AMIS49587

Getting started with the AMIS-49587 Evaluation kit

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**ON Semiconductor®**

http://onsemi.com

Introduction

Congratulations, here is the AMIS-49587 power line carrier modem demonstration kit from ON Semiconductor, Inc.. The present document will help you to get the kit working quickly.

Unpack your material

The evaluation kit contains the following elements:
- 2 AMIS-49587 evaluation boards (Mother Board and plugged on Daughter Board)
- 2 USB serial cables
- This manual

Mains connection
Mothter Board
AMIS-49587 RESET
Daughter Board
USB connection
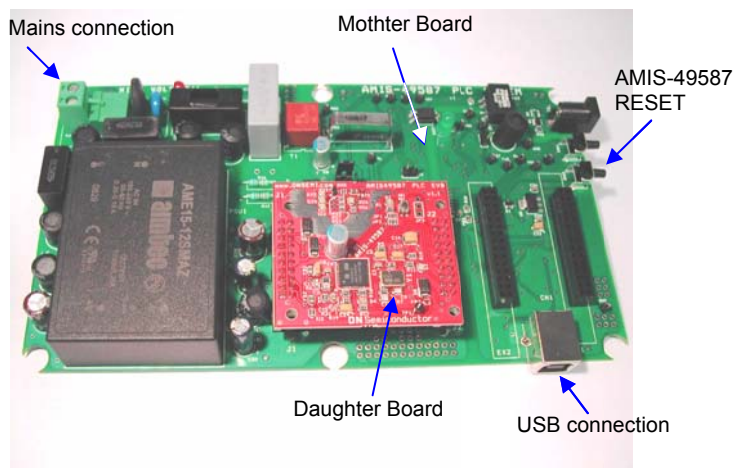
HW requirements

The material necessary to run a communication with the kit is given hereunder:
- 1 PC running Windows XP or higher with 2 USB ports free.
- 2 AMIS-49587 evaluation boards
- 2 USB cables
- 2 mains cables. To connect to the Mother Board main connector. (not included). Please take care to correctly connect to Line and Neutral.

SW requirements

Before starting the PLC UI, make sure the Java Runtime Engine JRE 6.13 or higher is installed or download and install it from 'java.com/getjava'. On MS Windows based platforms the JRE will be installed automatically.

The User Interface Software and most recent documentation can be downloaded from:.
http://www.onsemi.com/PowerSolutions/product.do?id=AMIS-49587

The USB port communicates with a FTDI serial UART converter. A dedicated USB driver is needed for this. You can download it from the FTDI website:
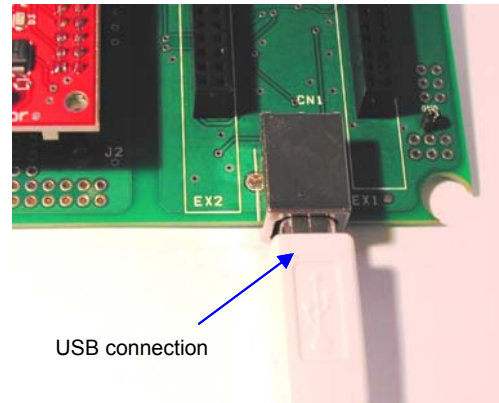http://www.ftdichip.com/FTDrivers.htm.

Setting up the hardware

Once you get the above listed elements, you need to:

Step 1:
Connect the both PLC MODEM's to the USB ports of the PC.

USB connection

Step 2:
Connect the PLC MODEM mains plug to the mains.
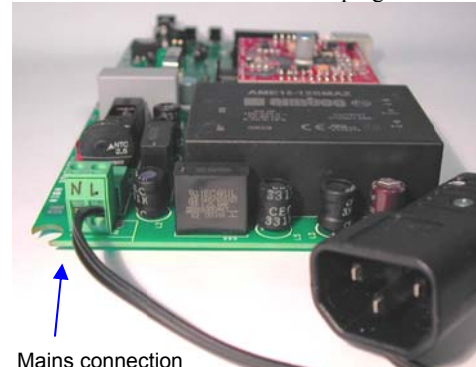
Mains connection

Step 3:
Power the PLC MODEM.

IMPORTANT REMARK: 230V mains are present on the demonstration board. Keep the board in a safe area. Disconnect the board from the mains before any manipulation of it. Be sure that only trained people are authorized to manipulate it.

AMIS-49587

Setting up the software

The kit is delivered with a CDROM. Insert the CDROM in the CD drive. For MS Windows based platforms, an installer application is available: ONSemiPLCInstall.exe. The installer application checks if the required Java Runtime Engine is installed. If it is not, the installer will start downloading it from the Sun website and install it.

