object from PDO list and update data byte of PDO then press “Update data byte” button. (See Figure 26)

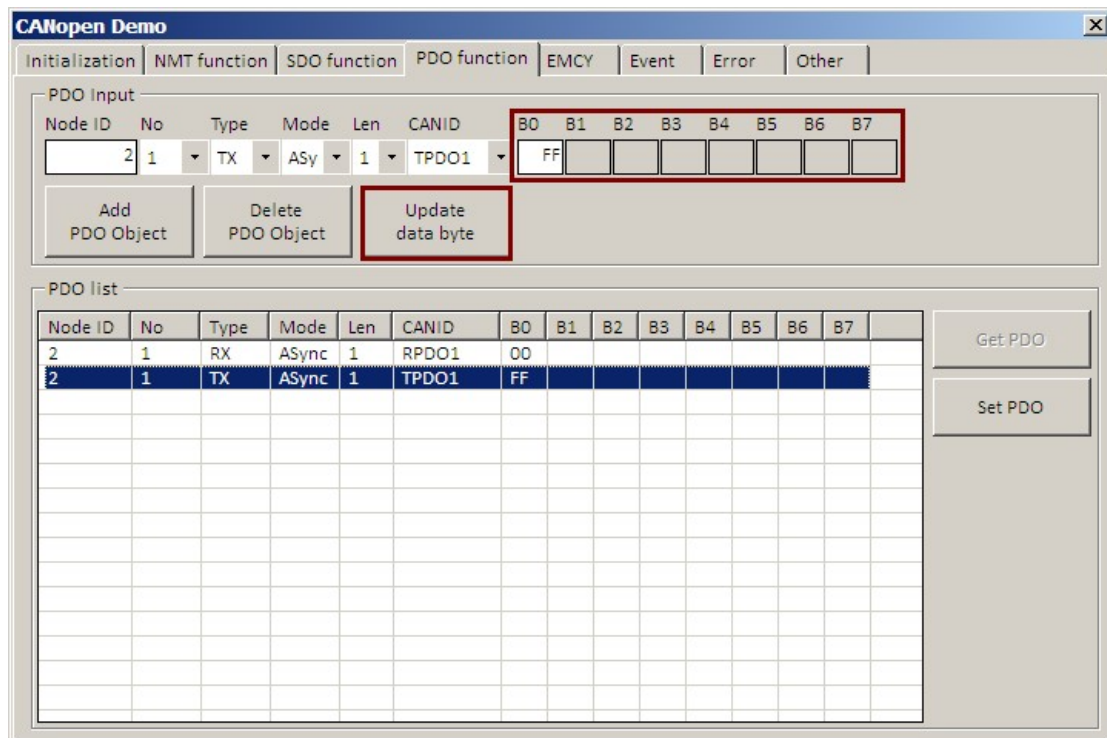


Figure 26

#### 6.4. Get PDO

- Select a RX-object from PDO list and press “Get PDO” button. (See Figure 27)
- Get data will be show in list

