
Reach PoE4N Tester Manual 1.2

Model RT-PoE4N

Software Version 1.0 and above

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1. Revision History

1.1. *RTI-PoE4N - Base Model*

The Model RT-PoEN4 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/24
PN 53-0003-11 Rev A 01 SW 1.02 06/26/2014
Copyright (C) 2005-2014 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 provides diagnostic functional testing of 24 PSE ports compatible with IEEE Standards 802.3af and 802.3at. 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 gigabit traffic. It provides high density with 24 Powered Device (PD) loads in a 1U high chassis.

Each RT-PoE4N port passes up to GbE speed traffic to the next port to facilitate data traffic testing. That is, Port 1 data connects to Port 2, 3 to 4, and so on. This is useful when the PSE has diagnostics to do port-to-port traffic testing, or when the PSE is set up for port pair VLANs to force traffic through all ports. This contrasts with the RT-PoE3N that has the data broken out to a separate REF port.

2.2. Front panel



Picture 1: Front of RT-PoE4

2.3. Features

- ♦ IEEE signature options: nominal, high, and over-spec capacitive
- ♦ Classification 0 through 4 (all nominal)
- ♦ Passes GbE traffic from each test port to the neighboring port isolated from PD load (1-2, 3-4, etc)
- ♦ Datapath uses relays 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 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 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. The unit does not need regular calibration.

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 Section 6. 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 (Unit Under Test) and Reference connections

The RT-PoE4N has twenty-four identical test ports. Connect the port of the PSE (PoE Supplying Equipment) under test to the port connector via a standard straight through Ethernet cable. The PSE data will be routed to the next port (1 to 2, 3 to 4, etc) on a straight-through, non-crossover basis. There is a UPoE, GbE rated 802.3at class transformer isolating the PoE4N RJ45 so that power can be tapped from the PSE while data is passed on. All datapath connections are made via signal relays and 100 ohm differential pairs for data integrity.

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

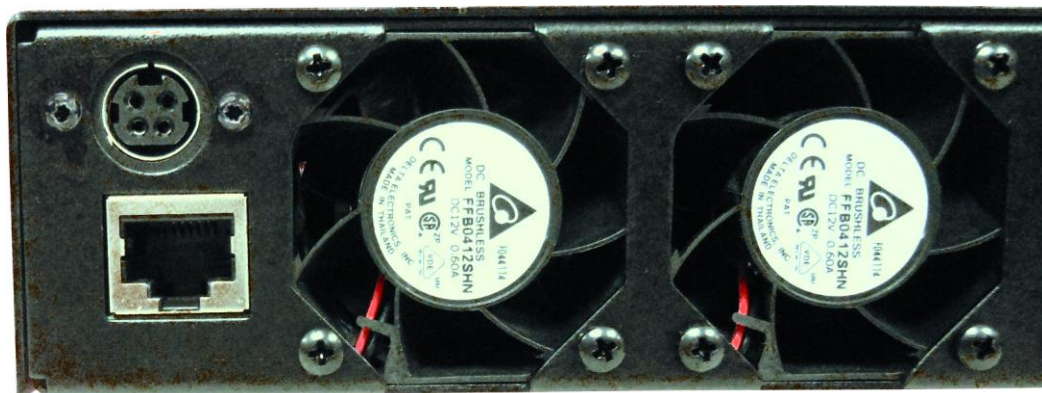
4.1. RJ-45 Ethernet connectors



Picture 2: Far left side of RT-PoE4N front panel

There are 24 numbered Unit Under Test (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 ($N=1,3,5,\dots$) 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 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 Section 2.2 for pinout.