For non MS Windows based platforms see SW requirements.

When the required Java Runtime Engine is installed, installation of the ON Semiconductor PLC Modem application will proceed.

```
1.4.7
|   AMIS49587 GUI application note.pdf
|   plcui.chm
|   PlcUi.jar
|   rxtxSerial.dll
|   Slave 7.1.plc.xml
|   Master 7.1.plc.xml
|   Spy 7.1.plc.xml
|
\---lib
        AbsoluteLayout.jar
        appframework-1.0.3.jar
        RXTXcomm.jar
        swing-worker-1.1.jar
```

PlcUi.jar is the main application, 'AMIS49587 GUI application note.pdf' is this manual and 'Master 7.1.plc.xml' and 'Slave 7.1.plc.xml' are MODEM configuration files. Plcui.chm is the source code documentation.

All other files are supporting libraries.

Running the Graphical user interface

The graphical user interface consists of 3 types of windows. The main window allows the user to open a configuration file for a PLC MODEM and implements a log of messages that traces user activities and MODEM events. This event log can be cleared or saved into a text file from the file menu. When a correct MODEM configuration file is opened, a new window will appear, implementing a user interface tailored to the type of configuration that is opened (master, slave, monitor or spy). Master and slave windows look very similar. Only the area where the MODEM's status is displayed is different. The application limits the number of master or slave windows to 6.

The logging level can be set from 0 to 3 to choose the level of detail of the log messages. Level 3 gives most details. The status fields of the master and slave windows will update when the button 'Update Status', Reset' or 'Write Config' are clicked or, automatically, when the status pane is activated.
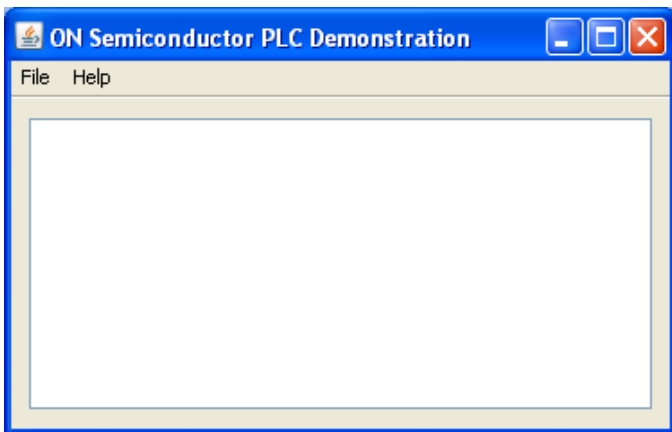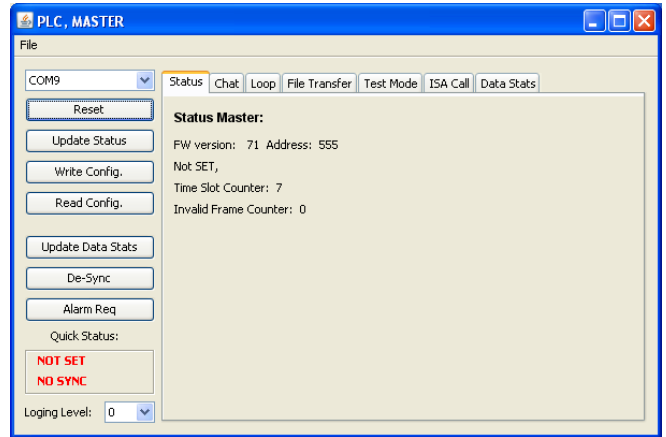

Figure 1 Main Window

Figure 2 Master Window

The MODEM's can be forced to disconnect (lose synchronization) by clicking the 'De-sync' button. The 'Reset' button shall be clicked when the modem is in an unknown state or the user would like to start from a not configured MODEM.

When parameters, listed in the configuration file and exposed in the GUI are changed, these changes can be saved into a new configuration file by picking 'Save Configuration' from the master or slave window file menu, or by pressing 'CTRL-S' (for now, only the communication port and the MAC layer filter setting can be changed from the GUI).

Note that all MODEM's settings can be modified by editing the configuration file in a text editor. The configuration file is an XML file. Each MODEM parameter is encapsulated in parameter name and value keywords. All parameters are to be coded in hexadecimal numbers. Below is an example that shows how the local MAC address is set to 0x555:

```
<LocalMac>
    <Bits>16</Bits>
    <Value>555</Value>
    <Note>Number within FIMA to LIMA range</Note>
</LocalMac>
```

Only the value between <Value> and </Value> should be changed. New settings can be activated by loading the new configuration file from the main window.