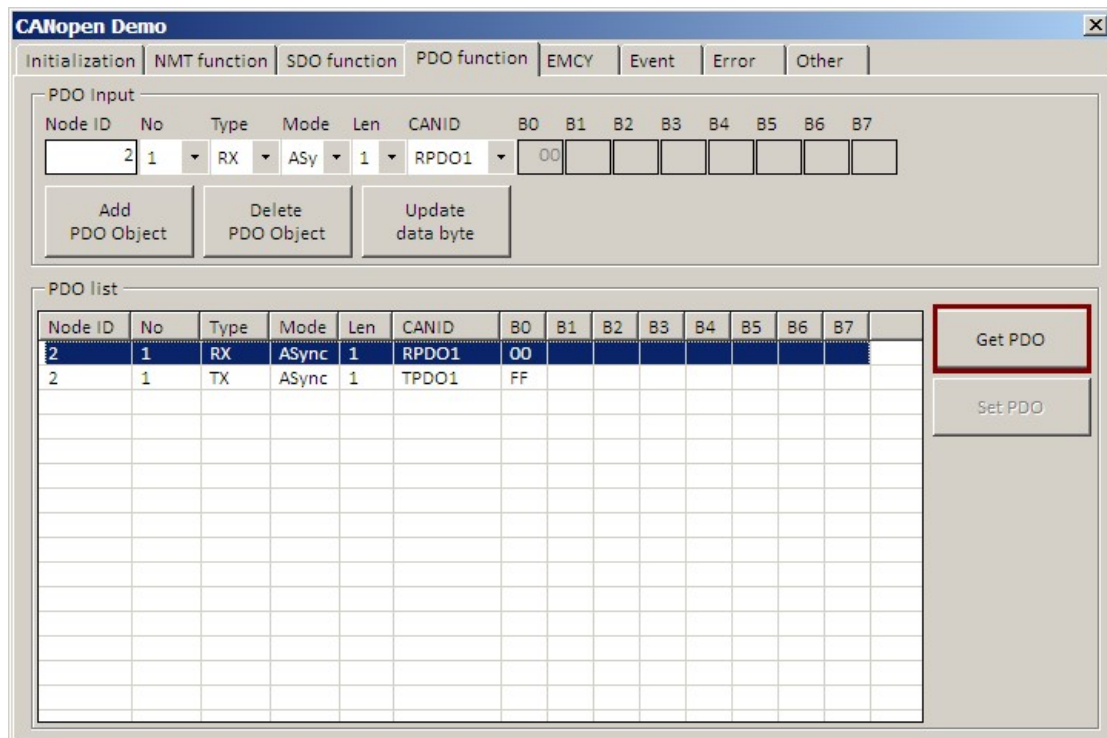


Figure 27

- If it fail to get PDO will be switch to Error page. (Figure 28)

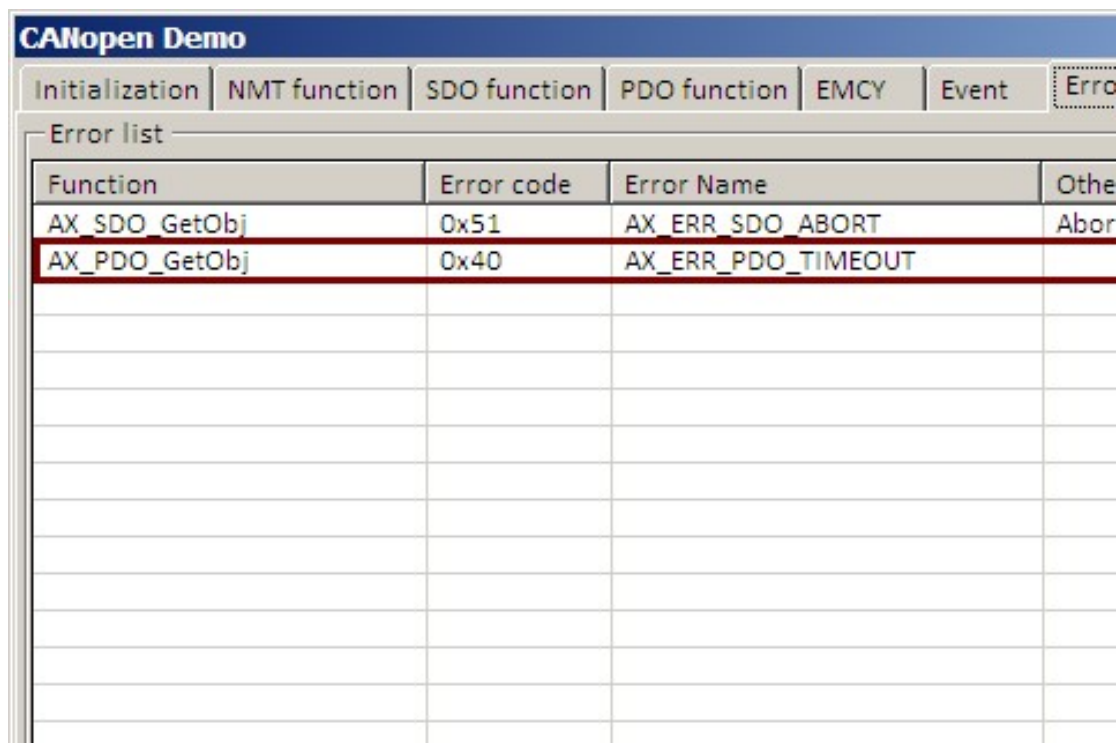


Figure 28

## 6.5. Set PDO

- Select a TX-object from PDO list and press “Set PDO” button. (See Figure 29)

