

## Application Note #1233: CANopen Master and 3rd Party Devices

### Introduction

CANopen is an internationally standardized CAN based communication system. It includes several application layer protocols and application profiles. This document is provided to help you connect a Pro-face CANopen master to third party slave devices. The devices can be various things such as I/O assemblies, drives, motion control servos, encoders, high speed counters, measuring devices, and loop controllers.



For each display unit, you can construct an open network, connecting up to 63 CANopen compatible slave units. (When using LT4000 series with CANopen slave units, we recommend a maximum 16 units.)

**Note:** To learn more about CANopen go to: <http://www.can-cia.org/can-knowledge/canopen/canopen/>

### The CANopen Object Dictionary

Every CANopen device must have an object dictionary.

- All communication and application objects belonging to a CANopen device are managed in a standardized listing - the CANopen object dictionary.
- In this object dictionary, each data item that needs to be exchanged between the communication part and the application part of the device owns its unique 24-bit address. This address is divided in a 16-bit index and an 8-bit sub-index.
- Any entry in the CANopen object dictionary is readable via CANopen communication services.
- The default SDO channel of a CANopen device offers the system designer the possibility to configure the desired CANopen device behavior via the network.

The Electronic Data Sheet (EDS) includes the object dictionary and communication specifics.

- Describes each object dictionary entry with address, parameter name, data type, access type, and default value.
- ASCII file format
- Unique for each device. Always provided by the device manufacturer or their configuration software.
- Required for each device on CANopen

### Materials

- 3<sup>rd</sup> party device meeting these requirements:
  - **Full CANopen specification support.** (i.e. not CAN bus)
  - **Supports 11 bit COB-ID (CAN2.0A).**
  - **CANopen Electronic Data Sheet,** An ".eds" file matching the device is required.
  - **CANopen configuration manual** to configure setup and access device data.
  - **Single SDO channel** (if more than one channel disable the others)
- Pro-face GP-Pro EX development software

- Pro-face LT4000M series., AGP3300 series with a CA1M suffix, or LT3000 series with a CA8-CANLT-01 CANopen master module
- Standard CANopen cable with DB9 ends and TERM switches.
  - Pro-face CA-CABLE-010M CANopen cable (10 meters)
  - Pro-face CA-CN00-TRM or CA-CN90-TRM Connector DB9
  - CANopen connector and termination resistor or switch for Third party device.

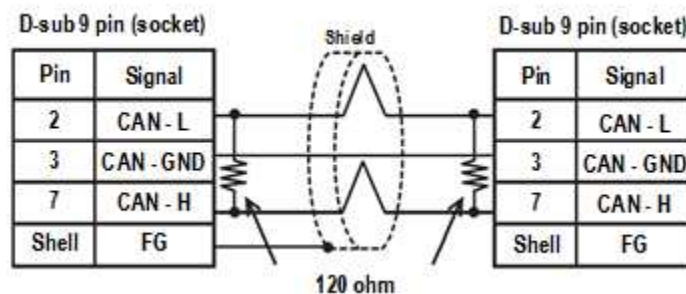
**Note:** In most cases the CANopen EDS file is provided by the device manufacturer or is user generated by the device configuration software. The EDS file may be firmware specific. The file for some devices is user generated by the device configuration software. Check with the device manufacturer.

### Connect the 3<sup>rd</sup> Party Device

Connect a CANopen cable from the master CANopen port to the third party device CANopen connection. Set the cable connector TERM switches at both ends of the network to the ON position. If the connector for the third party device at the end of the network and does not have a TERM switch place a 120 ohm resistor from CAN-H to CAN-L.

Various forms of connection are used with CANopen. DSUB 9 (DB9) is most common type. Phoenix, M12, and RJ45 connectors as well as open style terminals may be used.

We recommend purchasing CANopen connectors and cable. If the 3<sup>rd</sup> party device also has a DB9 interface and you choose to build your own cable using standard DB9 connectors the following diagram provides information needed to build the cable:



**Note:** If you build your own, cable and components should meet CANopen standards.

The CANopen standard includes a conductor for power. (DB9 Pin 9) Pro-face CANopen interfaces to not connect to this pin.

### Configure the 3<sup>rd</sup> Party Device

Refer to the Third party device CANopen configuration manual for instructions. Configuration settings may be device parameters or physical switches. Most slave devices require these steps:

- Set the CANopen address (Node ID)
- Select baud rate.
- Configure error control. Heartbeat error control is preferred. Pro-face master default heartbeat is 200ms.

Additional 3<sup>rd</sup> party device CANopen configuration may be required.

