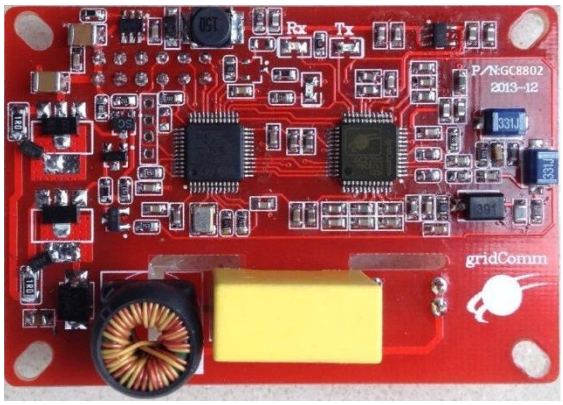
# INTELLIGENT OFDMA POWER LINE COMMUNICATION MODULE




## Overview

The intelligent GridComm Power Line Communication (PLC) module is a complete hardware and software networking solution. In Auto-Routing modes, the software automatically self-adapts to varying conditions on the power lines with the most optimal data routing paths. When powered with a DC12V@300mA power supply, it functions as a full system-level PLC modem. The GridComm GC9802 PLC Module demonstration node, shown in Figure 1, is an example. The PLC module utilizes the industry-leading gridComm GC2200: an OFDMA (Orthogonal Frequency Division Multiple Access) Power Line Communication Transceiver.

The PLC module is designed to be used node for use in applications such as Advanced Metering Infrastructure (AMI), Automated Meter Reading (AMR), Smart Lighting Control, Industrial/Home Automation, Alternative Energy and M2M.

**Figure 1 - PLC Module Demo Board, GC9802**

## Benefits

- Tackles signal variations that are commonly present in power line applications due to signal attenuation, impulsive noise, and changes in line impedance
- Allows selection of carrier frequencies to suit the operating environment
- Scan Frequency tool to scan for best 18 carrier frequencies based on RSSI and Received Success Rate for up to 8 nodes
- Automatically forms a multi-tier network to reach otherwise non-contactable nodes
- Maintains optimal routes between nodes
- Supports UART via a transparent protocol
- Factory set for operation on CENELEC A, B C & D, or FCC/ARIB bands
- Designed to connect directly to DC power lines or AC power lines in Single-Phase and Three-Phase power line system *(modifications of coupling capacitor are required for Three-Phase)*
- Built-in AFE and Coupling Circuit
- Small form factor, can be easily integrated into a target system
- Noise Indicator tool to detect noise level for selected frequency channels
- Debug tool to test success rate of communication links

## Auto Network Communication

The most common application is in network applications.

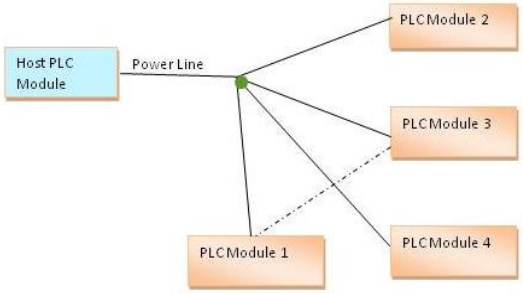



**Figure 2 - "Star" Structure Network**

Figure 2, shows a simple PLC network system connected with five modules which can be installed in a "Star" configuration on the same power line. When power line conditions are ideal, the Host PLC Module can communicate with all other slave modules in Simple Broadcast mode. However, when the power line conditions deteriorate, e.g. due to attenuation or noise, communications may become difficult or impossible.

Using Auto-Routing mode or Broadcast-over-Auto-Routing mode will enable the network to overcome such issues. If direct communication between Host PLC Module and PLC Module 3 breaks down, the Host PLC Module may continue communicating with PLC Module 3 by routing the data packets through PLC Module 1 which acts as a repeater.

The Host PLC Module builds and maintains a data path routing table to all Slave nodes automatically. Auto-Routing mode is ideal for large deployments of PLC nodes where PHYid addressing is used. Broadcast-over-Auto-Routing is suited for users who require a transparent protocol without PHYid addressing. Broadcast-over-Auto-Routing is recommended to be used in smaller networks, or when response time from nodes is less of an issue.

Auto-Routing modes allow the formation of a multi-tier "Tree" structure configuration as in Figure 3.

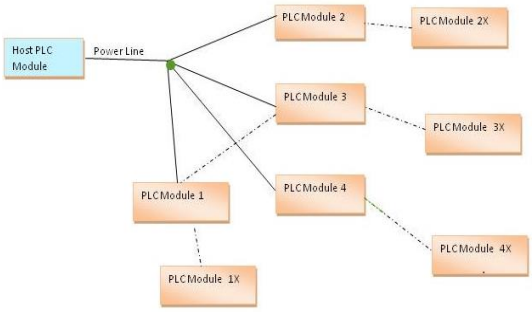



**Figure 3 - "Tree" Structure Network**

## Point-to-Point Application

The PLC module also works in Point-to-Point applications where the user wishes to create a data communications path between two points without the need to install a communications cable. Two PLC nodes are connected on the same power line as in Figure 4.