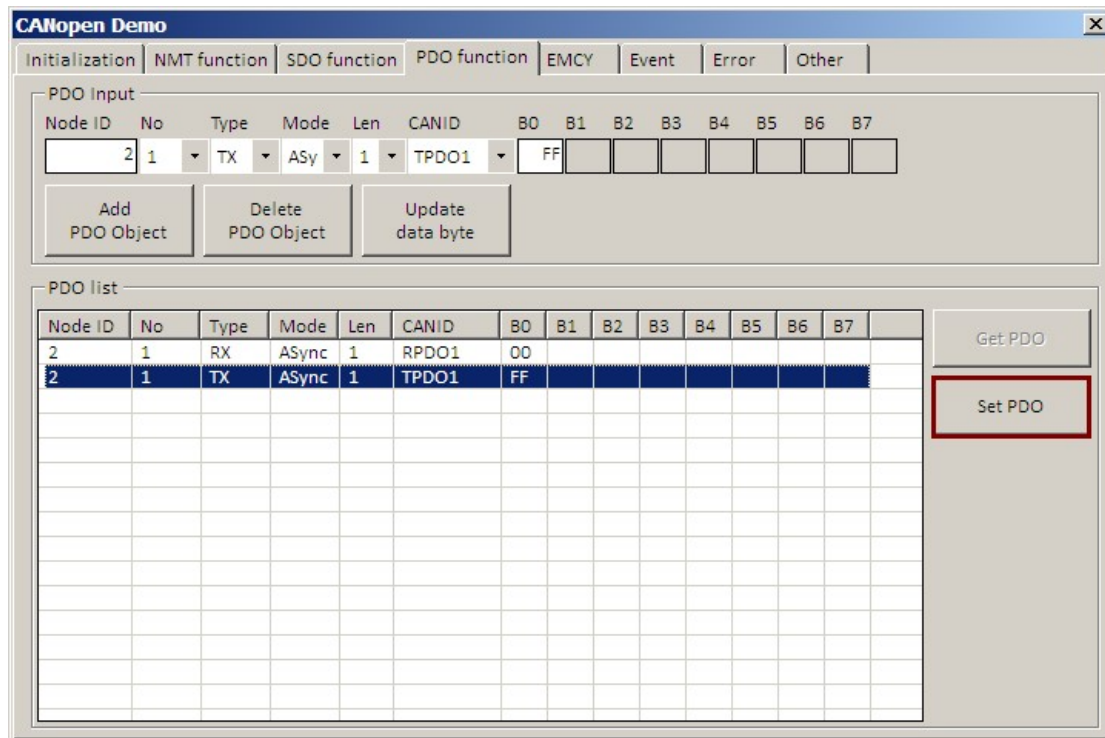


Figure 29

- If it fail to get PDO will be switch to Error page. (Figure 30)