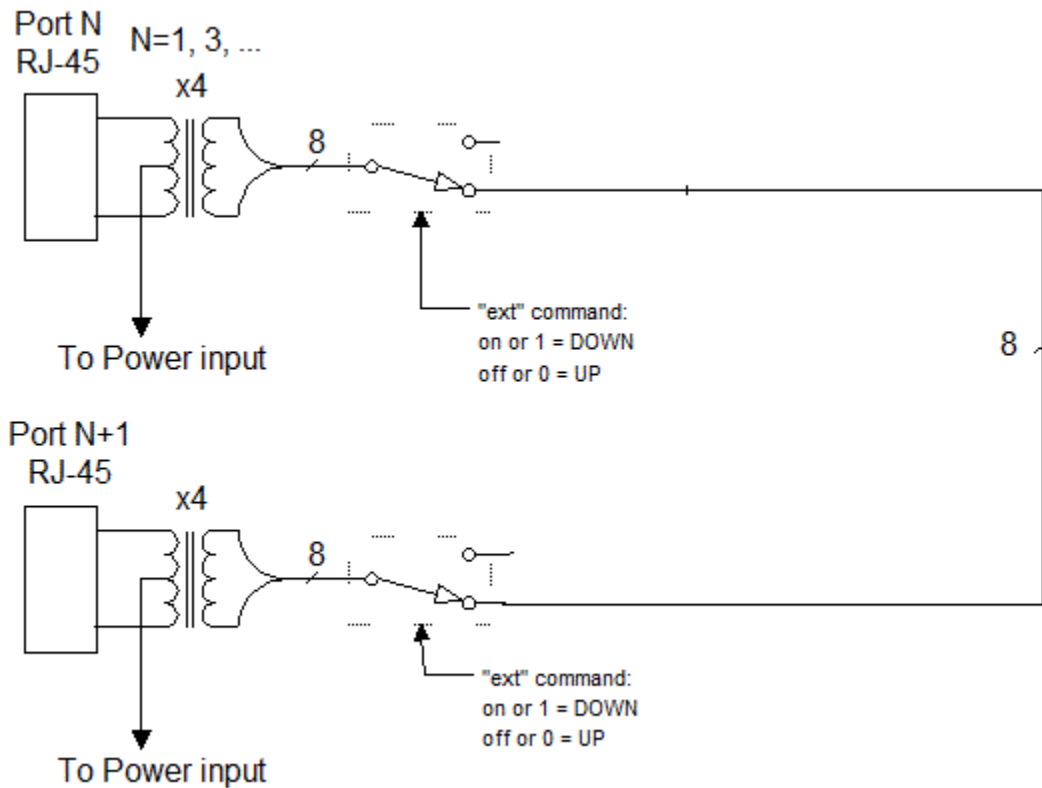
4.3. *Ethernet Power Selection*

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

5. Operational Overview

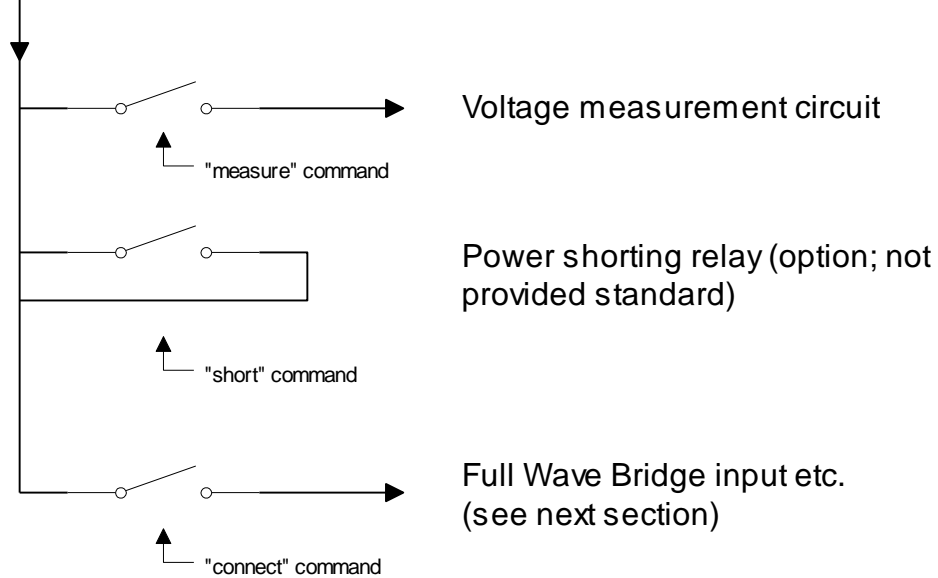
5.1. Data path

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.



