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Application Programming Interface

for

EtherRain

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Introduction

EtherRain is a sprinkler valve controller that is configured and operated by sending commands via the built-in Ethernet port.   The device features 8 zones and an integrated rain detector. Rev C of EtherRain can receive flow pulse count information on a UDP channel and can be configured with a pulse count delay and pulse count threshold. Power is supplied to the device by a single 24VAC valve transformer.

While the device provides some HTTP web configuration capabilities, it was designed to be configured and controlled by an application program, not through direct web page access. The device was designed to be configured locally. Once configured, it can be controlled locally or remotely. For use in remote control applications, the device provides an HTTP client capable of contacting remote web-based applications to receive control information.   Rev. C of the controller has some web page configuration capability.

This document provides information needed to write software to control the EtherRain sprinkler valve controller.

General Discussion of Device Operation

Commands are sent to EtherRain and result codes are received from EtherRain by way of the built-in Ethernet port.   The commands are divided into Configuration commands and Operating commands. Configuration commands as well as detailed command formats and protocols are provided after this general description of device operation.

The following Operating commands are accepted by the device:

Irrigate
Clear
Status
Direct Relay On/Off
Timed Relay

The "Irrigate" command contains all of the data required to control a complete cycle. This approach ensures that a valve is not turned-on without a defined turn-off time. EtherRain does not contain a clock so the irrigate command must be delivered to the device by the scheduling software within 249 minutes of the desired cycle start time. The "Clear" command is used to interrupt/stop an in-process irrigation cycle, and the "Status" command returns information about the state of operation of the device.

The Direct Relay commands and the Timed Relay commands control individual relays. These commands are described fully in the Appendix 3. These commands aren't generally used in an irrigation cycle.

The controller always resides in one of two operating modes:

1. **Ready**
2. **Irrigate**

The controller enters the Ready mode after reset or power up and remains there until a valid Irrigate or individual relay command is accepted. When the controller receives the "Irrigate" command it enters the Irrigate mode. The device stays in Irrigate mode from the time that a valid Irrigate command is received until either the cycle has completed, or until the cycle has been stopped by receipt of a Clear command.

When an operating command is sent to the device a response is returned. The response contains the following five status fields:

Status Field Name		Status Field Description
Command Status	(cs)	indicates if the command was accepted or not
Operating Status	(os)	indicates which state the device is currently in (rd/wt/bz)
Operating Result	(rz)	indicates the result of the previous irrigate command issued
Relay Index	(ri)	indicates the last relay that has finished executing
Rain Indicator	(rn)	provides the state of the Rain Indictor

The status fields always reflect the result of the last valid command sent. For example, if a valid Irrigate command is received, the device will return the following:

Command Status:	OK
Operating Status:	WT or BZ ("Waiting" or "Busy")
Operating Result:	OK (the previous irrigate command was successful)
Relay Index:	0
Rain Indicator:	0 or 1 (1 indicates that rain is being detected)

The result codes are explained in more detail below.

The Operating Result field contains the result of the last Irrigation command. This field will usually contain the status of "OK." When an Irrigate Command has completed, this field will contain the result status (see paragraph below). The result status field remains unchanged until a another Irrigate command has completed.

Once an Irrigate command is accepted, the irrigation cycle is completed by any of the following events:

1. Natural cycle completion per the Irrigate command parameters
2. Rain is detected.
3. A short circuit is encountered in the valve wiring.
4. The pulse count threshold is exceeded (Rev C and above)

If the device completes its irrigation cycle without issue, the Operating Result indicates "OK." If the Rain Detector indicates rain when an Irrigate command is issued, or anytime during the cycle, the cycle is stopped and the Operating Result set to "Rain" [RN]. If a short circuit is detected during the cycle, the cycle is stopped, and the Operating Result is set to "Short" [SH]. If the irrigation cycle is interrupted due to power outage the Operating Result will reflect "Short" [SH]. The controller can reflect a false short status as the effects of a power outage are very similar to those of an actual Short in the valve wiring. If the controller (Rev C and above) receives a pulse count on the monitor channel that is above the set threshold, the irrigation cycle is interrupted and the Operating Result will reflect "Blow Out" [BO]. Upon completion of a cycle by any of the above events, the Relay Index value provides the value of the last zone that completed its full cycle.

An irrigation cycle can be stopped if the device receives a Clear command. If a Clear command is received while the device is in the Irrigate mode, the device returns to the Ready mode and the status fields are reset. The Operating Result is set to "OK" [OK], and the relay index is set to 0.