The current PLC GUI implements a simple chat, data loop or file transfer application between a master and a client. Before being able to exchange data, one master configuration and at least one slave configuration needs to be opened from the main window on one or more PC's.

To start communication, the following steps need to be executed for both the master and the slave(s) windows:

Common to all 3 communication examples are:
1) Pick the serial port that is connecting the PLC master MODEM. Only the serial communication ports available in the PC are listed. Success or failure to open the chosen communication port can be monitored in the log that is displayed in the main window.
2) Click the 'Reset' button to bring the MODEM into a known, not configured state.
3) Click the 'Write Config.' button to send the configuration parameters to the MODEM. Check the main window log to find out if this step completed without errors.

Chat Application

When the Chat application is chosen:
1) Type the address of the MODEM to whom you would like to send a message in the 'Destination Address' field. The MODEM address is coded in the configuration file and displayed in the status area.
2) Type a message in the bottom single line text field and hit 'Enter'.

When the first message is sent from the master window, the slave will synchronize with the master and display the message it received in its text frame above its text input field. Follow the log in the main window to check if all goes well. The first message always needs to be initiated from the master window. When the slave is properly synchronized, messages can be transmitted from slave to master.

Depending on the previous state of the master, the first message may fail to deliver. Initiate the send request again.
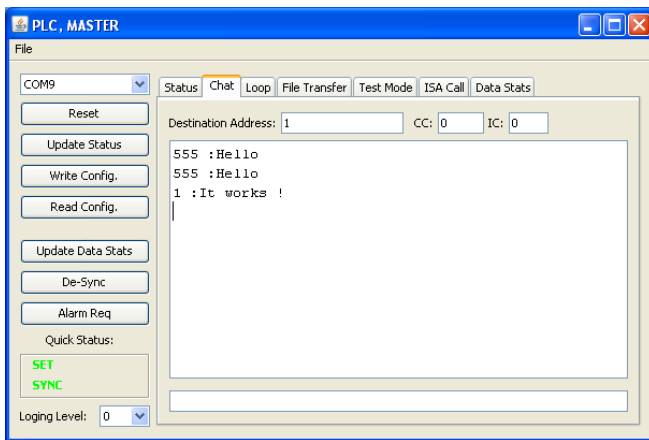
Figure 3 Master Window, configured with chat trace
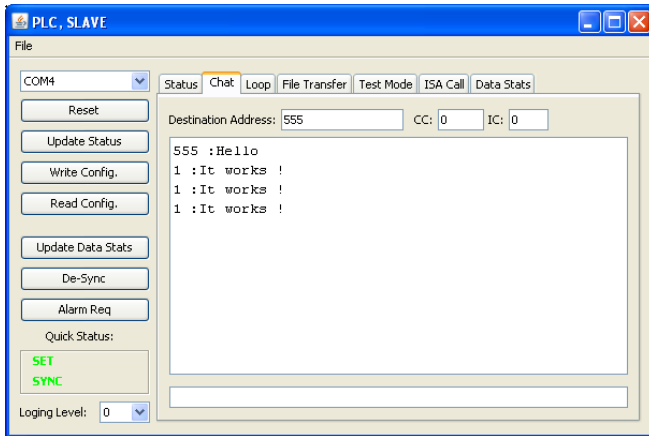
Figure 4 Slave Window with chat trace

Data Loop Application

In the data loop application a constant data frame is sent from one node (master or slave) and is received by the addressed node. The receiver node can be configured to send the data back to the sending node, implementing a data loop.

To setup a data loop, make sure the configuration file is written to the MODEMs and in one node:
1) Check the 'Enable loop' checkbox to make this node into a receiver and loop node.
In the window of the transmitter node:

2) Enter the frame length. The maximum is 247 bytes, the minimum is 13 bytes.
3) Enter the number of times the data needs to be transmitted
4) Enter the destination address
5) Check the 'Wait for looped data' checkbox to make sure the transmitter doesn't send a new frame before receiving the looped data.
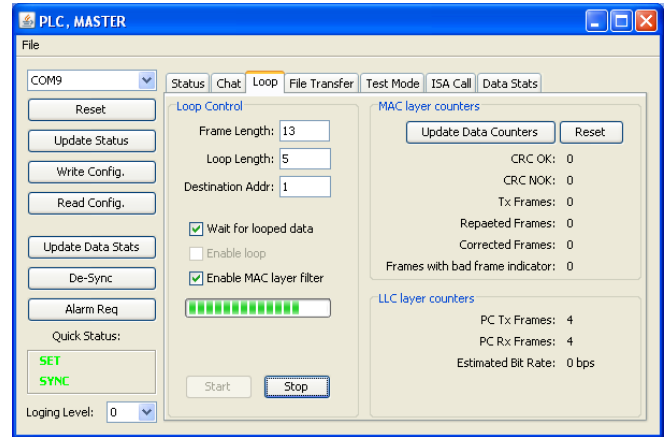6) Click the start button