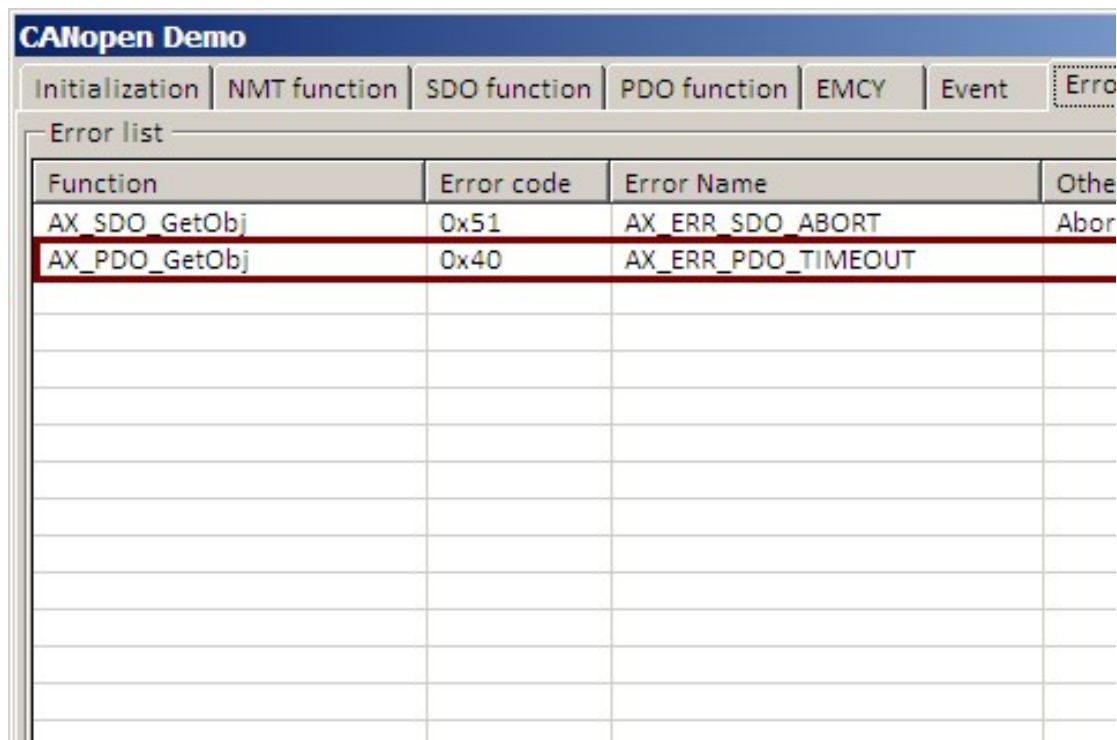
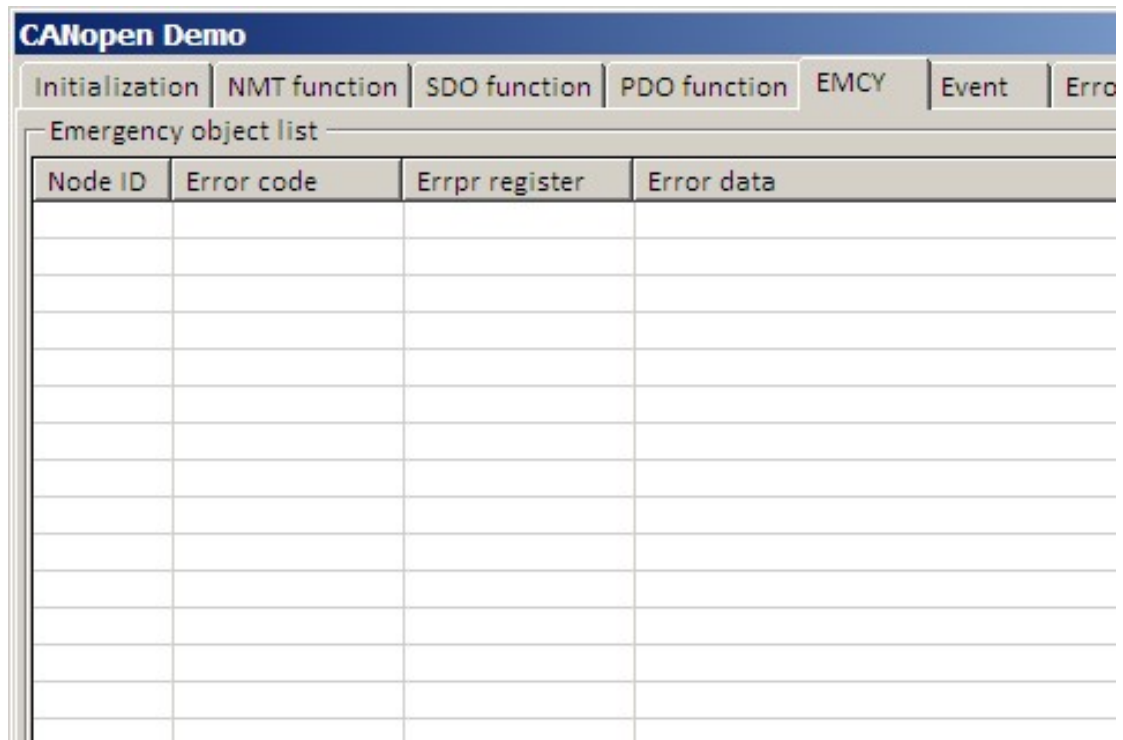


Figure 30

## 7. Emergency object (EMCY)

EMCY list will be receive EMCY object of all node. (See Figure 31)



The screenshot shows a software interface titled "CANopen Demo". It features a series of tabs: "Initialization", "NMT function", "SDO function", "PDO function", "EMCY", "Event", and "Error". The "EMCY" tab is currently selected. Below the tabs, there is a section labeled "Emergency object list" which contains a table with four columns: "Node ID", "Error code", "Errpr register", and "Error data". The table is currently empty, with only the header row visible.