Typical Command Sequence

Before sending an Irrigate command to the device it is recommended that a Status command be sent first to ensure the device is in the Ready state. No relay control commands are accepted if the controller is already in the Irrigate mode.   Only one Irrigate command can be accepted at a time.

Once the device is in the Irrigate mode, the Operating Status field and the Relay Index field can be checked to determine the status of the irrigation cycle. An irrigation cycle can be stopped by issuing the Clear command.

From a programming perspective, an authenticated login must first be accomplished before any other command will be accepted. See the section "Logging In" for more information.

Now that the general operation of the device has been covered the following pages will provide the necessary specific information needed for programmatically configuring and controlling an EtherRain device.

Programming

Finding EtherRain on the Network

EtherRain contains a discovery function to allow a network connected control application to find its address. The Windows-based and Java-based EtherRain Administration Utility uses this discovery function to allow a user to select a device for configuration or testing.

The process of finding the EtherRain device on the network depends on how the device was configured. If the device was given a static address then the device can easily be reached by issuing an HTTP command directed at that address and port. The default port for the HTTP server in the EtherRain device is 80. When communicating with the EtherRain device, be sure to include both the IP address and the HTTP port. For example:

```
http://192.168.1.204:80  (this will display the main page)
```

If the device was configured to receive a dynamic address using the DHCP protocol, the address will generally not be known so the address can be found by using EtherRain's built-in discovery function.

On Rev C controllers, EtherRain implements DHCP DNS so if the LAN router uses DHCP DNS then the controller can usually be located from a browser by typing http:// and the controller name in the browser URL bar.   The controller name must **not** contain a period character (.) to use this feature. Example: If the router or DHCP server has DHCP DNS then entering: http://etherrain-8 (where EtherRain-8 is the name of the controller), in a browser will display the main index page of the controller. This assumes that the default port for the controller is 80.

EtherRain listens on port 8089 for UDP broadcasts containing the key string:

```
eviro_id_request1
```

When this packet code is detected EtherRain returns a confirming UDP packet to the sender. The confirming packet contains a string that includes:

1. device product type
2. device unique name (which is assigned during configuration)
3. port number to which the device's HTTP server has been set.

An example return string sent in response to discovery broadcast looks like this:

```
eviro t=ER8a n=EtherRain-8 p=8080 a=
```

The fields present within the discovery packet response are:

T=   Device Type. ER8a/b/c identifies EtherRain 8 within the Eviro family
N=   Unique Name.   The unique name provided at time of configuration
P=   Current HTTP server Port
A=   Additional parameters - not used on EtherRain

The IP address of the EtherRain is determined from the remote address of the packet received.

Example discovery send and receive VB6 code is available by contacting QuickSmart.

The factory default configuration for EtherRain is:

IP Address: 192.168.1 204
HTTP Port: 80
DHCP: ON
Unique Name: EtherRain.8. For Rev C: EtherRain-8 or EtherRain-7P
Password: pw

EtherRain requires the availability of a DHCP server on the network to which it is attached, at least initially. If the network to which the device is attached does not have a DHCP server or the DHCP server is malfunctioning) and the controller is configured in DHCP mode, the controller will reset in an approximate 10 second loop.   EtherRain can be configured with a static address, netmask, gateway, and DNS address, in which case the controller will then work without the need for a DHCP server on the local network.

If multiple EtherRain devices exist on the same network, each must be configured with a unique name and, if using static addressing, a unique static IP.

If the password for a device is misplaced, the device can be reset to the default password using a hardware jumper located on the relay board. See the appendix for more information.

Communicating with EtherRain

EtherRain uses the HTTP protocol for command communications. The device contains a simple HTTP server to process operating commands and configuration commands sent to the device using standard HTTP GET method format.   It is very easy to send commands to and receive information back from the device by using a programming language's built in browser command function. In VB6, this is the Inet control. In .NET the WebRequest function works well. In PHP use the cURL extensions or fsockopen.

The command format for communicating with EtherRain consists of a single URL with a HTTP "GET" query string appended to the URL. The "GET" format is commonly used for sending data entered into webpage forms back to a server. The "GET" extension, also called the "query string," provides parameters or commands that are to be sent to the device. In CGI methodology, parameters are returned to the server by appending a string onto the end of a URL using a "?" to delimit the command parameters. For example the following command:

```
http://192.168.1.204:80/ergetcfg.cgi?lu=admin&lp=pw
```

sends login parameters to the device. The device processes the login, and then sends back the requested page (ie., ergetcfg.cgi, which provides all current parameters) if the login is valid.