Figure 5 Initiator node of the data loop

The LLC layer counters indicate the number of transmitted and received frames. The approximate bit rate is calculated at the end of transmit and receive sequence.
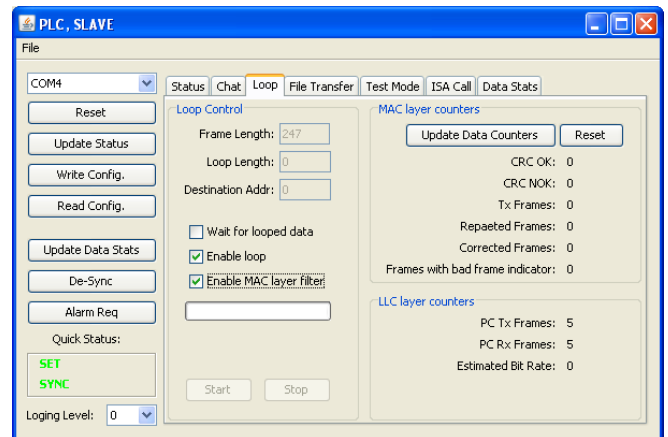

Figure 6 Receiving and looping node

By clicking the 'Update Data Counters' button, the MAC layer counters that are kept in the MODEM are retrieved. The number of received frames is the total of 'CRC OK' and 'CRC NOK' frames. All counter values can be reset by clicking the 'Reset' button.

The current implementation of the data loop does not check for errors in the looped data.

File Transfer Application

The file transfer application sends a file from the transmitter to the receiver. Before initiating transmit, the addressed node should be ready to receive the file. Click on 'Receive File' to open a file save dialog box. Enter the file name. The receiver node is now waiting for the complete file to arrive. On the transmitter node, click the 'Transmit File' button. A file open dialog box will appear. Choose the file to be sent. Transmit will start immediately.
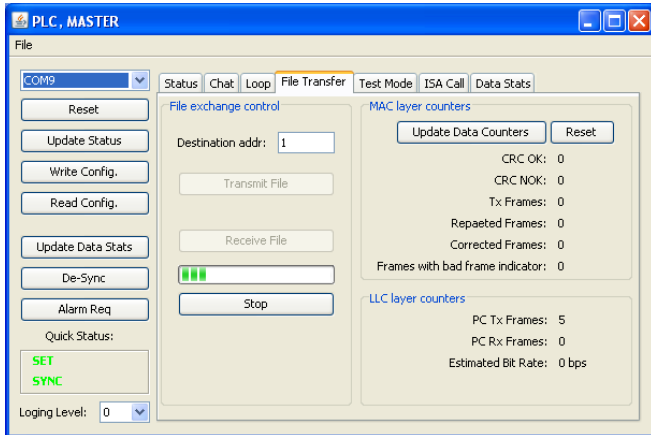

Figure 7 Node transmitting a file

Transmit or receive can be aborted at any time by clicking the 'Stop' button.

The file transfer application can be used to implement a BER test. Bit error rate can be calculated by comparing the received file with the original (not implemented by this application).
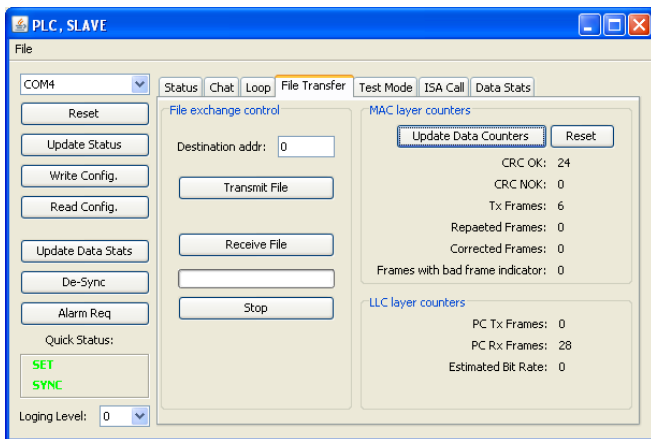
Figure 8 Node receiving a file

Special Scenarios

Repetition with Credit and Time Slot Counter change.