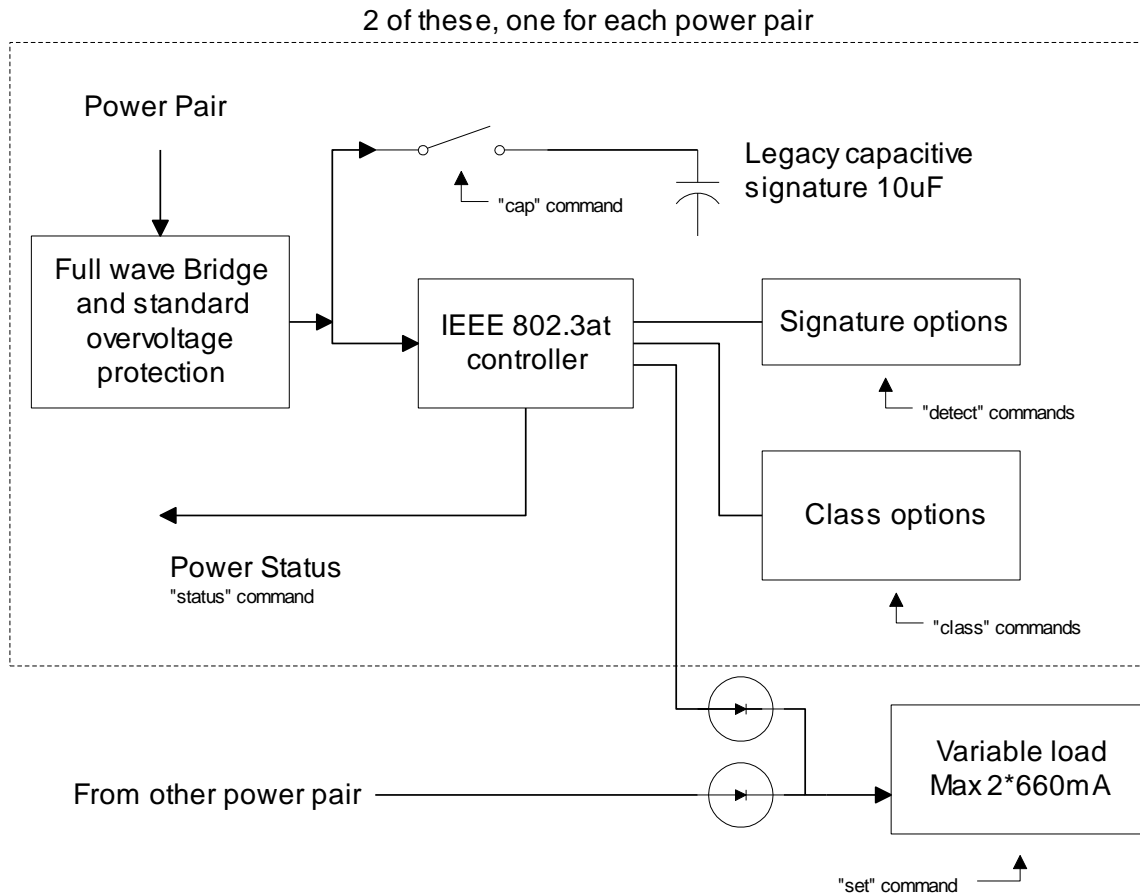
5.2. Power input

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) shorted (this is only provided for special order), 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. 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-PoE4>". 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/24 PN 53-0003-11 Rev A 01 SW 1.02 06/26/2014 Copyright (C) 2005-2014 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: `err[ors]`

Result: `"1 - one or more errors have occurred; error flag
reset\r\n"`

or

`"0 - no errors have occurred\r\n"`

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: `host[name] <string>`

Example: `hostname myTester`

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: `*baud <baudrate>`

`<baudrate> = 9600, 19200, 38400, 57600, or
115200`

Example: `baudrate 19200`

Response: `"Console baud set to %lu. Cycle power or issue
*boot to effect change.\n"`

