NAFEM Gateway

User's Manual

For Watlow part numbers NGW0-0000-0000, NGW0-0000-2400, NGWC-0000-0000, NGWC-0000-2400

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NAFEM Gateway

Table of Contents Page

Introduction

This manual is intended for the user who is already familiar with the NAFEM protocol, Ethernet and Modbus RTU. For more information see:

NAFEM Data Protocol User Manual located at:
http://www.nafem.org/resources/tech/DataProtocol.cfm
MODBUS RTU Standard located at:
http://www.modicon.com/techpubs/toc7.html.
RFCs located at: http://www.ietf.org/

Product Overview

The NAFEM Gateway has three physical connectivity points to the physical world; the device's EIA-485 serial communication port, the RJ45 Ethernet network communication port (10BaseT) and the power supply jack.

The NAFEM Gateway is a protocol converter that connects Modbus devices to the NAFEM protocol using an Ethernet connection. The requirements are set forth by the selected protocols of register based Modbus RTU for control devices and NAFEM Data Protocol [NDP] using digital signal connectivity.

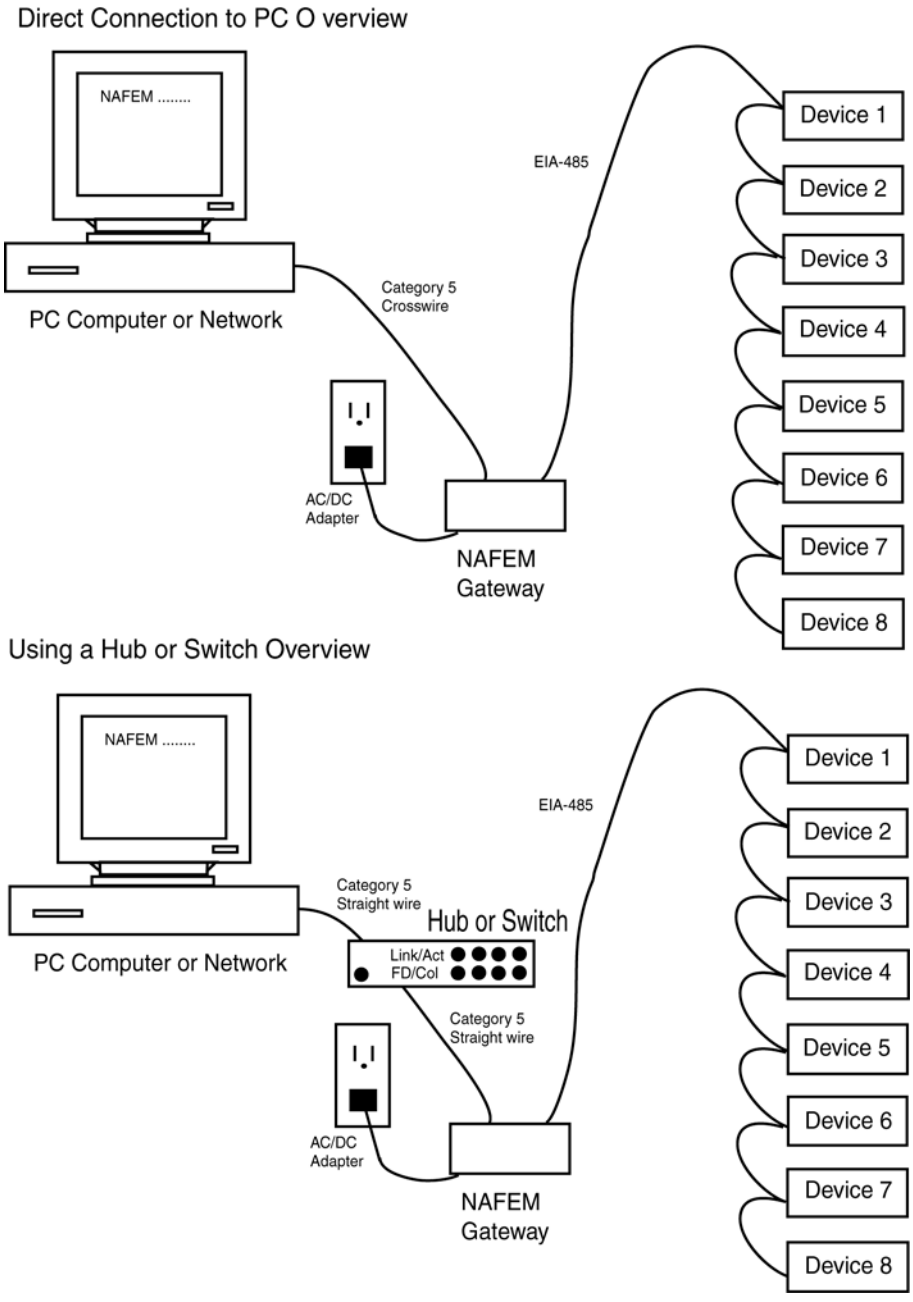
This Gateway device performs these tasks with the use of six firmware components; Poll Engine, Alarm Module, SNMP v1 Agent, Web Server, TFTP Client, and a Device Protocol Driver. In addition, a database resides within the Gateway that contains the NAFEM Objects. This is where the information is exchanged between the NAFEM and Modbus elements.

