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# Reach PoE4N/10G Tester Manual 1.0

Model RT-PoE4N/10G

Software Version 1.0 and above

August 09, 2017

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# 1. Revision History

## 1.1. *RT-PoE4N/10G - Base Model*

The Model RT-PoE4N/10G is the initial version in production. It can be recognized by the version string as follows (see [VERSION](#) command; also seen on power-on).

```
Reach PoE Tester Model RT-PoE4N/10G/24  
PN 53-0004-11 Rev A 01 SW 1.03 11/01/2016  
Copyright (C) 2005-2016 by Reach Technology Inc.
```

## 2. General

### 2.1. Overview

Manufacturers of Ethernet Power Sourcing Equipment (PSE) such as Ethernet Switches need to test PoE power functionality during manufacturing. Once a unit is in manufacturing, it can be assumed that it has already been tested for full Compliance with the applicable IEEE 802.3 PoE standard. It is not cost-effective, nor necessary, to perform full compliance testing at the manufacturing stage. What is needed is a functional test that verifies the software's ability to detect and control power, and the basic connectors' and magnetics' ability to provide power and pass data.

The Reach RT-PoE tester family has been designed for cost-effective functional production test. It assumes that the PSE can be operated in a “diagnostic” mode whereby the power control and detection functions of the PSE can be individually tested. The LLDP protocol specified by the 802.3at standard is not supported so as to keep the cost of the tester low. Most switches provide a way of bypassing LLDP to provide full power to a particular port. LLDP is implemented in firmware: if the unit can pass data under power it can pass LLDP packets, and so testing LLDP functionality is not necessary for a production test.

The Reach Power-over-Ethernet Tester Model RT-PoE4N/10G provides diagnostic functional testing of 24 PSE ports compatible with IEEE Standards 802.3af and 802.3at, plus it will support data path speeds up to 10GBASE-T. In addition, it can test high power ports such as UPoE that use all four pairs to provide power. It can draw up to 660mA per power pair while passing 10Gb traffic. It provides high density with 24 Powered Device (PD) loads in a 1U high chassis.

Each RT-PoE4N/10G section has a “UUT” port (Unit Under Test). The UUT port is connected to the PSE and acts as a PD load to that port. The UUT data path is connected via power-isolating magnetics to the adjacent UUT port (1 to 2, 3 to 4, 5 to 6, etc.). In this way, an external data bit error tester or PSE test functionality can be used to test data integrity while power load is enabled.

### 2.2. Front panel



**Picture 1: Front of RT-PoE4N/10G**

### **2.3. Features**

- ♦ IEEE signature options: nominal, high, and over-spec capacitive.
- ♦ Classification 0 through 4 (all nominal).
- ♦ Passes 10GbE traffic from each test port to the neighboring port isolated from PD load (1-2, 3-4, etc.).
- ♦ Relay data path for compatibility with Phy-based cable diagnostics.
- ♦ Low cost compared to compliance-level PD emulators.
- ♦ Universal voltage (110/220) power supply.
- ♦ Serial RS232 console control.

### **2.4. Dimensions**

The unit fits in a standard 19" rack using screw-on ears.

Case outside dimensions are:

16.665" deep  
17.30" wide (fits 19" rack; mounting ears provided)  
1.74" high

### **2.5. Electrical Characteristics**

The RT-PoE4N/10G is powered via a locking power DIN 4 pin connector and requires 12V DC at a maximum of 8.5 Amps.

The unit is supplied with a worldwide universal AC input power supply brick. Its characteristics are:

85-264VAC input, 87.5% efficient, 0 to 40C operation, IEC320/C14 input

### **2.6. Environmental**

Operating temperature range is 0C to 40C. Storage is -30C to 70C.  
Humidity is 85% maximum, non-condensing

### **2.7. Warranty**

The RT-PoE4N/10G is warranted by Reach Technology against manufacturing defects for one year.

### **2.8. Operating Software**

No Software license is required.

### **2.9. Calibration**

The unit performs self-calibration on power-on, or on command.

## 3. Configuration Guide

### 3.1. Power

The power input is located on the rear of the unit. The power supply provided is a "desktop" type brick with a three prong IEC input connector. An AC power cord compatible with U.S. power outlets is optional. There is no power switch; it is on when the power is applied.