The following parameter pages can be requested by EtherRain. They are:

ergetcfg.cgi	Returns the status of all configurable parameters
result.cgi	Returns the current operating status of the device
direct.cgi	Returns status of the relays (see appendix 3)
timedrelay.cgi	Returns status of the relays (see appendix 3)

When the device receives a valid command, it first processes the commands that are included in the query string and updates all internal parameters. It then sends back the requested page which contains the latest parameters.

Logging In and Logging Out

Before the EtherRain device will accept a command, the client application must first be authenticated by a login process.   Login requires input of a valid username and password.   Once logged in, further commands are authenticated by the IP address received during login. The login authentication expires two minutes after the last valid command is sent. All commands that configure the device or initiate irrigation require login authentication. The device can only be "logged into" by one administrator at a time.

Here is an example of a login command where the username is "admin" and the password is "pw":

```
http://192.168.1.204:80/ergetcfg.cgi?lu=admin&lp=pw
```

Assuming the IP address and port is correct, the device will return an html formatted page providing the results of the command. If the login is accepted the parameter "ur" will be set to "admin". See the configuration section for more detailed information regarding the parameters returned within the "ergetcfg.cgi" page.

Logout is automatic after a short time or reset. In addition, logout can be assured by sending the following command:

```
http://192.168.1.204:80/ergetcfg.cgi?m=o
```

(the value is the letter o)

EtherRain 8 Configuration

EtherRain can be configured by sending CGI GET request to the device using the HTTP protocol. The query string of the request can contain as many parameter name value combinations as needed.

EtherRain has a set of parameters that can be set to configure the device to work in different network settings.

The following list of parameters can be set:

Device Name   -see section below on character limitations
HTTP Port
DHCP Status
Default IP Address
Default Net Mask
Gateway Address
DNS Address
Scheduling Host URL   - for use with an Internet Scheduling service
Scheduling Host Account   - for use with an Internet Scheduling service
Operating Mode   - L: Local; P: Polling;

Retrieving Configuration

The current configuration of the EtherRain device can be retrieved from the device by logging in using the following command:

```
http://192.168.1.204:80/ergetcfg.cgi?lu=admin&lp=pw
```

Where the IP address is the address of the device, the number after the colon is the HTTP server port, and the parameter following the "lp=" command is the device password. The user name must remain as "admin" for configuration and operation.

If the device's IP address and HTTP server port are unknown, they can be obtained by using the discovery function discussed above.

The command can be sent from your internal browser function provided by your programming language. For example:

VB6:   the Inet control
Dot Net: WebRequest function;
PHP: the cURL functions

Assuming the command is accepted the device will respond with an HTML formatted page. An example of such a page is:

```
<html>
     <head>
     </head>
     <body>
          Configuration: EtherRain Rev C <br>
          ur: admin <br>
          un: EtherRain-8CT <br>
          hp: 80 <br>
          dh: 1 <br>
          ip: 192.168.1.204 <br>
          nm: 255.255.255.0 <br>
          gw: 192.168.1.254 <br>
          dn: 192.168.1.254 <br>
          ma: 0.4.163.26.130.38 <br>
          sh: www.lawncheck.com <br>
          ac: <br>
          sv: 3.00 <br>
          av: 4.00 <br>
          om: 80 <br>
          si: 173.255.192.185 <br>
          mi:  192.168.1.99 <br>
          sn: 1500 <br>
          pc: 0 <br>
          ct: 2000 <br>
          cd: 30 <br>
          mp: 1 <br>

     </body>
</html>
```

Example Page Returned When Requesting ergetcfg.cgi

There is a difference in the page parameters returned depending on the version of EtherRain. The latest version, Rev C, returns the above page. Older versions do not return the lower six parameters.

The parameter definitions are defined here:

```
ur:   username  (should be set to admin if logged in)
un:   device unique name (max of 14 characters)
hp:   HTTP Server Port  (usually 80)
dh:   DHCP ON (1= ON; 0= OFF)
ip:   Default IP Address
nm:   Default Net Mask
gw:   Gateway IP address
dn:   Domain Name Server Address
ma:   Mac Address (not changeable)
sh:   Scheduling Host URL <br>
ac:   Scheduling Service Account Number
sv:   Stack Version (not changeable)
av:   Application Version (not changeable)
om:   Operating Mode (L, P, or S)
si:   Scheduling Host IP address (not changeable)
mi:   Device current IP   (Rev C only)
sn:   Device serial number   (Rev C only)
pc:   Pump control status (0:Etherain-8; 1:EtherRain7P)
ct:   Pulse counter (PPM) Count Threshold
cd:   Count Delay in seconds before monitoring Pulse Count
mp:   Monitoring port option (1 through 4) UDP base: 620X
```

The value associated with each parameter can be extracted by parsing the text that is received.