The function of the Gateway is to receive request for reads and writes of NAFEM Objects. These objects are the registers within the devices. This request comes to the Gateway in the format of the NAFEM protocol. The Gateway converts the request into the appropriate Modbus RTU packet and forwards the information to the device. Up to 8 devices may be connected to the serial port. The Gateway can access up to 64 registers divided between these devices. The information returned to the Gateway from the device is converted into the NAFEM protocol and sent to the SNMP Manager or to the Web browser. The Trivial File Transfer Protocol (TFTP) is used when program updates are sent to the Gateway or to a device capable of flash re-programming.

Network Services

The NAFEM Gateway supports DHCP client, AutoIP, and static IP for address assignment. Normally you will not need to make any changes. The user is able to configure preferences as to which services are used if available. Intelligence is employed within the Gateway to revert to backup IP assignment methods if the primary method is unavailable.

Ethernet Gateway Architecture



Ethernet Wiring

Connect the RJ-45 Ethernet jack to a Hub or Switch with standard CAT5 cable. The Gateway is a 10BaseT device, so a switch is the best solution for a multi-speed network. The device can be connected directly to a computer's Ethernet jack with a crossover cable.

Authentication and registration

Authentication and registration of the Gateway to the Ethernet is accomplished via a DHCP Client to a system DHCP service if available. This may take up to 1 minute. The result of the DHCP method will define the device's Internet Protocol address, SubNet mask and Default gateway. The Microsoft AutoIP scheme is employed to address possible networking environments where DHCP services are not available.

The Ethernet interface is designed to work without user intervention on most networks. Just connect to an Ethernet network and browse the device. In order for the Gateway to communicate over an Ethernet network, an address must be established and registered.

Program Upgrades for Connected Devices

Internal TFTP client protocol services will provide program upgrades over the network communications port to a system TFTP server. This provides support for:

- Flash update of Gateway code
- Flash update of Modbus RTU code for products that support field firmware update
- File Transfer of multiple register RTU

Alarm Notification

This functioning and behavior is provided by the internal Firmware Alarm module and utilizes the Trap function of the SNMPv1 Agent. Alarms are defined within the NAFEM PROTOCOL USER MANUAL along with the behavior for acknowledgement and retries. All alarms specified and enabled by the user follow this scheme. The Alarm notification supports:

- Clear *Reset Alarm Action*
- Bypass *Disable Alarm Action*

Supervisory Control and Data Acquisition

The Poll Engine reads parameters from the connected equipment and records the readings into the Data Value of the assigned NAFEM Object Group for retrieval and review by the user via the SNMP Agent services. Upon the modification of parameters via the SNMP v1 Agent by the user, the Poll Engine will write parameters to the connected device.

Poll Engine

When the Poll Engine attempts to read from a remote device and an error occurs, the Poll Engine will immediately retry to read from the remote device. If all retries have failed, then the Poll Engine shall increment the protocol read message failure count by one and attempt the next poll attribute. If all active attributes for a single device fail, then the poll engine shall disengage the device from the poll cycle.