When the configuration for a server is setting the MODEM as a repeater: set 1,2 or 3 in the Repeater section of the xml configuration file, the MODEM will repeat messages addressed to a different MODEM only when the current credit field in the data frame is higher than 0

```
…
<Repeater>
    <Bits>2</Bits>
    <Value>3</Value>
    <Note>
```

```
0 Never Repeater or Mode=Master,
1 Always Repeater,
2 Not Repeater (accept frame ISACall),
3 Repeater (accept frame ISACall)
</Note>
</Repeater>
```

The time slot counter is communicated to an external processor or to the GUI by means of the time slot field in the status message. The time slot counter should be used by the external processor to block data transmission when repetition is ongoing.

The default value of the time slot counter is 7 (maximum number of repetitions is 8: from 0 to 7) and indicates that the communication channel is free for transmission. When the MODEM is repeating a message, it is decrements it's time slot counter every time the MODEM autonomously sends the message on the power line. At the same time the MODEM decrements the current credit field in the frame.

This process can be partially visualized using the GUI. 3 MODEMS are needed:

        One with master configuration
        One with slave configuration
        One with Spy configuration

Steps to follow, after all MODEMS have been configured:

1) Make sure the Spy window is set to logging level 1 and master to level 3.
2) Make sure the master/slave are not synchronized
3) Check the status of both MODEMS and witness that the time slot counter is in both 7.
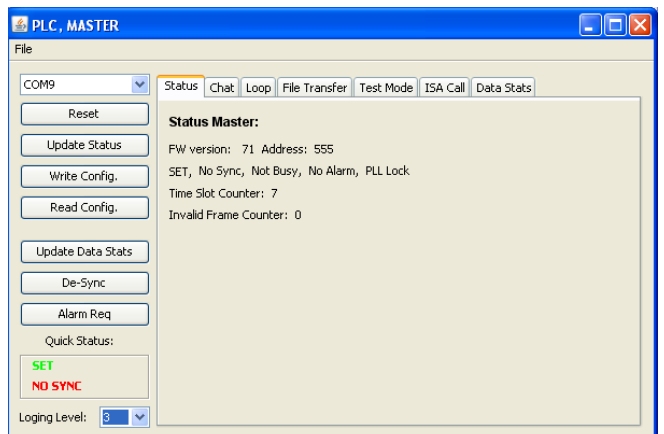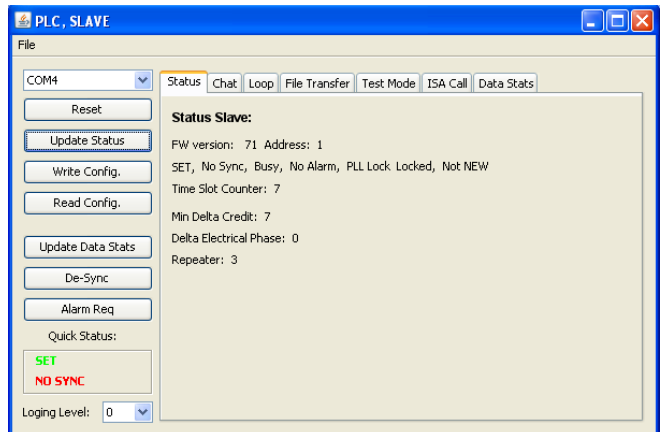
4) Open the chat window in master
5) Set CC (Current Credit) and IC (Initial Credit) to 2
6) Set the Address field to an address that is different (!!) from the slave address
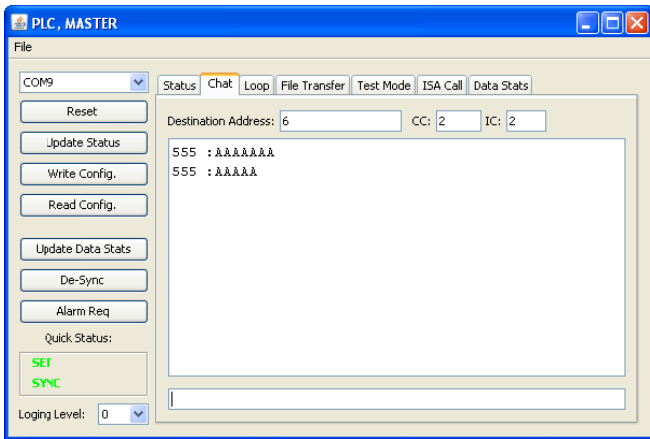
7) Send a message from the master.