### 3.2. Serial Console

The serial console port is located at the rear of the unit. It is an RJ-45 with a three-wire RS-232 level interface. The interface has the same pinout as found on Cisco routers and switches. The baud rate factory default is 9600, 1 stop, no parity, 8 bits. The baud rate can be changed by software command – see the [BAUD](#) command in the Command Reference section. Characters are echoed as they are typed (full duplex).

RJ-45 Connector:

Pin	Signal (DTE name)
1	**
2	**
3	RS232 data output (TxD)
4	Ground
5	Ground
6	RS232 data input (RxD)
7	**
8	**

\*\* these signals are connected to each other

### 3.3. UUT Connections

The RT-PoE4N/10G has 24 test ports, configured as 12 pairs (1-2, 3-4, 5-6, etc.). Each port has the ability to act as a PD load to the UUT. In addition, each port pair can be configured to pass data from one port to the other via internal straight through connections, allowing the loads to be applied while passing traffic. All data path connections are made via signal relays and 100 ohm differential pairs for data integrity.

Connect the port of the PoE supplying device under test to the UUT connector via a standard straight through Ethernet connector (see the [Ethernet Cables](#) section for more information regarding cables). There is an 802.3at class transformer isolating the UUT ports in each port pair so that power can be tapped from the UUT (see the [Data Path](#) section for more details).

Note that the devices connected to any given port pair cannot "see" the power from the other port. In other words, the UUT ports in a port pair are connected from a data perspective, and each UUT port connects to the RT-PoE4N/10G active load from a power (PoE) perspective.

***NOTE: with high power loads, the DC balance of the patch cables used is important to avoid DC saturation of the Ethernet transformers. DC Balance (DC resistance per side of the power carrying pair) should be within 3%. The standard patch cable specifications of Cat 5, 5e, and 6 do not specify DC balance.***



## 4. Connectors and Jumpers

### 4.1. RJ-45 Ethernet Connectors



**Picture 2: Far left side of RT-PoE4N/10G front panel**

There are 24 numbered UUT ports. The RJ connector should be cabled to the corresponding PSE port using a standard Ethernet 1-1 jumper cable. When enabled via software command, the data component of the port N (N=1,3,5,...) will be connected to the data of port N+1 via Ethernet transformers and relays. This is a straight-through connection, not a crossover.

### 4.2. Rear Connectors



**Picture 3: Far left side of RT-PoE4N/10G rear panel**

The rear of the unit, left side is shown above. The power jack is a power DIN 4 pin with lock type, KYCON KPPX-4. Pin 1,4 are 12VDC and pin 3,4 are GND. Below that is a console connector RJ45 three wire RS232. See the [Serial Console](#) section for pinout.