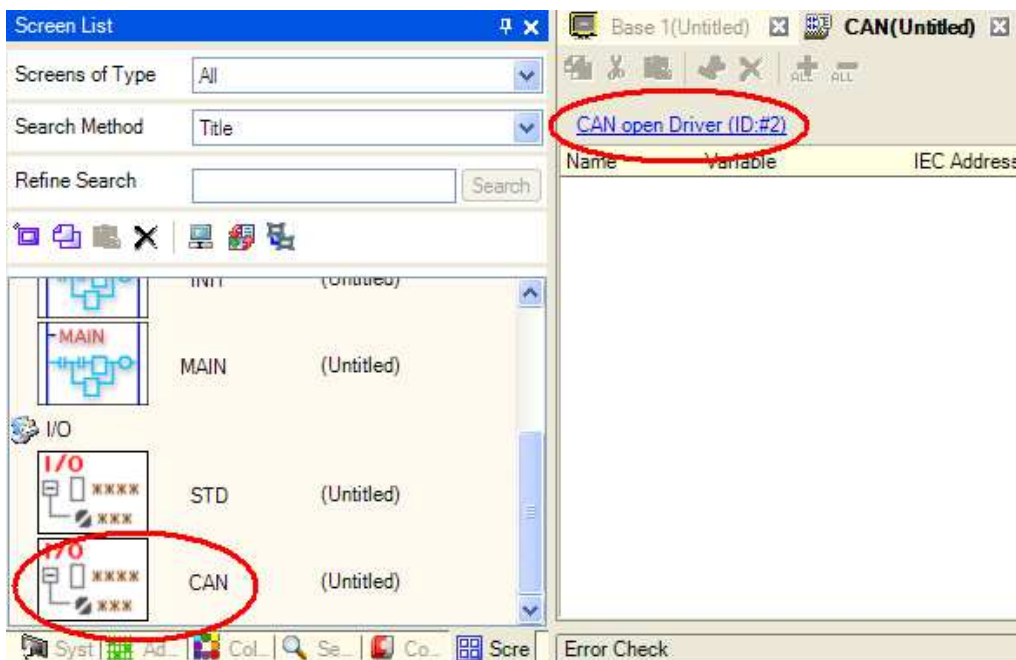
## CANopen Network Configuration in GP-Pro EX

The steps to configure an AGP or LT3000/LT4000 project are nearly identical.

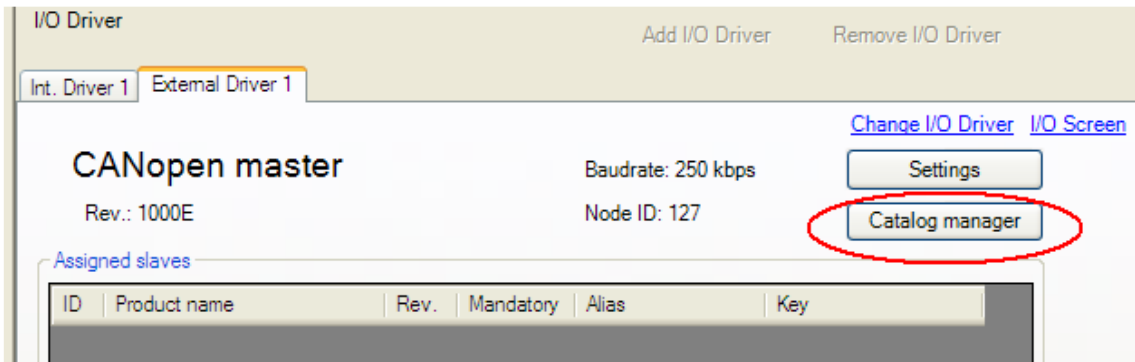
- 1.) If you are creating a new project for a LT3000 or LT4000 select the CANopen Driver. If you have an existing project simply open the project. (*LT only. New AGP3000 projects skip this step*)



- 2.) From the Screen List in GP-Pro EX Click on the I/O Icon labeled "CAN".  
*Note: LT3000 users, if the icon is labeled "EXM" click on it and select the "External Driver 1" tab. Click on "Change I/O Driver". Select "CAN open Driver". Click OK.*
- 3.) Then click on "[CANopen Driver \(ID:#...\)](#)"



- 4.) Click on [Settings].
- 5.) In the lower window "Registered devices" the 3<sup>rd</sup> party slave device may be displayed. If so skip to step 7. If it is not shown continue to step 6.
- 6.) Adding the 3<sup>rd</sup> party slave device to the list of Registered Devices:
  - a. Click [Cancel] return.
  - b. Then click on [Catalog Manager]