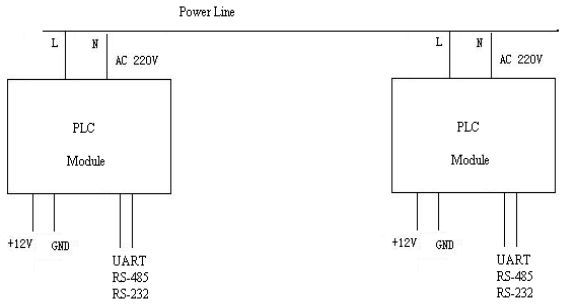



**Figure 4 - Point-to-Point Communication**

## Single-Phase Connection

The module is designed for use in single-phase and three-phase power line networks. Figure 5 below illustrates the single-phase connection.

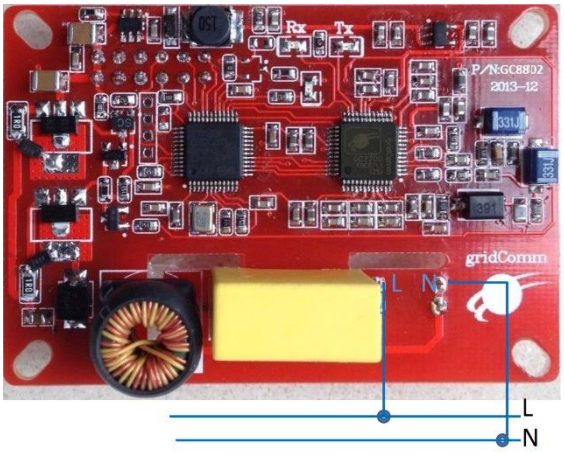



**Figure 5 - Single-Phase Module Connection**

## Three-Phase Connections

In order to use the module in a three-phase voltage system, the default 275VAC coupling capacitor (in blue) should be replaced with a higher voltage level coupling capacitor (e.g. 420VAC). *To customize the module to support 3-Phase and withstand a 1000VDC continuous isolation test, please contact GridComm.*

The three-phase connections are shown in Figure 6 and Figure 7.

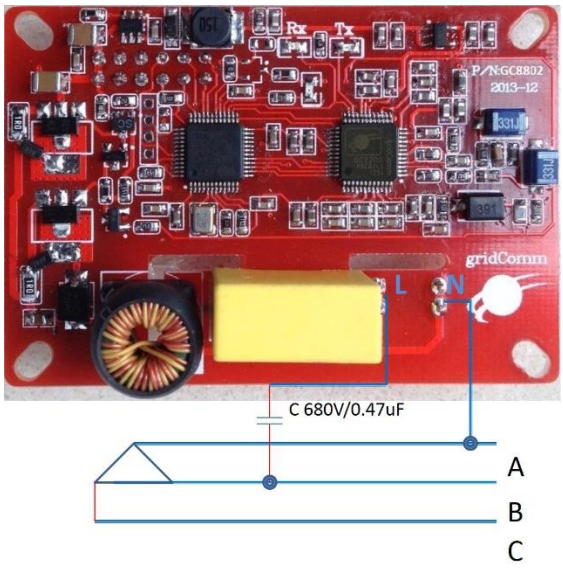



**Figure 6 - "Delta" Network Three-Phase Module Connection**

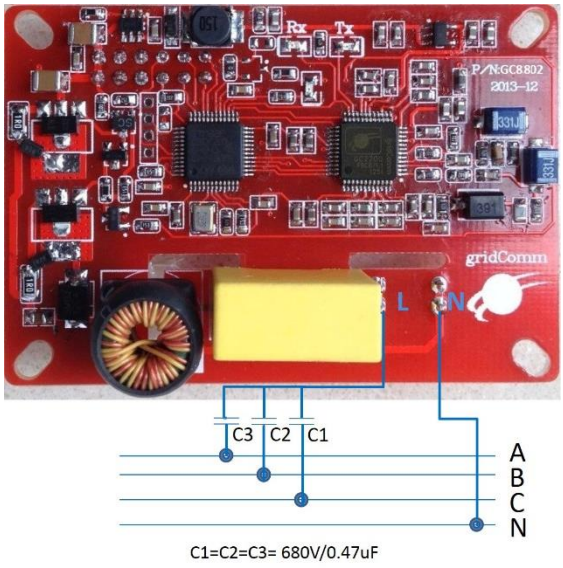
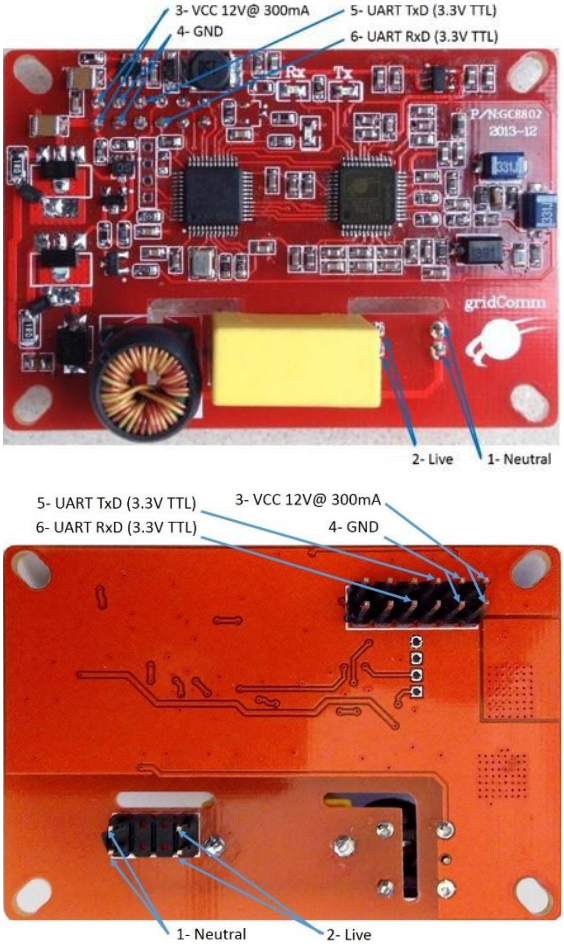