Sending Configuration Data

Configuration data is sent to EtherRain using the HTTP Get Method format described above, which is a URL with an attached query string. The query string contains the parameter and data pairs separated by an "&" ampersand, as per the standard format.

Each parameter has a special command code that identifies the value type to the EtherRain.

The following codes are used:

```
Login:              lu=   admin   (don't change this user name)
                    lp=   (password up to 8 characters, default is: pw)

New Password:       lb= {max of 8, characters, limit characters}
Device Name:        ld= {max of 14 characters, limit characters}
Scheduling Host:    ls= {max of 18 characters; domain name only}
Account Number:     li= {up to 10 digits}
HTTP Port:          lh= (port number}
DCHP Status         k16= {0 or 1}
Operating Mode:     k8F= {L, P, or S}


IP Address:         k00= (most significant octet, ie, 192)
                    k01=
                    k02=
                    k03= (least significant octet)

NetMask:            k0A= (most significant octet)
                    k0B=
                    k0C=
                    k0D=

Gateway Address:    k0E= (most significant octet)
                    k0F=
                    k10=
                    k11=

DNS Address:        k57= (most significant octet)
                    k58=
                    k59=
                    k5A=
```

An example of sending a new IP address to an EtherRain, assuming the new IP address is 192.168.1.200 the URL and query string would look like this:

```
http://192.168.1.204:80/ergetcfg.cgi?k00=192&k01=168&k02=1&k03=200
```

As many parameters as required can be sent at one time, however, it might be wise to limit the number to a maximum of 6 parameters in one query string.
The device needs to be reset after any changes to the network address or addressing scheme (ie. Change in static IP, net mask, any server, and change in status of DHCP functionality) have been uploaded for the configurations to take effect. To issue a device reset command, send the following query string in a separate command:

```
?m=r
```

An example URL for this would be:

```
http://192.168.1.204:80?m=r
```

After reset, wait about 30 seconds to issue a new discovery packet to ensure that the device is ready to receive a discovery packet and return its identifying information.

REITERATION: To alter configuration data, the IP address must first be authenticated by logging in. Also, the ergetcfg.cgi page must be used with the query string in order to send new configuration commands to the EtherRain.

Device Name and Password Character Limitation

When changing the device name and password it is important to limit the usage of certain ASCII characters so that the device name change takes place as intended.

When your embedded HTTP browser sends a query string it encodes the string using URL Encoding. In this encoding scheme certain characters are changed. The EtherRain device does not have a URL Decoding function, so it is important to avoid those characters that are encoded. The following characters should not be allowed to be entered into a device name:

> Space
> Quotation marks
> 'Less Than' symbol ("<")
> 'Greater Than' symbol (">")
> 'Pound' character ("#")
> Percent character ("%")
> Left Curly Brace ("{")
> Right Curly Brace ("}")
> Vertical Bar/Pipe ("|")
> Backslash ("\")
> Caret ("^")
> Tilde ("~")
> Left Square Bracket ("[")
> Right Square Bracket ("]")
> Grave Accent ("`")
> Period {"."}

All alphanumeric characters can be used. In addition, the following special characters work without being automatically encoded:

Underline {"_"}
Dash {"-"}

The maximum length of the unique device name is 14 characters. It is important to impose a character limit on the name.

Operating Commands

EtherRain features three irrigation mode operating commands (see appendix for additional relay control commands):

Irrigate
Status
Clear

Irrigate Command

The Irrigate command is the most complex command. It contains all of the parameters to control a complete cycle. It contains a parameter to specify an optional starting delay time.

The format of the irrigate command is:

```
xi= d:vt1:vt2:vt3:vt4:vt5:vt6:vt7:vt8
```

There are nine parameters within this command, and they are all required. Each parameter represents a time in minutes. The parameter "d" represents a turn-on delay specified in minutes.   The vt1 through vt8 parameters provide valve on-times in minutes. The parameter range is 0 to 240 for each parameter allowing up to 4 hour valve on times, or maximum 4 hour turn-on delay. If a valve is not to be turned on during a certain cycle then it should be assigned a value of 0. If the cycle is to begin when the command is received, the delay value should be zero.

If the command is accepted and after any delay period has timed out, the first valve that has a non-zero time value will turn on within 10 seconds. The controller will cycle through the valves turning each valve on and off in sequence, for the number of minutes specified for each valve.