You will notice that both MODEMS synchronize and that the time slot counter in the slave window is different from 7. It will be 0 or 1, depending on how fast and when the slave sent out the sync. Response.
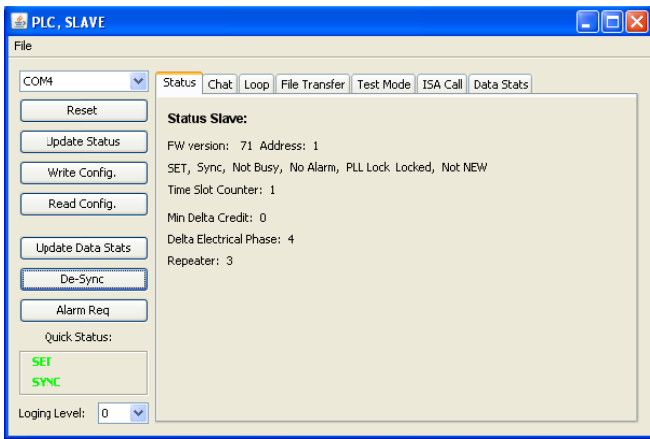
When you update the slave status, the time slot counter will be again set at 7 because by now the received frame will have been repeated 2 times already.

Check the log the spy has generated. The transmitted message will be visible 3 times: one time from the master and 2 times repeated by the slave. Also check that the current credit counter in the frame is lowered each transmission.

```
MONITOR:15:43:47:745:Spy Synchronization Found,
MONITOR:15:43:47:854:SpySubFrame
MONITOR:15:43:47:854: Received SDU:
0 0 6c 6c 48 55 50 6 15 41 41 41 41 41 1 2 3 4 5
6 7 8 9 a b c d e f 10 11 12 13 14 15 39 f6 b7
MONITOR:15:43:47:854: Spy No Alarm Found
MONITOR:15:43:47:854: Alarm pattern: 2 db
MONITOR:15:43:47:964:SpySubFrame
MONITOR:15:43:47:964: Received SDU:
0 0 6c 6c 44 55 50 6 15 41 41 41 41 41 1 2 3 4 5
6 7 8 9 a b c d e f 10 11 12 13 14 15 a3 8a 31
MONITOR:15:43:48:073: Spy No Alarm Found
MONITOR:15:43:48:073: Alarm pattern: 2 fb
MONITOR:15:43:48:183:SpySubFrame
MONITOR:15:43:48:183: Received SDU:
0 0 6c 6c 40 55 50 6 15 41 41 41 41 41 1 2 3 4 5
6 7 8 9 a b c d e f 10 11 12 13 14 15 d2 f9 e6
MONITOR:15:43:48:183: Spy No Alarm Found
MONITOR:15:43:48:183: Alarm pattern: 1 26
MONITOR:15:43:48:292: Spy No Sub Frame received
correctly
MONITOR:15:43:48:292: Received SDU:
```

Sending an alarm

When a slave encounters an alarm condition, managed by the application layer on the external controller, the application may decide to send out an alarm notification on the power line. The PLC master application layer will start sending out data frames querying more information on the alarm condition. To monitor this behavior in using the GUI:

1) Make sure the NbAlarm parameter in the slave configuration file is set to 8.
   ```
   <NbAlarm>
       <Bits>4</Bits>
       <Value>8</Value>
       <Note>Number of repetitions of a Phy
           Alarm, 0 for Disable Phy Alarm
           functionality</Note>
   </NbAlarm>
   ```
2) Open master and slave configuration.
3) Make sure master and slave are synchronized by sending a couple of characters from the master to the slave, using the chat application.
4) Hit the alarm request button on the slave window.
5) Hit the status update button on the master window.
6) Witness that the status changes from no alarm to alarm.
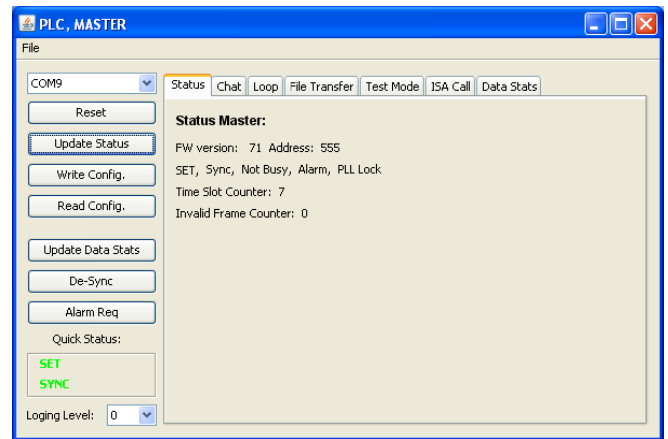
Update expert settings

Not all MODEM configuration settings can be altered from the GUI. To change all parameters, the configuration .xml file needs to be edited with a regular text editor. To activate the new settings either close the master/slave/spy node frame and open a new one or reload the new configuration from the node window file menu.