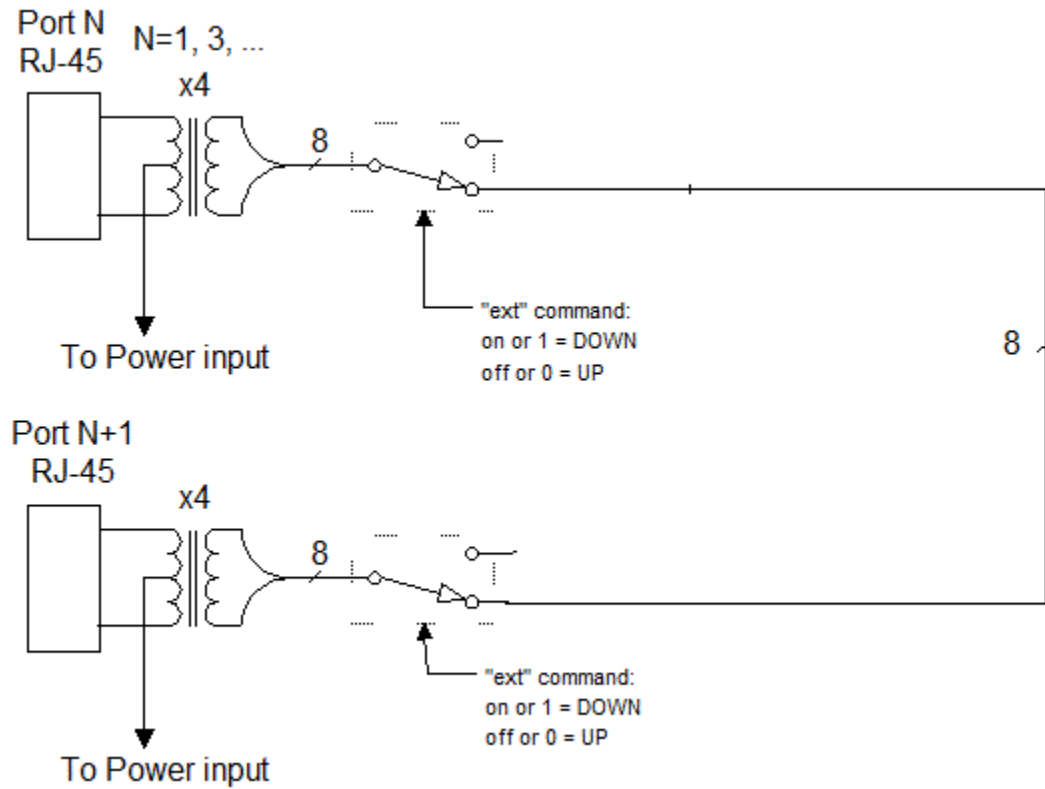
### **4.3. *Ethernet Power Selection***

Unlike the RT-PoE3N model, there are no jumpers required to set which conductors provide power. The unit contains two separate power paths for pairs 1,2 / 3,6 and 4,5 / 7,8. These have the standard full wave bridge so any polarity is accepted. The voltage measurement function handles either polarity and can be used to validate the expected PSE port polarity.

## 5. Operational Overview

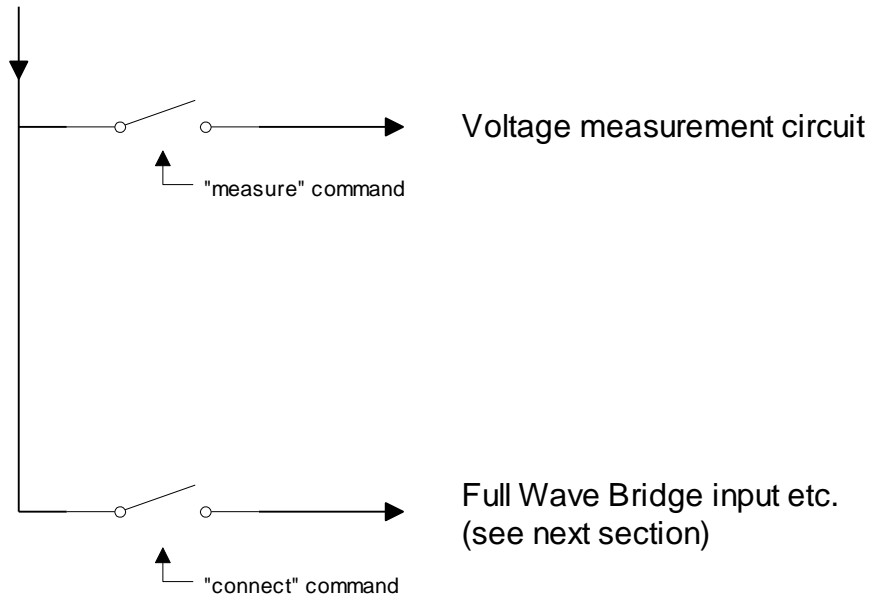
### 5.1. Data path

The data path section allows the UUT port data to be in two states: disconnected, or connected to the data of the next UUT port. This allows data to pass from port to port for testing.