Irrigation command Examples

The following command executes upon receipt and turns valve 1, 3, and 5 on for 14 minutes each:

```
http://192.168.1.204/result.cgi?xi=0:14:0:14:0:14:0:0:0
```

The following command waits one hour before starting and then turns each valve, except for valve 7, on for 5 minutes:

```
http://192.168.1.204/result.cgi?xi=60:5:5:5:5:5:5:0:5
```

The result of the command can be obtained by monitoring the command status parameter in the returned page. The Command Status parameter will return one of the following values depending on conditions:

OK   - if the command was accepted
ER   - if the command had a formatting error
NA   - if the command came from an unauthorized IP address

To ensure that the irrigate command will be accepted, issue a valid login command before issuing the irrigate command.

The command status field will be set to "ER" if any of the following formatting errors are found:

1. A parameter value with a number greater than 240
2. Less than 9 values are received
3. More than 9 values are received.

Once an Irrigate command is accepted by the device it will not accept further Irrigate commands while the current command is active. Any Irrigate command issued during a valid cycle will return a command status of "ER" even if the command is properly formatted. An irrigation cycle can be stopped by issuing the "Clear" command described below.

When an Irrigate command is active, the operating status field will reflect the activity by returning either a "BZ" or "WT" result code. The result code of "WT" is returned if the command contained a delay parameter and the device is currently in the delay portion of the cycle (WT stands for "waiting"). When the device enters the active irrigation phase of the command, the operating status field will reflect this activity by returning "BZ" or busy. When the command has been completed, the operating status will return the value of "RD" or ready.

When an irrigation process has been completed the operating result field will be set to indicate the result of the command. The operating result field will return the following values:

OK   - the command completed with no issues
RN   - the command was interrupted by the rain indicator
SH   - the command was interrupted by the detection of a short in the valve wiring
BO   - the command was interrupted by a pulse count exceeding the set threshold
NC   - the previous command did not complete.

If the command was interrupted by rain or short circuit, the Relay Index field is useful in providing the value of the last valve to fully complete its cycle. In the case of a short circuit, the short is most likely to be found at the relay wiring of the valve that is set to execute after the one noted in the relay index field.

The operating result of "OK" is set whenever the device is reset, power cycled, cleared by receipt of the "clear" command, and upon receipt of a new Irrigate command. If the operating result of an Irrigate command is desired it should be queried before issuance of further Clear or Irrigate commands.

Special Delay Command for Valve Testing

The "d" or delay value sent with the Irrigate command should not exceed 249 for operation in standard mode. If the delay value is set above 249 the EtherRain device will enter a "valve test" mode. In valve test mode, all valve time values are interpreted as seconds instead of minutes, and the command executes when received (no delay). An example of a command that provides valve testing for the first 4 valves, 30 seconds per valve is:

```
http://192.168.1.204/result.cgi?xi=250:30:30:30:30:0:0:0:0
```

Clear Command

The Clear command is designed to reset the Irrigation function. If the device is in an Irrigation process, the process will be stopped. All status fields are set to their default ready state with the exception of the Relay Index field which is not changed by the clear command and reflects the last relay that completed its cycle (updated 3-11-2011)

To issue a Clear command send the following query string to the device:

```
?xr
```

An example of a clear command is:

```
http://192.168.1.204/result.cgi?xr
```

If the command is successful, the command status result will be "OK". As with the Irrigate command, the IP address of the device issuing the command must first be authenticated through the logon procedure before the command will be accepted. If the address is not authenticated the command status field will return "NA".

Status Command

The status command reads and returns the device's current status registers. To issue a Status command, send the following query string to the device:

```
?xs
```

An example of a clear command is:

```
http://192.168.1.204/result.cgi?xs
```

The status command does not alter any states or activities of the EtherRain. It merely provides a listing of the current status fields.

After issuing the command the result.cgi page is returned. This page has the following format:

```
<html>
     <head>
     </head>
     <body>
          EtherRain Device Status <br>
          un:  EtherRain-8CT <br>
          ma: 0.4.163.26.130.38  <br>
          ac: <br>
          os: RD <br>
          cs: OK <br>
          rz: OK <br>
          ri: 0 <br>
          rn: 0 <br>
          cm: 0 <br>
          cx: 0 <br>
     </body>
</html>
```

Result.cgi Page Format

Field definitions are provided on the next page.

The following fields are returned in the result.cgi page:

un: Device Unique Name
ma: the MAC address for the device
ac: the service account number (if used)
os: the operating status
cs: the command status
rz: the result of the most recently completed Irrigate command
ri: the most recent relay/valve to fully complete it's cycle
rn: current state of the rain detector
cm: maximum pulse count received during cycle
cx: blowout zone (set if pulse count exceeds threshold)

The "cm" and "cx" parameters are provided in Rev C and above.