Note that after reloading the configuration it still needs to be send to the MODEM by clicking 'reset' and 'Write Config.' Button.
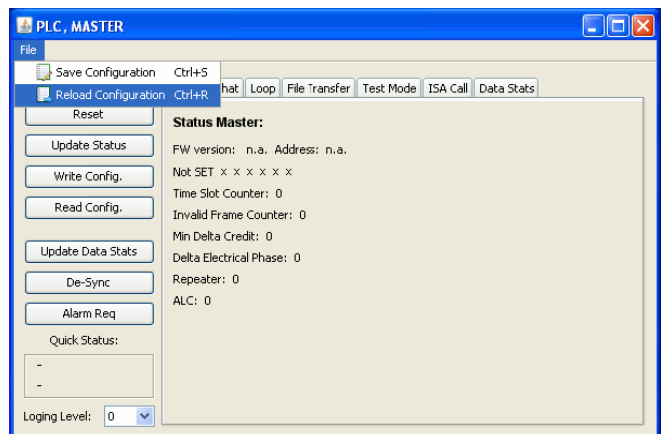
All MODEM parameters are listed in the xml configuration file as follows:

```
<parameter string representation>
      <Bits> the number of bits</Bits>
      <Value> the parameter value </Value>
      <Note> Some notes on the parameter </Note>
</parameter string representation>
```

The parameter string representation and the number of bits should not be modified!

All number fields in the xml configuration file are to be written in hexadecimal numbers without prefix like '0x'.

Send and receive ISA call pattern

ISA or Repeater Call is part of the CIASE protocol. The purpose of the RepeaterCall service is to adapt the repeater status of server systems depending on the topology of the electrical network. It allows the automatic configuration of the repeater status on the whole network. In the RepeaterCall mode, the client and the servers transmit short frames – two bytes long each – and measure the level of the signal to determine if a server system should be a repeater or not.

The ISA call request has 2 parameters:
1) Time slot: This pattern is transmitted on a pre definded timeslot:
   a. The local MAC address when the slave is not having address yet or has address NEW.
   b. A random time slot between Max_Adr_MAC and Max_Adr_MAC + (Nb_Tslot_For_New * 21). Max_Adr_MAC and Nb_Tslot_For_New are transmitted to the servers in a regular MA_DataRequest and are kept by the application layer. Note that if Nb_Tslot_For_New is 0, the servers in NEW state should not participate in the ISA call.
2) Reception_Threshold or level represents the signal level in dBµV threshold. The default value is 104.

The participation of the servers in the repeater call process and the effect of the process on their repeater status depend on the repeater management variable and the signal level heard:
1) Servers configured as never repeater do not participate: they do not transmit during their sub-timeslot and their repeater_status is not affected;
2) Servers configured as always repeater participate: they transmit during their timeslot but their repeater_status is not affected;
3) Servers configured as dynamic repeater participate: they transmit during their sub-timeslot, if they have not heard a signal before from the client or from any servers, which is above the reception threshold. If during the whole repeater call process, a server does not hear a signal from the client or from other servers, which is above the reception threshold, then its repeater status will be TRUE: the server will repeat all frames. If a server hears a signal from the client or from other servers, which is above the reception threshold, then its repeater status will be FALSE: the server won't repeat any frames. NOTE If each server configured as dynamic repeater hears a signal, which is above the reception threshold this means that they are all close to a client, and no repetition is needed. So, none of them will become a repeater.

The embedded SW in our PLC silicon only issues the error message LM_SE, or syntax error at MAC level when:
1) The MODEM is master(client) and the transmission position is different from 1.
2) The MODEM is slave(server) and the transmission position is 0 or 1.

The embedded SW in our PLC silicon issues the error message LM_TU1, or NEG at the MAC level when:
1) Slave MODEM is set to 'never repeater'
2) The MODEM is busy handling other events. In this case the ISA call should be repeated until success.

Build a setup with one master (client) and one slave (server).