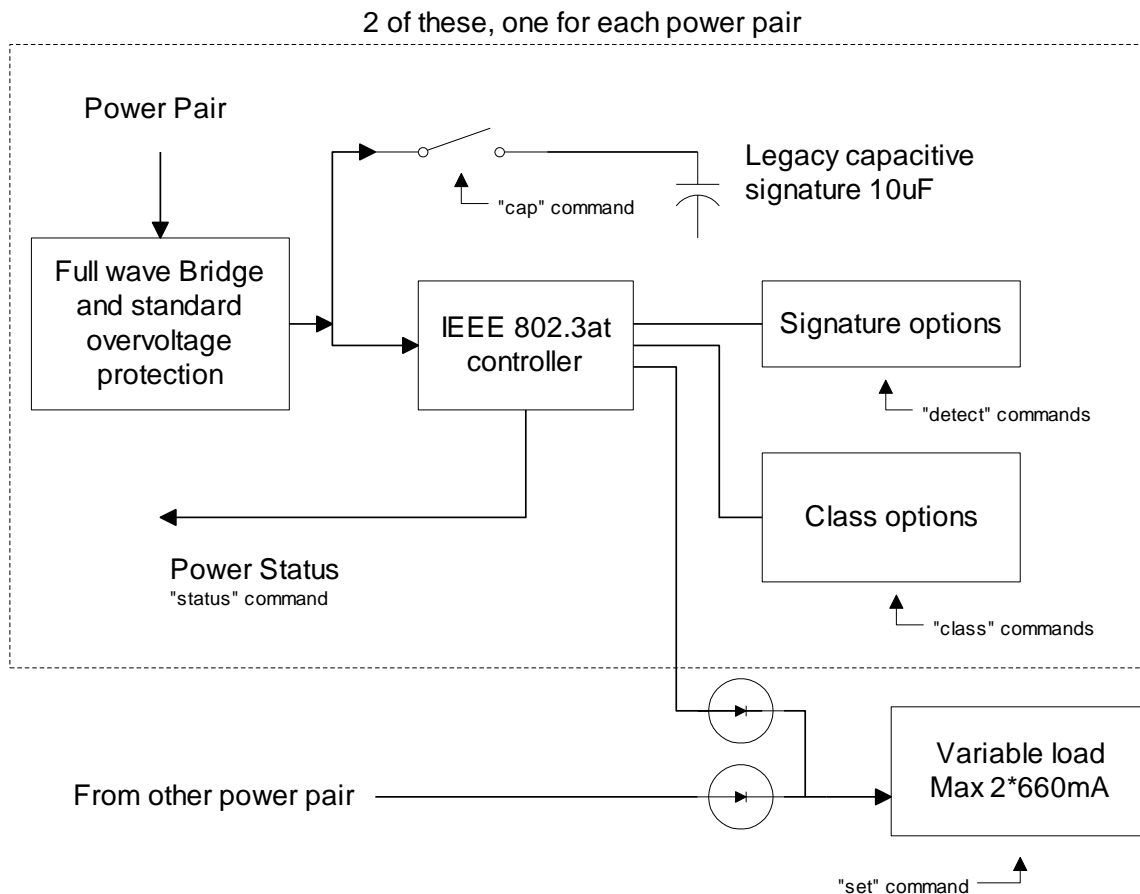
## 5.2. *Power input*

Power Input (above); 2 instances, one for each power pair:



Each UUT port can have either power pair measured (reported voltage can be positive or negative depending on polarity), or connected to the Full Wave Bridge and subsequent load circuits.

### 5.3. Signature, class, and load



The IEEE 802.3at controller (also known as the PD PoE controller) used is the TI TPS2378.

The signature resistor options are nominal, or invalid (too high). This is enough to validate the PSE's ability to detect the physical IEEE signature. A legacy capacitive load can be applied which should cause the signature detect to fail. This can also be used to simulate an AC load for AC disconnect testing. The classification (Class) loads are standard. The "power-good" status of the IEEE controller goes active once the load capacitor (not shown) is charged and can be monitored via the "status" command. This command reports the status of each of the two PoE PD controllers. This will indicate which pairs are powered.

#### **5.4. *Fans***

The fans engage when any of the test ports have been issued the “connect” command. After all ports are no longer connected (e.g. reset command has been issued) the fans will stay on until nominal heatsink temperature has been reached.