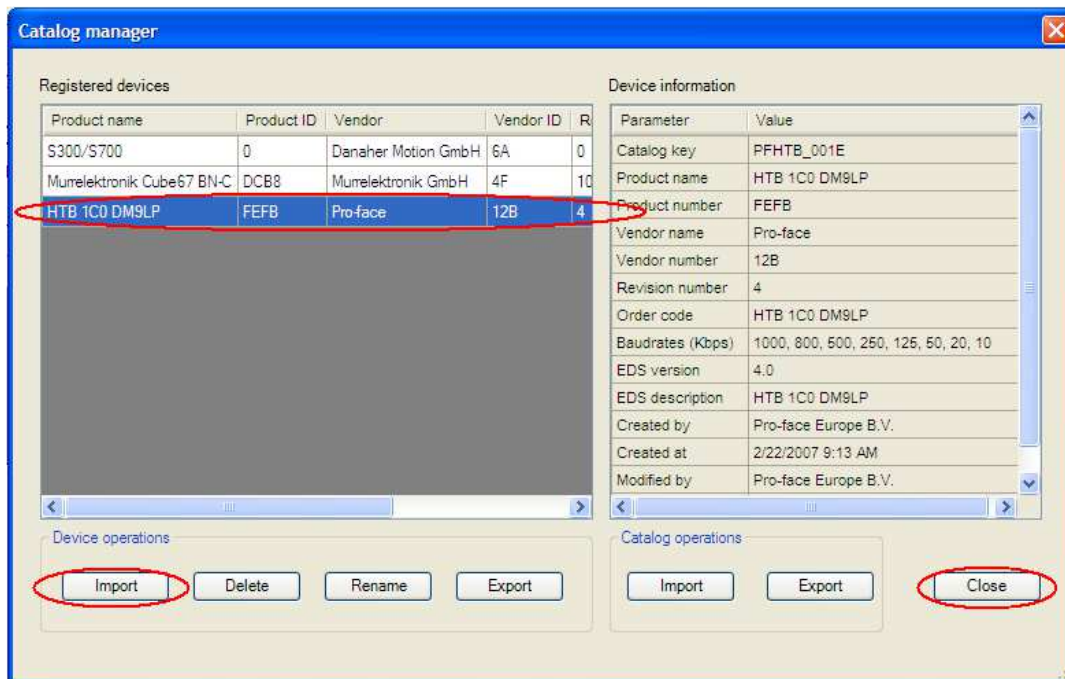


- c. In the Device operations dialog box click on [Import]
- d. Locate and select the correct 3<sup>rd</sup> party slave electronic data sheet “.eds” file.
- e. Click [Open] to import the EDS file into the GP-Pro EX “Registered devices” database.

*Note: When importing an .eds file a dialog box labeled “Device import” may appear.*

- The items with severity “Warning” are information about eds file properties that may require user action at some point.
- The items with severity “Error” are missing key components. The file is likely faulty and probably will not work. Contact the third party vendor for a CANopen compliant file or to have the file modified.

Click on [Help] for more information about the warnings.



- f. Another dialog box “Query” may appear “The device is registered with a key that is different than is specified in the file....(1209) This is a warning message. If

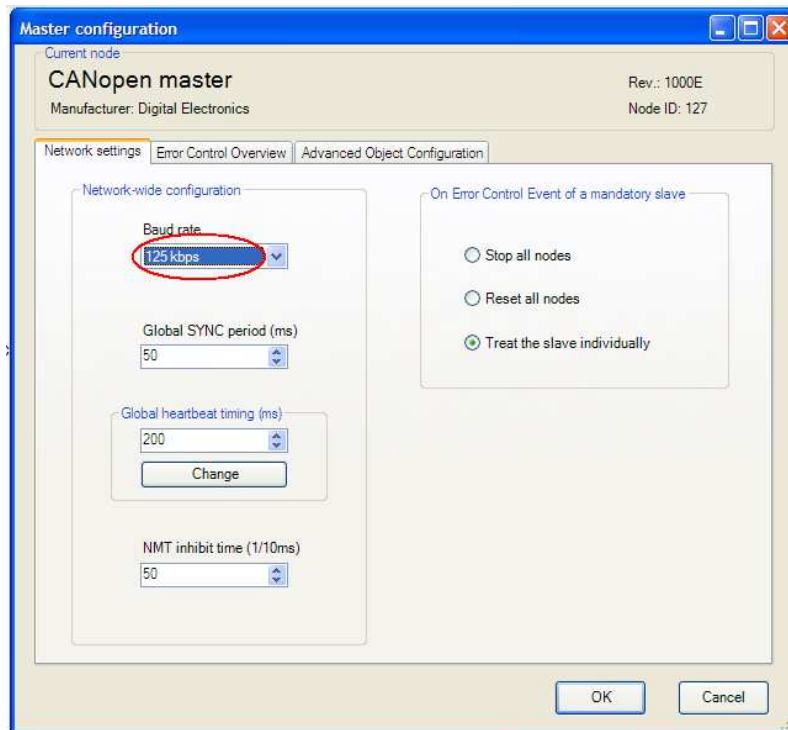
this is a new slave configuration the recommended response is [Yes]. The choice selected will be the “key” in the slave configuration.

*Note: When importing an .eds file to access an existing slave; the key that matches that slave “key” in network configuration is the best choice.*

g. Click on [Close].

7.) Click on [Settings].

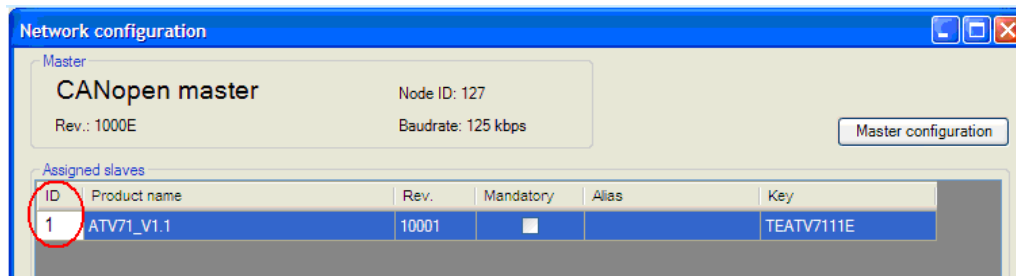
8.) The network baud rate is shown in the upper section of the “Network Configuration” window. To change the Baud rate or review the other network settings click on [Master configuration]. Before changing any other master configuration settings confirm the change is required by your third party device.