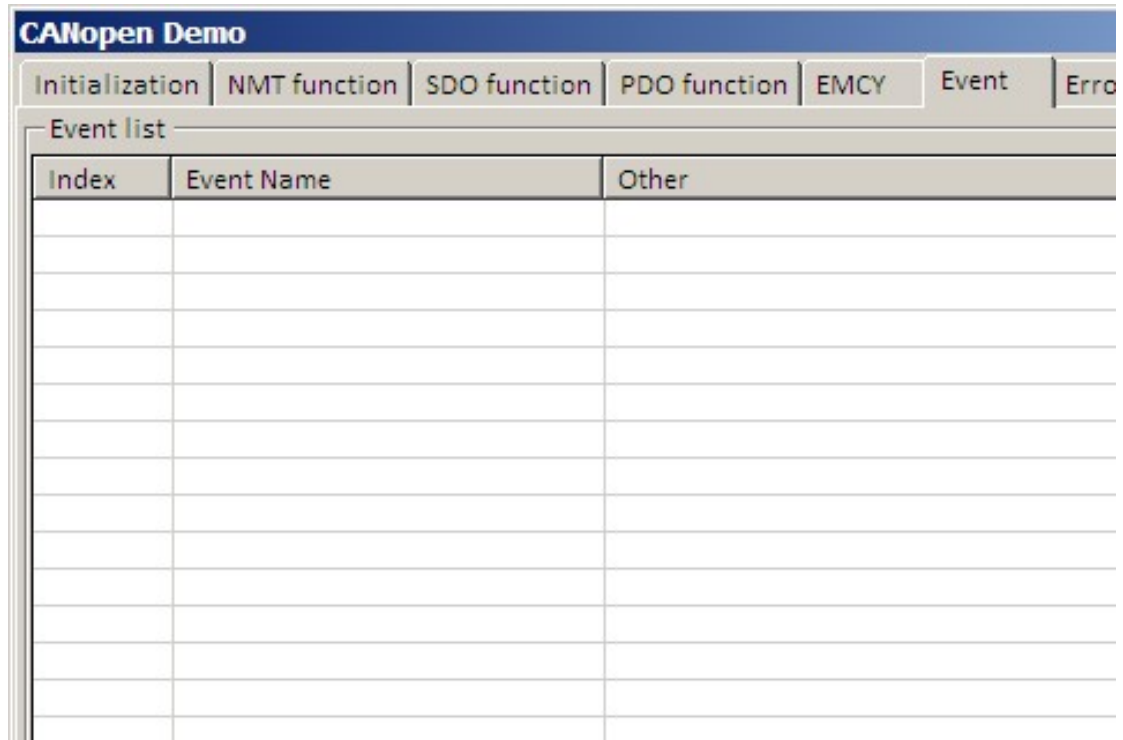
Node ID	Error code	Errpr register	Error data

Figure 31

## 8. Event list

Event list will be receive Event of API. (See Figure 32)

All event index will be show Table 3.



The screenshot shows a software interface titled "CANopen Demo". At the top, there are several tabs: "Initialization", "NMT function", "SDO function", "PDO function", "EMCY", "Event", and "Error". The "Event" tab is currently selected. Below the tabs, there is a section labeled "Event list" which contains a table with three columns: "Index", "Event Name", and "Other". The table is currently empty, with no data rows visible.