#### **5.5. *RJ45 LEDs***

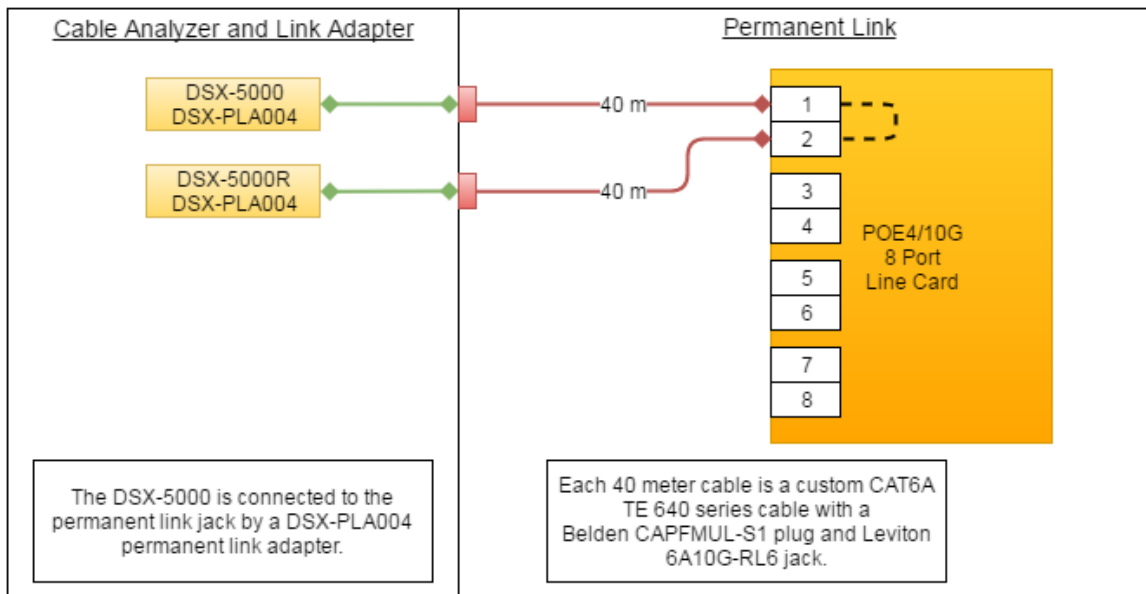
Each RJ45 connector has a green and yellow LED. The Green LED will be lit when the “power-good” status of the IEEE controller goes active. The “status” command can also be used to report the “power-good” status of each PoE PD controller. The yellow LED will be lit when a setting is changed on the port.

## 6. Ethernet Cables

The performance of a CAT6A rated link is dependent on the cabling, connectors, mated connections and hardware components that make up the link.

The PoE4N/10G data path passes 10GBASE-T traffic from each test port to the adjacent test port (ports 1-2, 3-4, etc.). The data path connections are made through magnetics and signal relays for compatibility with Phy-based cable diagnostics. When passing 10GBASE-T traffic through the PoE4N/10G data path, it is important to consider the type of cable, plugs and jacks used as part of that link.

The PoE4N/10G data paths are all tested to the TIA CAT6A permanent link test limit using the DSX-5000 and the DSX-PLA004 permanent link adapters as shown in Figure 1 below. The permanent link consists of two 40meter CAT6A cables. Each 40 meter length of cable consists of a plug mated to the test port and a jack mated to the DSX-PLA004 permanent link adapter. The combination of cable and connectors shown in Figure 1 was found to have the best performance.



**Figure 1: PoE4/10G Permanent Link Test Setup**

## 7. Command Reference

This section describes the commands available. For typical command sequences, see [Appendix B](#).

When the unit is ready for a command, it issues the default prompt "RT-PoE4N/10G>". The prompt may be changed via the "hostname" command so that a unit can be identified by its prompt. Command buffering is not supported; you must wait for the prompt before sending a command. The default baud rate is 9600. This can be changed via the "baud" command and is "sticky" across power cycles.

All commands are terminated by a <return> which is the character 0x0D (decimal 13).

Most commands have a short form version. The optional characters of a command are indicated by the [ ] brackets.

All commands that take "on" or "off" arguments can also take "1" and "0" as arguments.

Responses from the unit that include variable data such as the port number are shown as 'C' printf style strings, so the script writer knows exactly what to expect as a response.

### **HELP**

Description	Displays available commands.
Command:	he[lp]
Command:	?
Example:	help

### **VERSION**

Description	Displays software and hardware version
Command:	vers[ion]
Result:	"Reach PoE Tester Model RT-PoE4N/10G/24 PN 53-0004-11 Rev A 01 SW 1.03 11/01/2016 Copyright (C) 2005-2016 by Reach Technology Inc." An error is generated if the line card versions are inconsistent; that is, if the three 8 port line cards have different firmware.