9.) If you are not already there return to the Network configuration window.

10.) Adding a Slave device to the project.

- a. To add a slave highlight it in the list of “Registered devices”.
- b. Click [Add Slave].
- c. The ID must match the slave station setting. If you wish to change it click on slave ID number. Select or type the slave station number. Press [Enter].

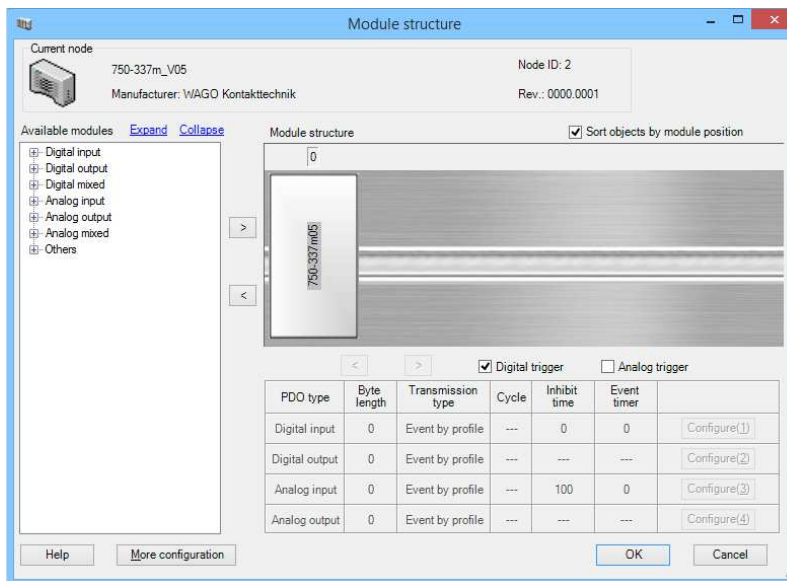


d. Do not make slave mandatory if not really necessary! Mandatory slave events are serious events. If mandatory slave is selected configure event control in Master Configuration.

11.) To configure a slave node highlight it and click [Slave configuration].

12.) **Follow the 3<sup>rd</sup> party manufacturer's instructions to configure the slave.** Two possible methods of configuration are possible depending on the options installed in GP-Pro EX and the vendor's EDS file. For either method follow the 3<sup>rd</sup> party manufacturer's instructions.

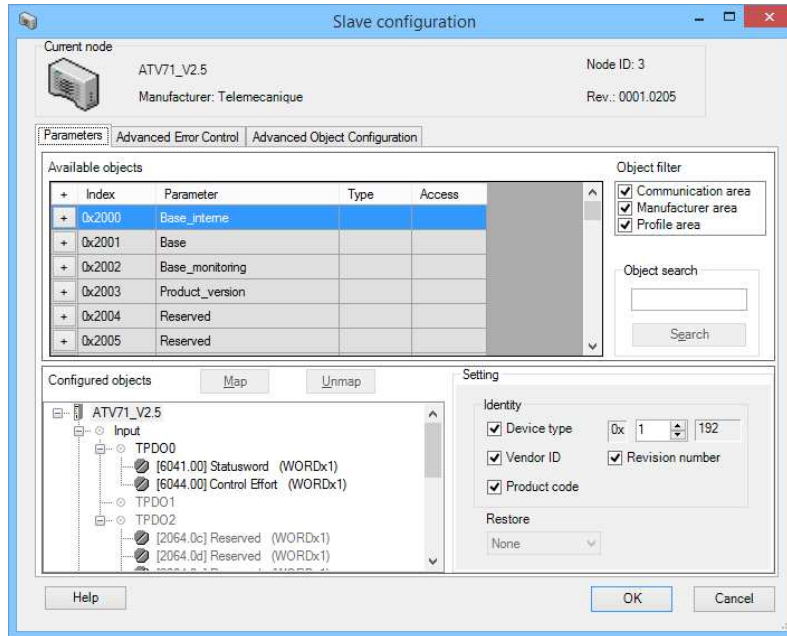
- If the dialog box resembles the sample screen below your GP-Pro EX includes the optional graphical interface and the 3<sup>rd</sup> party EDS file allows graphical configuration.



- If your device appears in the graphical interface and you do not want to use the graphical interface uninstall and reinstall GP-Pro EX to remove it.
- Click on each module to configure it.
- If the slave has analog inputs check the "Analog trigger" box and set an analog inhibit time. (Inhibit time 5000 = 500 msec.)