**Figure 7 - "Y" Network Three-Phase Module Connection**

## Dimensions

The overall dimensions of the PLC module are 66mm L x 45mm W (see Figure 8). There is over-current, over-voltage and electrostatic protection on the PLC module.



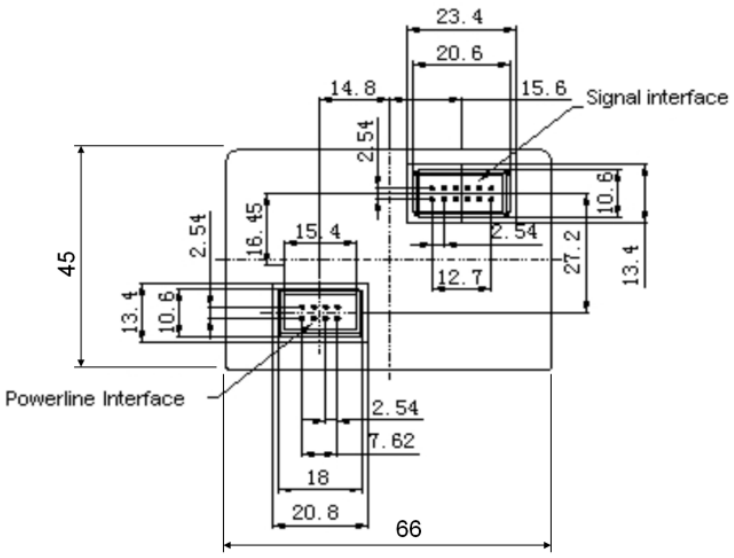




**Figure 8 - PLC Module Dimensions and Pin Locations (Bottom View)**

## Pins Descriptions

The pin locations are shown in Figure 8

| Pin No. | Name | Functionality |
|---|---|---|
| 1 | N | Power Line |
| 2 | L | Power Line |
| 3 | VCC | 12V@300mA Power |
| 4 | GND | Ground |
| 5 | TxD | UART1 (3.3V TTL) |
| 6 | RxD | UART1 (3.3V TTL) |

## Specifications

- 18 independent channels operating with up to 54 out of 100 pre-configured carrier frequencies between 5 kHz to 500 kHz.
- 3QPSK, 3BPSK, or 1BPSK modulation schemes with up to 18 levels of redundancy
- Raw data rates between 1.22 Kbps to 7.32 Kbps depending on power line conditions
- 32-bit addressing scheme
- Four operation modes: Point-to-Point, Simple Broadcast, Auto-Routing, and Broadcast-Routing
- One Master node supports up to 240 Slave nodes in Auto-Routing and Broadcast-Routing modes
- Options for operation on CENELEC A, CENELEC B, CENELEC C, CENELEC D, FCC or ARIB bands.
- UART input/output with preset COM Port settings: 115200 Baud rate, No Parity Bit, 8 Data Bit and 1 Stop Bit
- Support user packet size of up to maximum of 512 bytes
- Single Power Supply: DC12V @ 300mA with within ±10% tolerance limit and ± 5% maximum permissible ripple
- Normal Power Consumption- Receiving (Rx) Mode: 12V@42mA
- Tx Power Consumption- Maximum up to 12V@210mA and support continuous Tx Send at minimum 0.5 sec. interval over 1ohm load
- Rx Sensitivity: -75 dBm
- Distance: Up to 3km-the actual distance depends on power line conditions
- Operating Temperature -40°C to +85°C
- 0.5W Standby Power in listening mode

## Contact Information

For more information regarding the *GC8802 OFDMA PLC Module* including reference design, pricing and ordering please contact:

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www.gridComm-plc.com

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## Revision

| Version | Description | Date |
|---|---|---|
| 1.01 | Initial Release | 23/12/2013 |