## **ERROR CHECK**

Description:	The unit maintains an error flag that is set if any error message is generated. This command reports the error flag value. A test script can run an entire sequence of commands and check at the end to make sure there were no errors instead of having to check on a command-by-command basis.
Command:	<code>err[ors]</code>
Result:	"1 - one or more errors have occurred; error flag reset"
or	"0 - no errors have occurred"

## **HOSTNAME**

Description:	Used to change the unit's prompt. This is useful in a production system so the script knows exactly which physical unit it is talking to. Name must be equal or less than 31 characters long
Command:	<code>host[name] &lt;string&gt;</code>
Example:	<code>hostname myTester</code> This makes the unit's prompt "myTester>"

## **BAUD**

Description:	Used to change the unit's baud rate. This will not take effect until the unit power is cycled or the *boot command is issued. This is done to make sure the baud change is acceptable.
Command:	<code>*baud &lt;baudrate&gt;</code>  <code>&lt;baudrate&gt; = 9600, 19200, 38400, 57600, or 115200</code>
Example:	<code>baudrate 19200</code>
Response:	"Console baud set to 19200. Cycle power or issue *boot to effect change."

## **BOOT**

Description	Resets the system to the power-on state. This is the same as if the unit has its power cycled.
Command	<code>*boot</code>

## **ECHO**

Description:	Used to test the communication between the host and this unit. This is useful at higher baud rates to validate a baud can be used without error. A script can repeat the echo command continuously and verify that no communication errors are present.
Command:	<code>*echo &lt;string&gt;</code> <code>&lt;string&gt; = any ASCII string. May contain spaces.</code>
Example:	<code>*echo this is a test</code>
Response:	<code>"this is a test"</code>

## **PORT / GROUP PREFIX**

Description	For all port-specific commands, a port or group prefix will restrict the command to a specific port or port group. The prefix must be followed by a space before the port command. If no prefix is used, the command will be applied to all 24 ports.
Port Prefix:	<code>pN</code> This specified port N where N is from 1 to 24.
Group Prefix:	<code>gM</code> This specifies group M where M is from 1 to 3. group 1 = ports 1-8 group 2 = ports 9-16 group 3 = ports 17-24

## **CAL**

Description	Runs internal calibration of class and power loads.
Command:	<code>cal</code>
Response:	<code>printf(":p%d Autocal OK\r\n", port);</code> <code>or</code> <code>printf("!p%d Autocal FAIL\r\n", port);</code>

## **CAP**

Description	Controls the 10uF capacitor across the full-wave bridge. This represents either a legacy capacitive signature or an AC load.
Command:	<code>cap [on off]</code>
Response:	<code>printf(":p%d cap %d\r\n", port, state);</code> state = 1 or 0 for on and off respectively.

## CLASS

Description	Sets the IEEE load class. See IEEE 802.3af and 802.3at specification (external documents).
Command:	<code>cl[class] [0 1 2 3 4]</code>
Argument:	class value
Response:	<code>printf(":p%d class %d\n", port, class);</code>
Example:	<code>p9 cl 3</code>
Example response:	<code>:p9 class 3&lt;CR&gt;&lt;LF&gt;</code> This sets port 9 IEEE "class" to 3.

## UPOE

Description	Changes between regular PoE, PoE+ mode and UPoE mode. In UPoE mode the load is limited to 100mA until power good is detected on both pairs. In regular mode the load is limited to 100mA until power good is detected on the main pair. If a comma is present the command assumes the user is requiring that power be valid on a specified pair before releasing the 100mA limit e.g. when "upoe 0,1" is entered then the load will be limited to 100mA until power is valid on the alternate pair.
Command:	<code>upoe [on off 0,0 0,1 1,0 1,1]</code>
Response:	<code>printf(":p%d upoe %d\n\r", port, state);</code> state = 1 or 0 for on and off respectively.