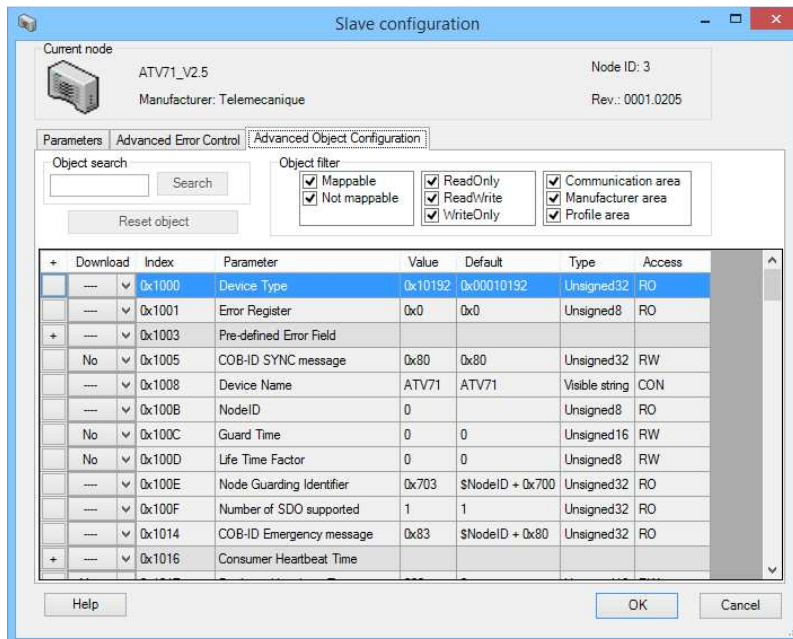


- iv. [More configuration] allows access to additional indexes. Refer to the 3rd party device manual for instructions. Change only parameters as instructed in the device manufacturer's documentation.
- If the dialog box resembles the sample screen below your GP-Pro EX does not include the graphical interface or your 3<sup>rd</sup> party EDS file is not compatible with the graphical interface.



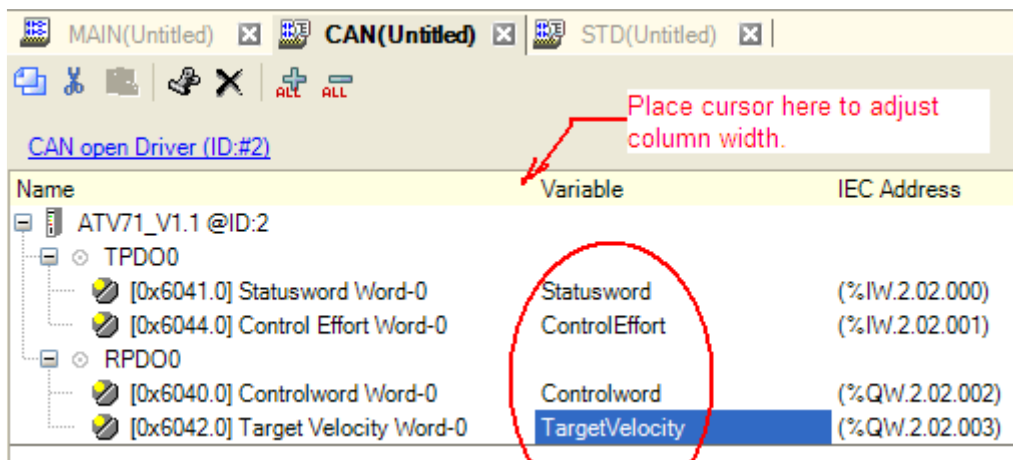
If you are using the standard interface some but not all of the following steps and others not mentioned may be required.

- i. Map the desired device input parameters in TPDOs and output parameters in RPDOs. Each PDO is a separate data message with an 8 byte limit. Mapping to various PDOs is free format within the limits of the EDS file.
- ii. EDS Files can predefine PDO Mapping. Duplicate mapped indexes are not allowed. It may be possible to delete duplicate indexes within a PDO or simply disable the entire PDO.
- iii. Select the Advance Configuration tab to configure other parameters as needed. Refer to the 3rd party device manual for instructions. Change only parameters as instructed in the device manufacturer's documentation.
- iv. If the device has analog inputs configure and enable them in the Advance Configuration as instructed by the device manufacturer. (Typically the enable parameter is 0x6423.00 "Analog input global interrupt enable" = 1)



v. If the slave has analog inputs check the “Analog trigger” box and set an analog inhibit time.

15. Assign Variable Names. Click “I/O Screen”. Enter Variable names for the I/O and click “Yes” (if prompted) to register them as variable names.



## Troubleshooting

### Error on importing EDS

EDS file is not compatible with GP-Pro EX. If it does not import it probably does not meet CANopen standards. Test it with a CANopen EDS checker software. Contact the device manufacturer to obtain a compliant EDS file.

*Note: The .eds file must be for CANopen rather than DeviceNet*



### **Cannot open CANopen configuration in GP-Pro EX:**

- CANopen configuration can only be opened when the matching EDS-files for all the slave devices in the project are included in the list of Registered devices. The file “Key” must also match the slave.
- Wrong version of the CANopen Graphical Interface Tool. (Older version)  
Symptoms: Cannot open LT4000M projects or cannot edit them.  
Solution: Uninstall GP-Pro EX to remove the tool. Reinstall GP-Pro EX. Obtain the latest version of the tool if you wish to reinstall.