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:	<pre>*echo <string> <string> = any ascii string. May contain spaces.</pre>
Example:	<pre>echo this is a test</pre>
Response:	<pre>"this is a test\n"</pre>

BOOT

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

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:	<pre>pN</pre> <p>This specified port N where N is from 1 to 24.</p>
Group Prefix:	<pre>gM</pre> <p>This specifies group M where M is from 1 to 3.</p> <p>group 1 = ports 1-8 group 2 = ports 9-16 group 3 = ports 17-24</p>

CAL

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

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.
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<CR><LF></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 Section 5 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:	<code>det[ect] [ok hi]</code>
Arguments:	<code>ok</code> signature resistance 24.9K 1% <code>hi</code> signature resistance 36K 1%
Response:	<code>printf(":p%d det %s\n", port, arg);</code>

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:	<code>ext[ernal] [on off]</code>
Response:	<code>printf(":p%d Ext Ref %d\n", port, state);</code> 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 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. Also, pin 4,5 = positive, and 7,8 negative are reported as a positive voltage.
Command:	<code>meas2</code>
Response:	<code>printf(":p%d %.1fV, %.1fV\n\r",port,fval, fval_alt);</code> The result will be between 0.0 and 60.0
Example:	<code>p1 meas2</code>
Example response:	<code>:p1 50.5V, 0.0V<CR><LF></code>

RESET

Description	Resets port(s) to fully disconnected state.
Command:	<code>res[et]</code>
Response:	<code>printf(":p%d reset\n", port);</code>

SET

Description Sets power load value in milliamps. If 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>

SET MPS (not typically available – contact Reach)

Description Sets a “maintain power signature” in which the load is cycled between the set value and a minimum (under 5mA) value. This informs the PSE that the load is valid but is using a duty cycle of less than 100% to save power. On time and off time are specified in milliseconds.

Command: set <value> mps <on time> <off time>

Response: printf(":p%d %dmA MPS on %dms, off %dms\r\n",port,value);

Example: g2 set 10 mps 60 240

Example response: :p9 10mA MPS on 60ms off 240ms<CR><LF>
:p10 10mA MPS on 60ms off 240ms <CR><LF>
:p11 10mA MPS on 60ms off 240ms <CR><LF>
:p12 10mA MPS on 60ms off 240ms <CR><LF>
:p12 10mA MPS on 60ms off 240ms <CR><LF>
:p14 10mA MPS on 60ms off 240ms <CR><LF>
:p15 10mA MPS on 60ms off 240ms <CR><LF>
:p16 10mA MPS on 60ms off 240ms <CR><LF>

SHORT (not typically available – contact Reach)

Description	Controls a relay that can short the UUT power before the full wave bridge. WARNING - SHORTING AT FULL POWER CAN DAMAGE UUT.
Command:	<code>sh[ort] [on off]</code>
Response:	<code>printf(":p%d short %d\n", port, state);</code> <code>state = 1 or 0 for on and off respectively.</code>

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>

Appendix A - Operational Notes

A.1 *Power-on*

When the unit is powered on, it 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. The prompt "RT-PoE4N>" indicates that the unit is ready for commands.

```
RT-PoE4N>"(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>
```

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	There value given with the port prefix was not valid.
! invalid group value	There 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	There CLASS command argument is not 0 thru 4.
! Error: set limit is 880mA	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 commands are issued in the order shown.

B.2 Signature Detect

RT-PoE commands:	PSE check after commands issued
reset connect on	
detect ok	Verify that the PSE recognizes 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)*

RT-PoE commands:	PSE action
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)

RT-PoE commands:	Check after commands issued
(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 $\pm 0.5V$ whichever is greater
Current setting, power load	$\pm 2\%$ or $\pm 2mA$ whichever is greater 5mA load guaranteed less than 5mA 10mA load guaranteed greater than 10mA
Current setting, class load	$\pm 2\%$ or $\pm 0.5mA$ whichever is greater

All specifications subject to change at any time without notice.