## CONNECT

Description	Controls the relays that connect the power load circuitry to the UUT port via the GbE transformer. From a power perspective, this is equivalent to plugging in the RJ45 from the UUT. See the <a href="#">Operational Overview</a> section for more details. Connect must be on for the UUT to see an IEEE 802.3af/at PoE load. The connect command can also be used to select the main, alternate, or both power pairs. If a comma is present the command assumes the user is specifying the connect status of each pair individually. The first value is the connect status of the main pair and the second is the alternate pair e.g. when "connect 0,1" is entered then only the alternate pair will be connected to the load.
Command:	<code>conn[ect] [on off 0,0 0,1 1,0 1,1]</code>
Response:	<code>printf(":p%d Connect Sig %d\n", port, state);</code> state = 1 or 0 for on and off respectively.

## ***DETECT***

Description            Sets the IEEE 802.3af/at detect signature.

Command:            `det[ect] [ok|hi]`

Arguments:           `ok`      signature resistance 24.9K 1%  
                      `hi`      signature resistance 36K 1%

Response:            `printf(":p%d det %s\n", port, arg);`

## ***EXT***

Description            Controls the connection of the data path from one test port to another. The data path is connected between adjacent ports: 1-2, 3-4, etc. when the ext command is set on for both ports. This is necessary for the ports to send data to each other. When ext is off, the data path is open.

Command:            `ext[ernal] [on|off]`

Response:            `printf(":p%d Ext Ref %d\n", port, state);`  
                      `state = 1 or 0 for on and off respectively.`

## ***MEASURE***

Description            Measures the voltage from the UUT (center taps of GbE magnetics) of the main. Reports the voltage as either positive or negative depending on the polarity of the pair. The "Cisco" standard 1,2 = negative, 3,6 = positive is reported as a positive voltage.

Command:            `meas[ure]`

Response:            `printf(":p%d %d.%uV\n\r", port, fval);`  
                      The result will be between 0.0 and 60.0

Example:            `p1 meas`

Example response:   `:p1 50.5V, 0.0V<CR><LF>`

## **MEASURE2**

Description Measures the voltage from the UUT (center taps of GbE magnetics) of the main and alt pair. Reports the voltage as either positive or negative depending on the polarity of the pair. The “Cisco” standard 1,2 = negative, 3,6 = positive is reported as a positive voltage.

Command: `meas[ure]2`

Response: `printf(":p%d %.1fV, %.1fV\n\r",port,fval,fval_alt);`  
The result will be between 0.0 and 60.0

Example: `p1 meas2`

Example response: `:p1 50.5V, 0.0V<CR><LF>`

## **RESET**

Description Resets port(s) to fully disconnected state.

Command: `res[et]`

Response: `printf(":p%d reset\n", port);`

## **SET**

Description Sets power load value in milliamps. If set too low, the minimum value will be set; if at or above 1400mA an error will occur. Note that this is the load for both the main and the alt pair.

Command: `set <value>`

Response: `printf(":p%d %dmA\r\n",port,value);`  
or  
`printf(":p%d %dmA (min)\r\n",port,value);`

Example: `g2 set 350`

Example response: `:p9 350mA<CR><LF>`  
`:p10 350mA<CR><LF>`  
`:p11 350mA<CR><LF>`  
`:p12 350mA<CR><LF>`  
`:p12 350mA<CR><LF>`  
`:p14 350mA<CR><LF>`  
`:p15 350mA<CR><LF>`  
`:p16 350mA<CR><LF>`

## **STATUS**

Description	Returns the "Power Good" status of the IEEE load controllers. The power status is active when the IEEE controller is receiving power above the UVLO value and the load capacitor is charged. Also reports if an over temperature condition occurred that caused the port to be shut down.
Command:	<code>st[atus]</code>
Response:	<code>printf(":p%d PWR %d, PWR2 %d\n",port, state1, state2);</code>  <code>state = 1 or 0 for on and off respectively.</code>

## **TEMPERATURE**

Description	Reports the temperature of the drain pin of the MOSFET load, as measured on the line card PCB.
Command:	<code>temp[erature]</code>
Response:	<code>printf(":p%d %3d C\n", port, tempC);</code>