*Figure 32*

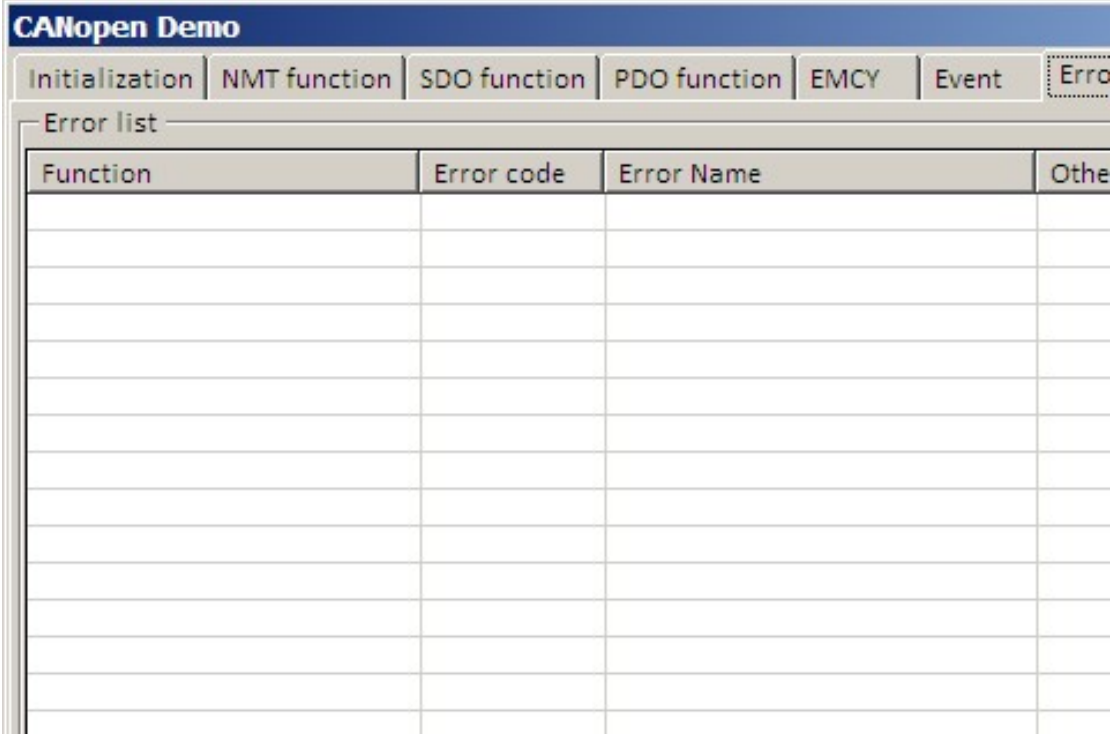
Name	Value	Description	Return value
AX_EVT_NMT_NODE_GAURDING	0x0101	Guarding error	INT(Node ID)
AX_EVT_NMT_HEARTBEAT	0x0102	Heartbeat error	INT(Node ID)
AX_EVT_EMCY	0x0401	EMCY event	NULL
AX_EVT_PDO_RX	0x0501	RPDO event	NULL

*Table 3*

## 9. Error list

Error list will be showing all error of Demo tool. (See Figure 33)

All error code will be show Table 4.



The screenshot shows the 'CANopen Demo' application window. At the top, there is a blue title bar with the text 'CANopen Demo'. Below the title bar is a navigation menu with several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The 'Error' tab is currently selected and highlighted. Below the navigation menu is a section titled 'Error list'. This section contains a table with four columns: 'Function', 'Error code', 'Error Name', and 'Other'. The table is currently empty, with only the header row visible.