The following fields are most useful for checking status:

os: the operating status
cs: the command status
rz: the result of the most recently completed Irrigate command

See the discussion of operation starting at the top of this document for more information on the values that are returned in these fields, and the next section for a summary.

Controller Status Summary

Here is a summary of the status variables return by EtherRain. There are three status variables as well as a rain indicator and an relay index. See the appendix for information on how to interpret the relay index.

The three status variables are:

OS - Current operating status
CS - Command status
RZ - Irrigation command result - result of the last Irrigation command sent

OS

Operating Status provides current the state of the controller. The states are:

RD – READY. The controller is ready to accept a new irrigate command
WT- WAITING. The controller has accepted an Irrigate command that had a delay associated with it and is waiting to start the command.
BZ - BUSY. The controller is currently executed an irrigate command.

CS

Command status: - The result of the last command sent to the controller. Values returned are:

OK - if the command was accepted
ER - if the command had a formatting error
NA - if the command came from an unauthorized IP address

RZ

Result of previous irrigation command. Values returned are:

OK - the previous I command completed with no issues
RN - the previous I command was interrupted by the rain indicator
SH - the previous I command was interrupted by the detection of a short in the valve wiring (RI will give a clue to the zone causing the issue)
NC - the previous command did not complete - most likely a power outage

Appendix 1: Initial Configuration

The EtherRain 8 controller is shipped from the factory with the following settings:

IP Address: 192.168.1.204
Net Mask: 255.255.255.0

DHCP: ON
Unique Name: EtherRain.8
Logon Username: admin (lower case)
Logon Password: pw   (lower case)

Discovery Port: UDP 8089
HTTP Port: TCP 80

The actual IP address used by the device depends on whether a DHCP server exists on the network to which the device is attached. If a DHCP server exists, the EtherRain 8 controller will receive an IP address and net mask from the DHCP server. As initially configured, EtherRain requires a DHCP server on the network in which it is installed in order to operate.

If a DHCP server is not available and if the controller has not been set use a static address then the EtherRain will cycle waiting for a DHCP address. This behavior is necessary to prevent EtherRain from connecting into a network using the wrong IP address for the network.

Multiple Controllers per Network

EtherRain control software applications address each device by name, so each controller must have a unique name.   If more than one EtherRain device exists on a network then each controller should have its name changed as a first priority after being added to the network,

Hardware Factory Reset

After configuration, the device can be reset to the factory default password listed above using the following procedure (this is useful if the password has been changed and the new password misplaced or forgotten)

1. Remove the power plug
2. Remove four screws from underside of unit
3. Separate the top and bottom parts of the unit
4. Locate the two-pin jumper at the right side of the unit (connectors facing you)
5. Install the jumper to connect the two pins.
6. For Rev A and Rev B, keep the Ethernet cable plugged in; Rev C: ok to unplug
7. Temporarily put the case top back on; plug in the power cable for 20 seconds
8. Remove the power, remove the case top.
9. Remove the jumper, reposition the jumper so that the two pins are not connected
10. Re-install the top and install the four screws.

The password will be reset to factory default and DHCP will be activated. The controller name will not be reset.

Appendix 2: Questions

How do I use the "ri" indicator?

"ri" stands for "relay index"

Here's how to use it:

After a controller reset, "ri" is set to 0.

The controller status generally progresses from "RD" (ready to accept an irrigation command) to "WT" (an irrigation command has been accepted but is in a delay state depending on the value of the first number in the irrigate command) to BZ (an irrigation command is currently running)

The "relay index" reflects two types of information depending on which operating mode the controller is in.

When in "RD" mode, the relay index provides the index of the last relay that operated. When in "WT" mode, relay index is reset to 0, because for the currently accepted command, no relays have yet completed.

When the operating mode changes to "BZ" relay index reflects the value of the last relay that has completed it's part of the sequence. So when the operating mode is "BZ" and the first zone has completed, then "ri" will provide 1, and this progress all the way through to 8. Note: even if a zone has a 0 minutes value, the "ri" progresses as though the zone completed.

When an irrigation command has completed, the "ri" number will reflect the value of the last zone completed. Most of the time this will be 8 (or 7 for the 7P). This index is not reset, because it can provide valuable information about whether a command ran fully. Events that can stop a cycle while not resetting the "ri" include: short circuit detected, rain detected.

A reset command will reset the relay index to 0.

How do I actively monitor the zones of an operating cycle?