Make sure the server or slave configuration sets the Repeater mode to 2: No repeater, but support for ISA call, or dynamic repeater. Open a slave or server node window.

Synchronize master and slave by typing few lines on the master Chat application, use slave MAC address or any other.
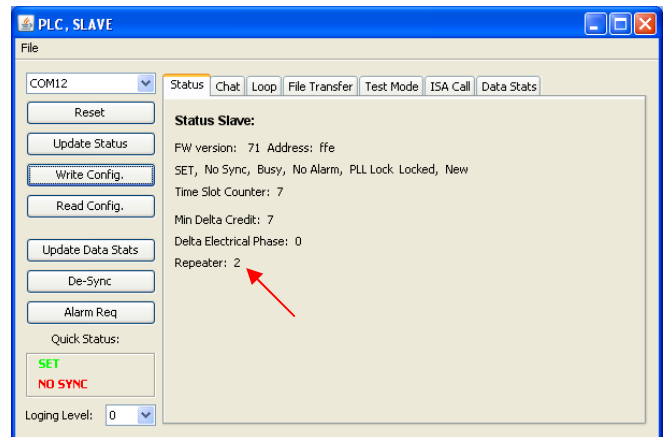
Open the ISA call tab. Enter any timeslot different from 1 and any level. Set the logging level to 3.
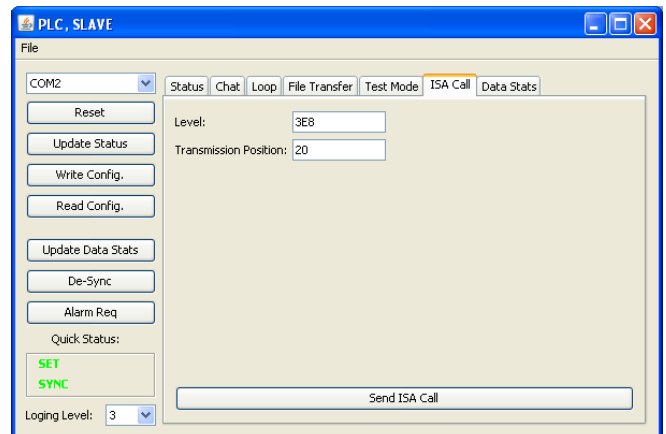
Hit the 'Send ISA Call' button many times quickly after each other until the logging shows an ISA confirm message with data ff.

```
SLAVE :09:50:50:625: Sending ISAREQUEST
SLAVE :09:50:50:703:    Message was sent to MODEM
SLAVE :09:50:50:703:    Received message from
                        MODEM: 62 0
SLAVE :09:50:50:703:IsaConfirm
SLAVE :09:50:50:781: Sending ISAREQUEST
SLAVE :09:50:50:843:    Message was sent to MODEM
SLAVE :09:50:50:843:    Received message from
                        MODEM: 62 0
SLAVE :09:50:50:843:IsaConfirm
SLAVE :09:50:50:906: Sending ISAREQUEST
SLAVE :09:50:50:984:    Message was sent to MODEM
SLAVE :09:50:51:203:    Received message from
                        MODEM: 62 ff
SLAVE :09:50:51:203:IsaConfirm
```

Go back to the status pane on the slave node and witness that the repeater status has changed from no repeater to repeater because the server did not receive any ISA call pattern from any other MODEM.
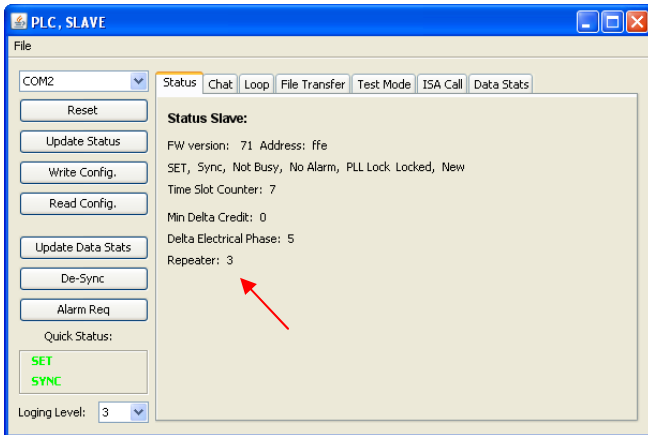
Note that the MODEM may respond negative (62 00) many times because its physical layer is busy. The management application should send ISA call request in polling for success (62 ff) loop.

Other scenarios can be tested where level and transmission position is set depending on system topology in a multi-server network with proper line attenuators.

Notes

PUBLICATION ORDERING INFORMATION