Function	Error code	Error Name	Other

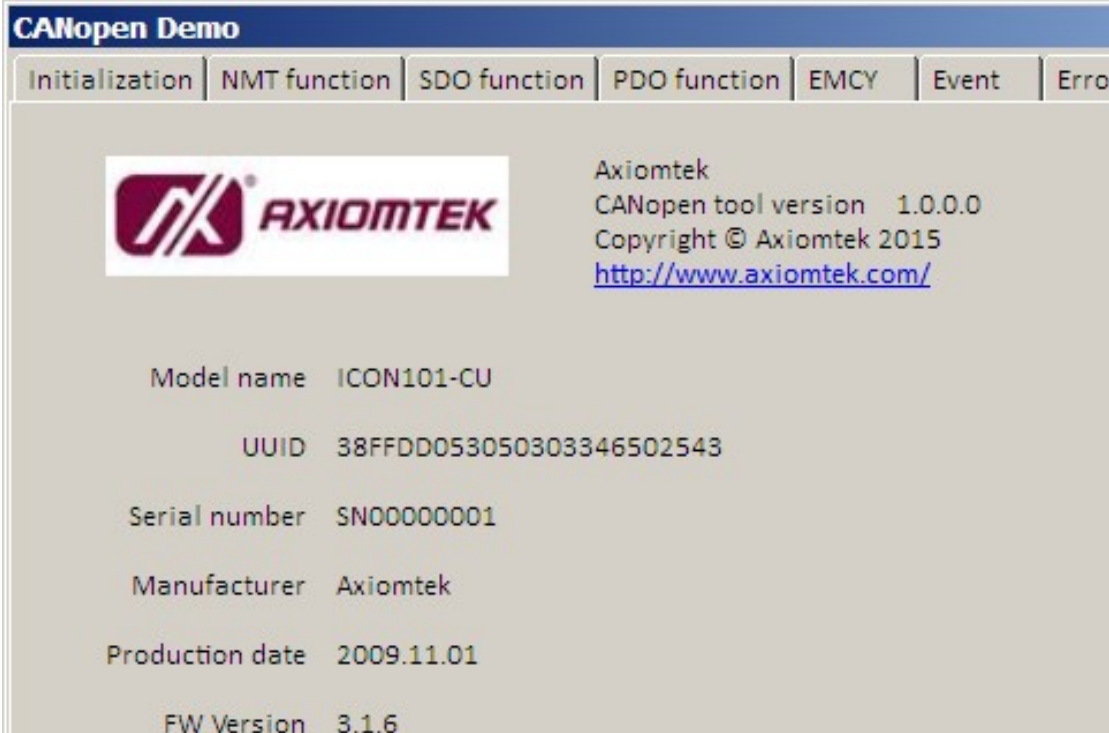
*Figure 33*

<b>Name</b>	<b>Value</b>	<b>Description</b>
AX_ERR_NONE	0x0000	No error
AX_ERR_BUSY	0x0001	Function busy
AX_ERR_PARA	0x0002	Parameters error
AX_ERR_CONNECTED	0x0010	Device has been connected
AX_ERR_DISCONNECTED	0x0011	Device has been disconnected
AX_ERR_QUEUEEMPTY	0x0012	Queue empty
AX_ERR_UNINITIALIZED	0x0013	CANopen has not been initialized
AX_ERR_THREADFAIL	0x0014	Resume thread error
AX_ERR_CAN_OPENED	0x0020	CAN-port has been opened
AX_ERR_CAN_CLOSED	0x0021	CAN-port has been closed
AX_ERR_CAN_BITRATE	0x0022	Set bitrate error of CAN
AX_ERR_CAN_CONFIG	0x0023	Set configuration error of CAN
AX_ERR_CAN_TERMIN	0x0024	Set termination error of CAN
AX_ERR_CAN_ID	0x0025	Set CAN-ID error of CAN
AX_ERR_CAN_MASK	0x0026	Set CAN-mask error of CAN
AX_ERR_CAN_TX	0x0027	Send message error of CAN
AX_ERR_CAN_RX	0x0028	Receive message error of CAN
AX_ERR_CAN_TIMEOUT	0x0029	Response timeout of CAN
AX_ERR_NMT_NODEEXIST	0x0030	NMT-node is exist
AX_ERR_NMT_NODENOTEXIST	0x0031	NMT-node is not exist
AX_ERR_PDO_TIMEOUT	0x0040	PDO timeout
AX_ERR_PDO_OBJEXIST	0x0041	Object is exist in PDO list
AX_ERR_PDO_OBJNOTEXIST	0x0042	Object is not exist in PDO list
AX_ERR_PDO_CANIDEXIST	0x0043	CANID is exist of object in PDO list
AX_ERR_SDO_TIMEOUT	0x0050	SDO timeout
AX_ERR_SDO_ABORT	0x0051	SDO abort
AX_ERR_SDO_FORMAT	0x0052	SDO format error
AX_ERR_EVENT_SYNC	0x1000	Sync object error
AX_ERR_EVENT_PDO	0x1001	Sync PDO error
AX_ERR_EVENT_TIME	0x1002	Time object error

**Table 4**

## 10. Other page

Information of Demo tool & Device. (See Figure 34)



The screenshot displays the 'CANopen Demo' software interface. At the top, there is a blue header bar with the title 'CANopen Demo'. Below the header is a navigation menu with several tabs: 'Initialization', 'NMT function', 'SDO function', 'PDO function', 'EMCY', 'Event', and 'Error'. The main content area is light gray and contains the Axiomtek logo on the left and device information on the right. The device information includes the model name 'ICON101-CU', a UUID '38FFDD053050303346502543', a serial number 'SN00000001', the manufacturer 'Axiomtek', a production date of '2009.11.01', and a firmware version of '3.1.6'. The software version is '1.0.0.0' and the copyright is '© Axiomtek 2015'. A URL 'http://www.axiomtek.com/' is also provided.

Field	Value
Model name	ICON101-CU
UUID	38FFDD053050303346502543
Serial number	SN00000001
Manufacturer	Axiomtek
Production date	2009.11.01
FW Version	3.1.6

*Figure 34*