To provide active monitoring of a cycle you have to monitor both the *operating status* and the "*ri*". First check that the operating status is "BZ." If operating status is "BZ" then the currently active valve is equal to the value of "ri" plus 1. When "ri" gets to 8, the cycle is over (this could also be confirmed by the operating status reverting to "RD")

How do I control the pump/master valve terminal on ER-7P ?

This output is preset. The terminal activates prior to the cycle start and deactivates after the cycle stops.

Appendix 3: Controlling Individual Relays

The main irrigation command for EtherRain, the "i" command, activates relays one at a time in sequential order.   The following commands control individual relays and allow for independent relay control.   While all relays can be turned on simultaneously, it is recommended that a maximum of 4 relays be activated simultaneously in production use.

Two types of individual relay control commands are available. The Direct Relay control commands turn individual relays on or off. This command type sets a relay on or off, and requires that the relay be given an "off" command to turn off.

The Self-Timed commands control individual relays but include timing information so the relay will turn off automatically. Self-Timed commands do not need to send an "off" command and so can offer extra reliability and fault tolerance to a network controlled application.

Direct Relay Control Command

As of serial number 600, EtherRain firmware includes a command that directly controls each relay.   This command is not intended for irrigation applications. EtherRain irrigation commands provide complete relay timing, while the direct command is an on-off type of command; once a relay is turned on, a separate command must be issued to turn the relay off

Format for the "D" or Direct Command:

```
xd=n:n:n:n:n:n:n:n
```

The "n" parameter in the above command can be one of three characters: 1; 0; or -

The first "n" is relay 1; a "1" turns the relay on; a "0" turns the relay off and a "-" means don't change the current relay state. A relay status can be obtained by sending 8 dash characters.

Command example: The following command turns relay 3 and 7 on and leaves the other relays in their existing state.

```
http://192.168.1.12:91/direct.cgi?lu=admin&lp=pw& xd=-:-:1:-:-:-:1:-
```

Result example: The result of the command can be monitored by viewing the operating status (os) and the command (cs) status parameters.   In addition the current state of the

relays is returned and can be found by viewing the results parameter (RS).   The status of
the rain sensor is also returned (rn: 0 – not raining, 1 – raining)

The direct.cgi page response to a direct command is as follows:

```
<html>
     <head>
     </head>
     <body>
           EtherRain Device Status <br>
           un: EtherRain-8CT <br>
           ma: 0.4.163.26.130.38  <br>
           ac: <br>
           os: RD <br>
           cs: OK <br>
           rs: 00100010 <br>
           rn: 0 <br>
           cm: 0 <br>
           cx: 0 <br>

     </body>
</html>
```

As with other EtherRain commands, the command will not be accepted if an irrigate (i)
command is executing (os: BZ) or pending (os: WT).

The "rs" parameter (Relay Status) provides individual relay status where 1 means the
relay is on, and 0 means the relay is off. The "cm" and "cx" parameters are only used in
the irrigate or timed-relay modes (cm: count max; cx: blow out zone) and are only
provide in Rev C and above. If the command is not accepted then the "rs" (Relay Status)
parameter will return only dashes.

It is important to remember that when using the direct relay control commands that each
relay must be turned off otherwise any relay that has been turned on will remain on until
the controller is reset.

See the next page for the Timed-Relay control commands.

Timed Relay Control Commands

As of serial number 1500, EtherRain firmware includes a flexible self-timed command that allows direct and independent relay control.

Timed-relay commands provide individual relay activation for a certain number of minutes or seconds without the need for a stop command. When the EtherRain receives a timed relay command it will manage the timing and shut the relay off when the time that is sent with the command has expired. Each timed relay command executes independent of other relays.

Multiple relays can be activated at once. The relays will all execute according to the timing associated with the command given.

As with other EtherRain commands, the command will not be accepted if an irrigate (i) command is executing (os: BZ) or pending (os: WT).

Because these timed relay commands can be useful for irrigation the local rain sensor will interrupt the commands or will cause the command to not execute if the rain sensor is detecting rain. The rain detect function is similar to that in the irrigation command – there is a 4 minute delay to activate from the first detection signal.

Similarly, the pulse monitor feature (Rev C) is active so exceeding the PPM (pulse per minute) threshold will interrupt the commands and turn all relays off.   Note: because multiple relays can be open simultaneously take special care in setting the threshold if you intend to use a flow meter input.

There are five timed-relay commands: two for starting a zone, two for retrieving status, and one command for reset.

After receipt of a timed-relay command EtherRain returns an html text page that contains status information. See below for more information. You can decode this page to obtain confirmation of command acceptance and monitor the time remaining for each relay.