## Appendix A - Operational Notes

### A.1 *Power-on*

When the unit is powered on, it performs a brief relay maintenance phase, and then performs a self-calibration of its power load. This takes around 10 seconds. While calibrating, the unit flashes the front panel LED and displays the following messages. The prompt "RT-PoE4N/10G>" indicates that the unit is ready for commands.

```
RT-PoE4N/10G>"(revision dependent version string)"
Calibrating all ports..
:p1 Autocal OK
:p2 Autocal OK
:p3 Autocal OK
:p4 Autocal OK
:p5 Autocal OK
:p6 Autocal OK
:p7 Autocal OK
:p8 Autocal OK
:p9 Autocal OK
:p10 Autocal OK
:p11 Autocal OK
:p12 Autocal OK
:p13 Autocal OK
:p14 Autocal OK
:p15 Autocal OK
:p16 Autocal OK
:p17 Autocal OK
:p18 Autocal OK
:p19 Autocal OK
:p20 Autocal OK
:p21 Autocal OK
:p22 Autocal OK
:p23 Autocal OK
:p24 Autocal OK
RT-PoE4N/10G>
```

## A.2 **Error messages**

All error messages begin with the "!" exclamation mark.

<u>Error Message</u>	<u>Description</u>
!Syntax error	There was syntax error in the previous command.
!Reach PoE Tester...	There is an internal version error in this unit.
! invalid port value	The value given with the port prefix was not valid.
! invalid group value	The value given with the group prefix was not valid.
! run calibration first	If the power-on calibration was interrupted, and the set or class commands are used, this error message is generated.
! invalid class value	The CLASS command argument is not 0 thru 4.
! Error: set limit is 1400mA	The argument for the SET command is too large.
!p%d Autocal FAIL	Autocalibrate has failed on the specified port.
! unsupported baud rate	Baud rate argument is invalid
! invalid arguments	Command argument(s) are invalid
(other messages)	There are other messages that begin with an exclamation point that are internal errors. If these appear, the unit needs to be repaired.



## Appendix B - Test Setups

### B.1 Overview

This Appendix gives an overview of basic test setups. No port or group prefixes are shown. PSE, PD as defined in IEEE 802.3af. The RT-PoE4N/10G commands are issued in the order shown.

### B.2 Signature Detect

RT-PoE commands:	PSE check after commands issued
reset connect on	Verify that the PSE does not see a valid PD.
detect ok	Verify that the PSE does recognize a valid PD.
detect hi	Verify that the PSE does not see a valid PD.
detect ok cap on	Verify that the PSE does not see a valid PD.

### B.3 Class Detect

RT-PoE commands:	PSE check after commands issued
reset connect on detect ok class 0	Verify that the PSE sees a "class 0" PD.
class 1	Verify that the PSE sees a "class 1" PD.
class 2	Verify that the PSE sees a "class 2" PD.
class 3	Verify that the PSE sees a "class 3" PD.
class 4	Verify that the PSE sees a "class 4" PD.

#### **B.4 Power Status and overload (IEEE 802.3af)**

<b>RT-PoE commands:</b>	<b>PSE action</b>
reset connect on detect ok class 3 set 20	
	Enable power to port Verify that PSE sees that device taking power.
status (verify that power is on)	
meas2 (verify that voltages are as expected )	
set 350	(Verify that PSE is providing full power)
set 390	(Verify that PSE sees overload and shuts off power)
status (verify that power is off)	

#### **B.5 Power Status and overload (IEEE 802.3at)**

Same as above, but use “class 4”, and “set 600” for full power and “set 660” for overload

#### **B.6 Power Status and overload (UPoE)**

Same as above, but use “set 1200” for full power and “set 1320” for overload

#### **B.7 Data transmission under power (IEEE 802.3af)**

<b>RT-PoE commands:</b>	<b>Check after commands issued</b>
(as above for specific test required)	
	Enable power to port Verify that PSE sees that device powers up.
status (verify that power is on)	
ext on	Run traffic test between port pairs 1 and 2, 3 and 4,...23 and 24. Verify no errors.

## Appendix C - Specifications

### C.1 *Measurement Specifications*

Voltage Measurement	$\pm 2\%$ or $\pm 0.5\text{V}$ whichever is greater
Current setting, power load	$\pm 2\%$ or $\pm 2\text{mA}$ whichever is greater 5mA load guaranteed less than 5mA 10mA load guaranteed greater than 10mA
Current setting, class load	$\pm 2\%$ or $\pm 0.5\text{mA}$ whichever is greater

All specifications subject to change at any time without notice.