### **Problem Saving Slave Configuration in GP-Pro EX**

- Dialog Box 1301: “One or more objects are mapped more than once in this slave. Please make sure that objects are mapped only once by unmapping objects or disabling PDOs. (1301)”  
- CANopen allows enabling only one PDO for each parameter (index). Some CANopen device manufacturers, notably servo and drives manufacturers, choose to enable multiple PDO configurations expecting the user to decide which ones best fit their needs.  
Solution:  
The duplicate entries can be disabled by disabling the PDO they are assigned to or the duplicate entries can simply be unmapped from the PDOs.
- CANopen Slave Configuration Error 1316 “Project compilation failed. Errors can be solved by modifying the settings of the slaves with errors. (1316)”  
- Solution: Review the error list presented at the bottom of the "Network Configuration" (CANopen network) dialog box and correct the problem(s).

### **CAN system bus is not supported**

#### **Error messages Upon Startup**

When powering up the master and slaves together the master may initialize CANopen communications before the slave is on-line. To prevent this situation set a Start Time delay in GP-Pro EX.

When powering up the master and slaves separately on the CANopen network, the CANopen slaves (HTB and others) must be powered up first, and then the CANopen master (display unit or other) must be turned on last. Otherwise, the CANopen network may not operate properly.

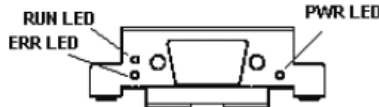
In most applications the DCF data is transferred to the slave memory on the first power up or master transition to run after the CANopen slave configuration is downloaded to it. Another power cycle may be required to load the DCF file into the slave runtime memory. Each time the slave configuration is modified in GP-Pro EX it this process may be need to be repeated.

#### **What can you do? - Checklist**

- Check CANopen LEDs
- Check baud rate and slave address
- Does slave configuration and settings in master match?
- Do you use latest driver version?
- Use Offline diagnostic screens
- Use diagnostic commands in logic

**Error messages (on LT / AGP)** Press the button with the blue bar next to the error message for a complete list of current errors.

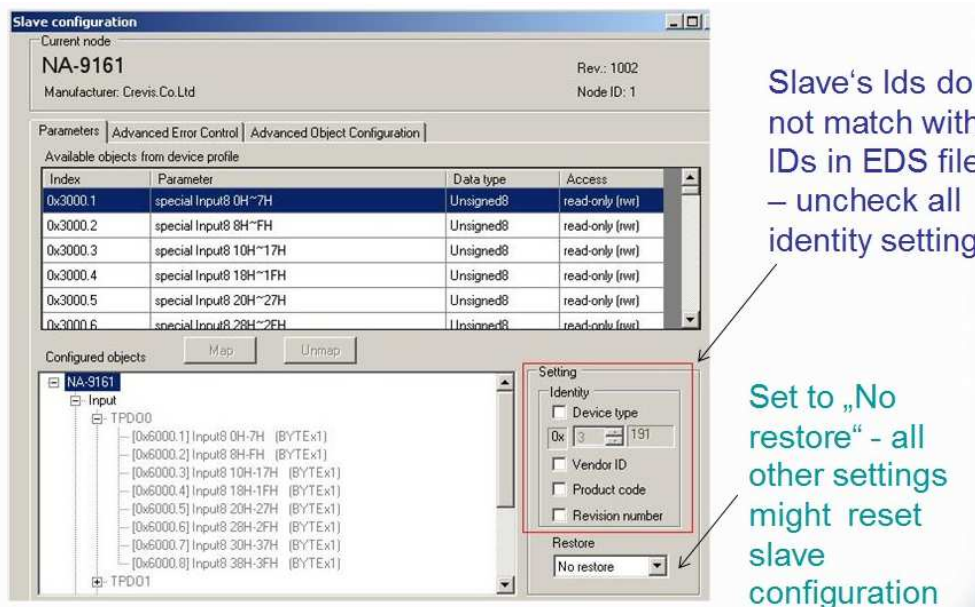
- **Fatal error: Bus off**  
- check LEDs



LED status			Description
PWRLED	Green	On	When the CANopen board is conductive, this LED turns on.
		Off	When the CANopen board is nonconductive, this LED turns off. Solution: If the GP supporting the CANopen master is on but this LED is off, the GP unit may be faulty. Please contact your local GP distributor. ☞ "1.11.2 Contact us!" (page 1-229)
RUNLED	Green	Turns on once per second.	The device is in STOPPED state.
		Turns on three times and then turns on again three times after 1 second has elapsed.	Initialization is in progress. The GP/LT supporting the CANopen master is now being initialized.
		On	The device is in the OPERATIONAL State.

- **Mandatory module is missing**  
- check Slave's address
- **Master alone**  
- verify Baud rate in GP-Pro EX Master Configuration matches the setting in the Slave  
- verify Slave ID in GP-Pro EX matches the setting in the slave  
- check the cabling and connections  
- check terminating resistors
- **SDO communication error**  
- check parameters (e.g. data type, length)
- **Incorrect PDO received**  
- check configuration (e.g. number of PDO bytes mismatch)
- **Invalid value in instruction**  
- check manual for command
- **SDO aborted**  
- check Slave address
- **Unexpected state for one or more optional slaves**  
- check Slave address,  
- 2<sup>nd</sup> SDO channel on slave must be deactivates  
- LT4000M only – error RGEA151. Set logic scan time to at least 20msec. If problem persists try 50 msec. If that fails assume the problem is caused by other issues.