If a timed-relay command is already active for a specific relay, and a new timed-relay command is issued for that relay, the original command will be reset and the new command will run.

Multiple timed-relay commands can be sent in the same statement. It is recommended that only four relays be activated simultaneously in production situations.

Timed Relay Activation Commands:

Timed-relay activation commands have the following format:

Starting a timed zone (minutes):

```
xt=m-R:nnn
```

Starting a timed zone (seconds):

```
xt=s-R:nnn
```

Where the command root is: `xt=m-` or `xt=s-`
The relay number is R (1 through 8)
The activation time is nnn (1-999) which will be interpreted as minutes or seconds depending on the command type.

Timed-Relay Command Examples:

This command starts relay 8 for 7 minutes:

```
http://etherrain-8ct/timedrelay.cgi?lu=admin&lp=pw&xt=m-8:7
```

This command starts relay 3 for 336 seconds:

```
http://etherrain-8ct/timedrelay.cgi?lu=admin&lp=pw&xt=s-3:336
```

The status of the relays is always returned in response to issuing the command. Because timed-relay commands execute independent of each other, the status provides the time remaining for all active relays. If the timed-relay command is issued in minutes, then the status will be returned in minutes. If the timed-relay command is issued in seconds, then the status will be returned in seconds.

Timed Relay Reset

The timed-relay reset command turns all relays off. The command is:

```
xt=r
```

Example:

```
http://etherrain-8ct/timedrelay.cgi?lu=admin&lp=pw&xt=r
```

Timed Relay Status

Timed relays are set individually and they count down individually. The status of the time remaining for each zone is provided using the following status commands. The timed relays can be set using seconds or minutes and their status can be returned in minutes or seconds.

Retrieve status of relays, time remaining in seconds:

```
xt=s
```

Example:

```
http://etherrain-8ct/timedrelay.cgi?lu=admin&lp=pw&xt=s
```

Retrieve status of relays, time remaining in minutes:

```
xt = m
```

Example:

```
http://etherrain-8ct/timedrelay.cgi?lu=admin&lp=pw&xt=m
```

Reading the Status of Timed-Relays

The current status of the relays is provided whenever an activation or status command is issued.   The timedrelay.cgi page returns information in the following format:

```
<html>
     <head>
     </head>
     <body>
          EtherRain Device Status <br>
          un: EtherRain-8CT <br>
          ma: 0.4.163.26.130.38  <br>
          ac:  <br>
          os: RD <br>
          cs: OK <br>
          rz: OK <br>
          ri: 8 <br>
          ts: m-0:0:0:0:0:0:0:7: <br>
          rn: 0 <br>
          cm: 0 <br>
          cx: 0 <br>

     </body>
</html>
```

The status of the timed-relays is obtained by parsing the "ts:" line.

If the status or command specifies seconds, the the "ts" line returns:

```
ts: s-z:z:z:z:z:z:z:z:   (z - time remaining in seconds)
```

If the status or activate command specifies minutes, the the "ts" line returns:

```
ts: m-z:z:z:z:z:z:z:z:   (z - time remaining in minutes)
```

Appendix 4: Flow Meter Pulse Counter Input

EtherRain Rev C can respond to flow meter pulse counts that are provided via the LAN on UDP port 620n where n is 1, 2, 3, or 4.

The pulse count threshold, in pulses per minute (PPM), and the PPM delay parameters can be set via web page configuration on Rev C controllers.

The networked sensor input must output the pulse count (in PPM) every 15 seconds.

In irrigate mode, the pulse count test starts after a settable delay period (in seconds) after each zone starts. Each pulse count stays in memory a maximum of 40 seconds. A new pulse count should arrive every 15 seconds, so the pulse count should be close to the steady state flow rate after 60 seconds, and a good value should be reported.

In irrigate mode, the highest ppm number received during the cycle, after the delay time has expired after a zone starts, is kept and is reported by the results.cgi page for monitoring purposes.

If a pulse count is received on the monitoring channel that is greater than the pulse count threshold, then the controller will stop the irrigation cycle and the status will reflect a blow out (BO).   The current relay index will give an indication of where in the cycle the blow has occurred.

When the threshold is set to 0, EtherRain does not monitor any pulse information

The UDP packet should be broadcast on the LAN.   The UDP packet content for EtheRain pulse count decoding should be:

```
ER-PPM::nnnnn
```

Where nnnnn is the pulses counted in PPM. (note the dual colon characters)

EtherRain listens on port 620n (where n= 1,2,3,4). Default is 1.