- **Identity error of an optional slave**
  - Slave's Ids do not match with IDs in EDS file – uncheck all identity setting
  - Set to „No restore“ - all other settings might reset slave configuration (Programs in intelligent devices will not be deleted when 'No restore' or 'Only communication parameters' are selected)
- **Concise DCF mismatch for one or more slaves**
  - The communication parameter for each PDO has to be changed to “Cyclic synchronous” – even if it is not enabled! The default value of 255 send with the default setting
  - Slave does not support settings from Masters configuration file. Possibly the EDS file is wrong and investigation with CANopen analyzer is needed. Contact the 3<sup>rd</sup> party vendor.
  - Slave configuration “Advanced error control” may need to be changed from Heartbeat to “Use NodeGuard”. Check the slave device documentation or contact the manufacturer.
- **Inconsistent DCF: Mismatch between configured slave and slave in the network**
  - Even though it has received the new cDCF file the slave must be power cycled to initialize the new configuration.
  - Slave node number does not match GP-Pro EX configuration.
  - Wrong version or faulty EDS file. Check with the manufacturer.
  - In the case of 3rd party devices: The slave may not be in a mode to accept or does not accept a DCF file. Check with the manufacturer of the device.
  - Some 3rd party slaves require a DCF configuration from an editor. In this situation the device is not configurable in GP-Pro EX but rather a preconfigured EDS file with the matching configuration is generated by the third party software to be imported into GP-Pro EX.
  - Slave IDs do not match with IDs in EDS file - under your slave configuration, uncheck all identity settings if they are checked, and set restore to "none". Here is a screen shot of the slave configuration menu where this can be adjusted:

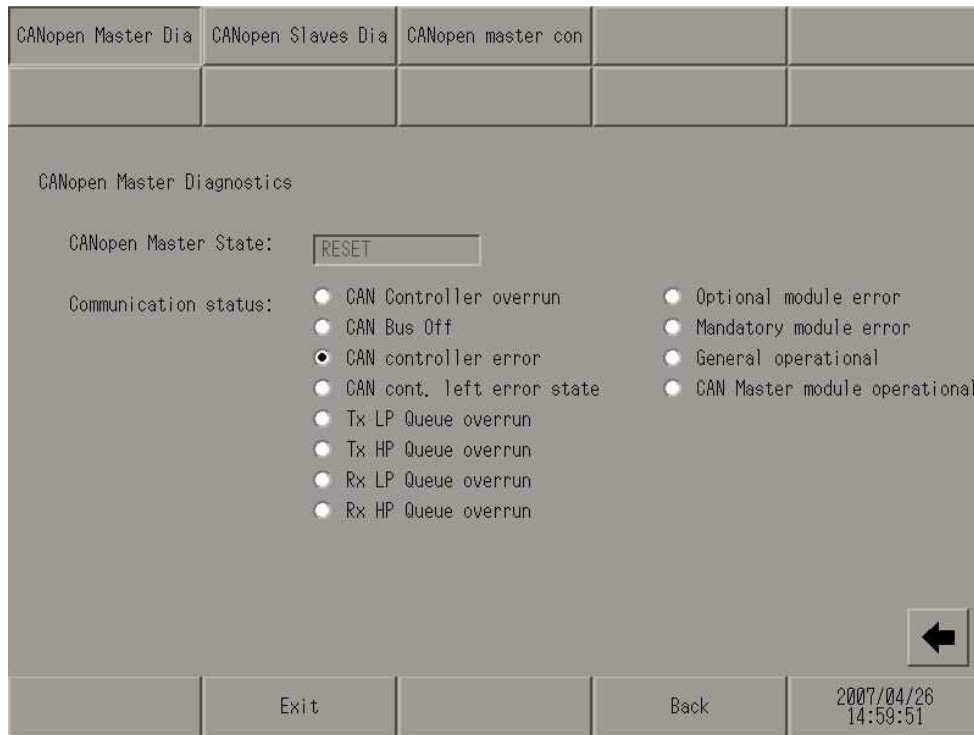


**Offline menus**

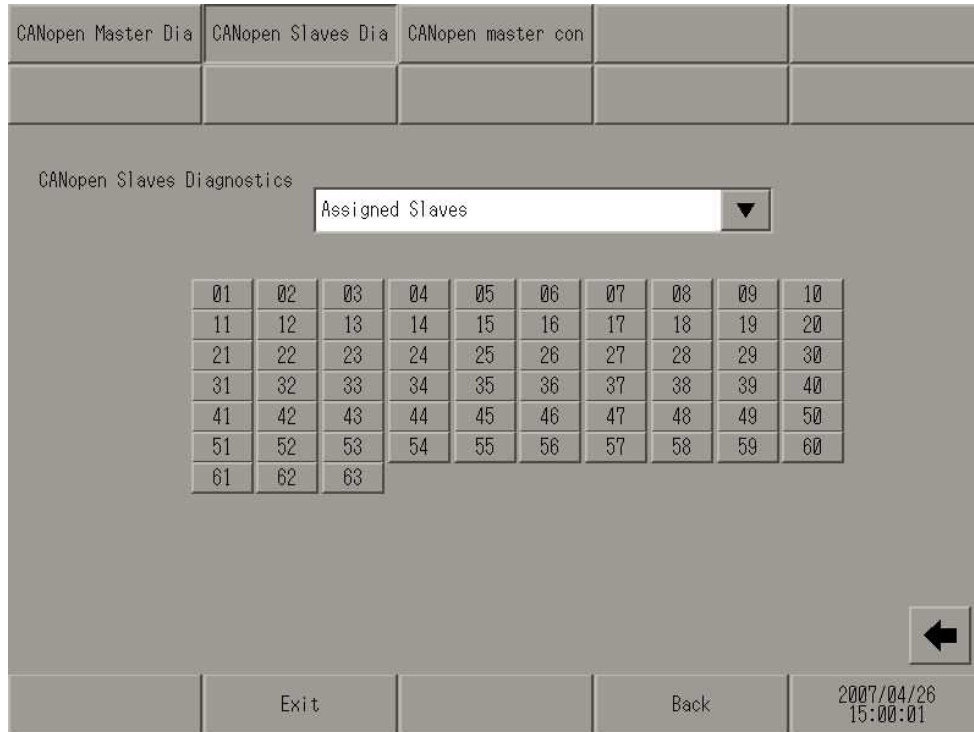
3 menus for CANopen:

- Master diagnostics
- Slaves diagnostics
- Master configuration & events

**Offline menu: Master diagnostics:**

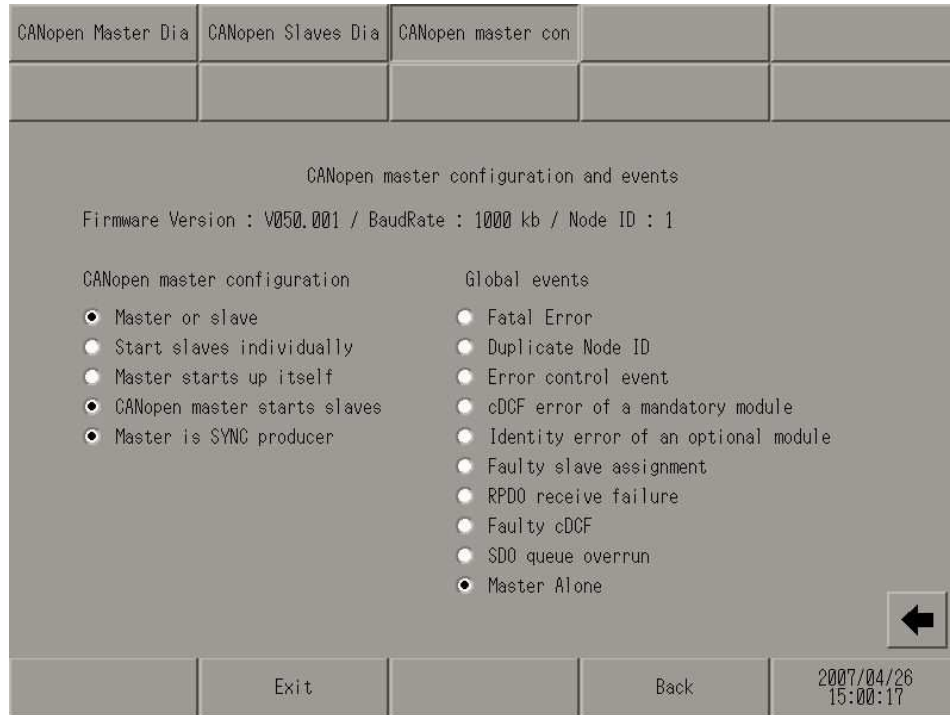


**Offline menu: Slaves diagnostics:**



- Assigned slaves
- Configured slaves
- Faulty slaves
- Emergency slaves
- Operational slaves
- Stopped slaves
- Preoperational slaves
- Inconsistent cDCF
- cDCF mismatch
- Identity error

**Offline menu: Master configuration & events**



**More Error Information:**

For more error information go to:

[http://www.pro-face.com/otasuke/files/manual/gpproex/new/refer/mergedProjects/logicio/logicio\\_mm\\_can-errorcode.htm](http://www.pro-face.com/otasuke/files/manual/gpproex/new/refer/mergedProjects/logicio/logicio_mm_can-errorcode.htm)

-----

For more information on Pro-face and our full line of HMI, Operator Interface and Industrial PC products please visit our web site at [www.profaceamerica.com](http://www.profaceamerica.com).

For technical support email: [support@profaceamerica.com](mailto:support@profaceamerica.com) or call: 800.289.9266.

-----

© 2015 Pro-face America. Specifications may change without notice. Pro-face is a registered trademark of Digital Corporation. Other brand or product names are the property of their respective owners.