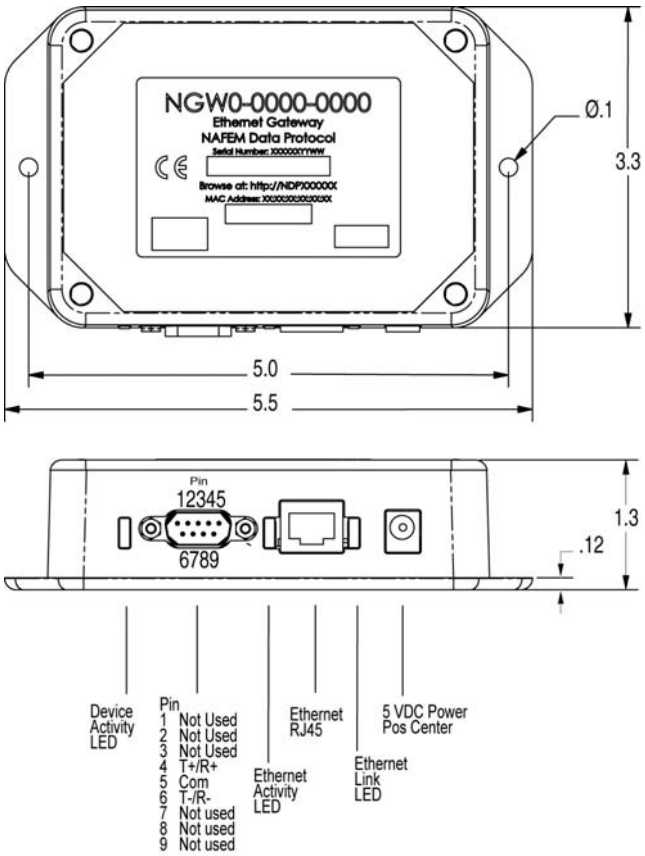
When the Poll Engine attempts to write to a remote device and an error occurs, the Poll Engine will immediately retry writing to the remote device. If all retries have failed, then the Poll Engine shall increment the protocol write message failure count by one and reset the programmable attribute for the write operation to the previous write value.

Device Protocol

Register based MODBUS RTU device protocol is used for communication between remote devices and the Gateway with the Gateway acting as the communication MASTER. The following functions are supported:

- Register Read
- Register Write
- Block Read
- Block Write
- Diagnostics
- Loop Back

Installation & Wiring



Dimensions are in inches

Connect the T+/R+ to the devices' T+/R+ terminals, the T-/R- to the devices' T-/R- terminals and the Com to the devices' Com terminal in a daisy chain fashion.

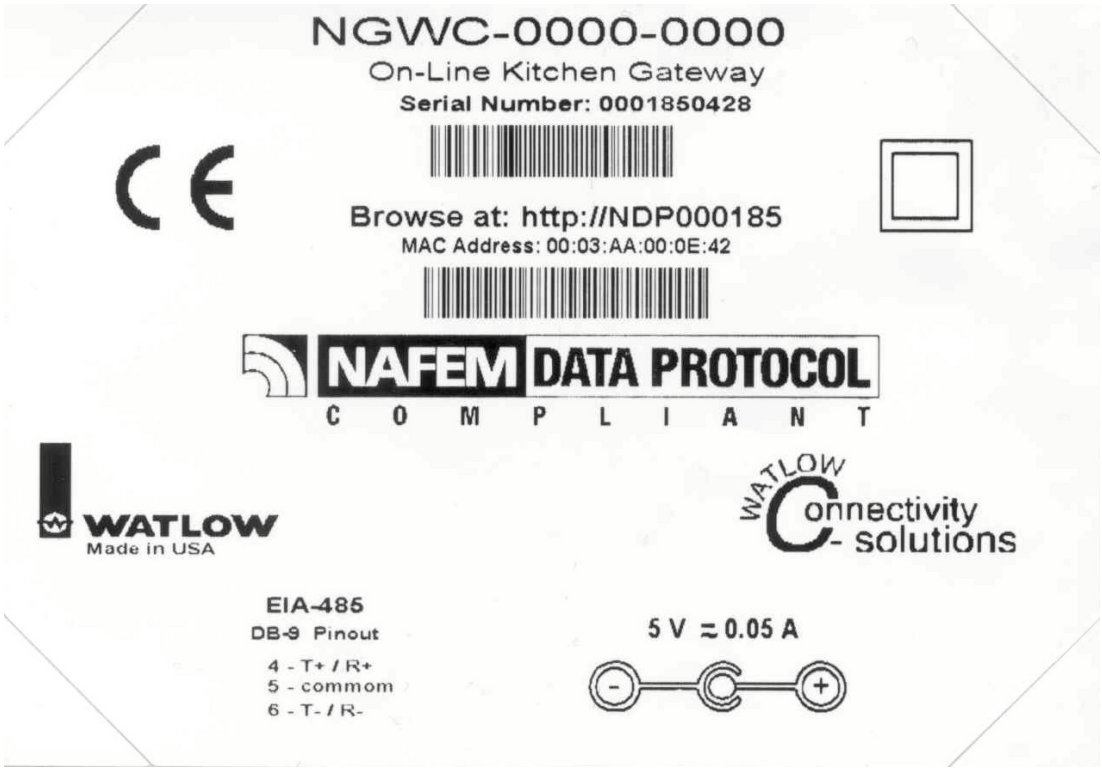
Plug in an RJ45 Category 5 straight wired cable to an Ethernet switch / hub.
If you are connecting directly to a PC, you will need to use an RJ45 Category 5 cross-wired cable.

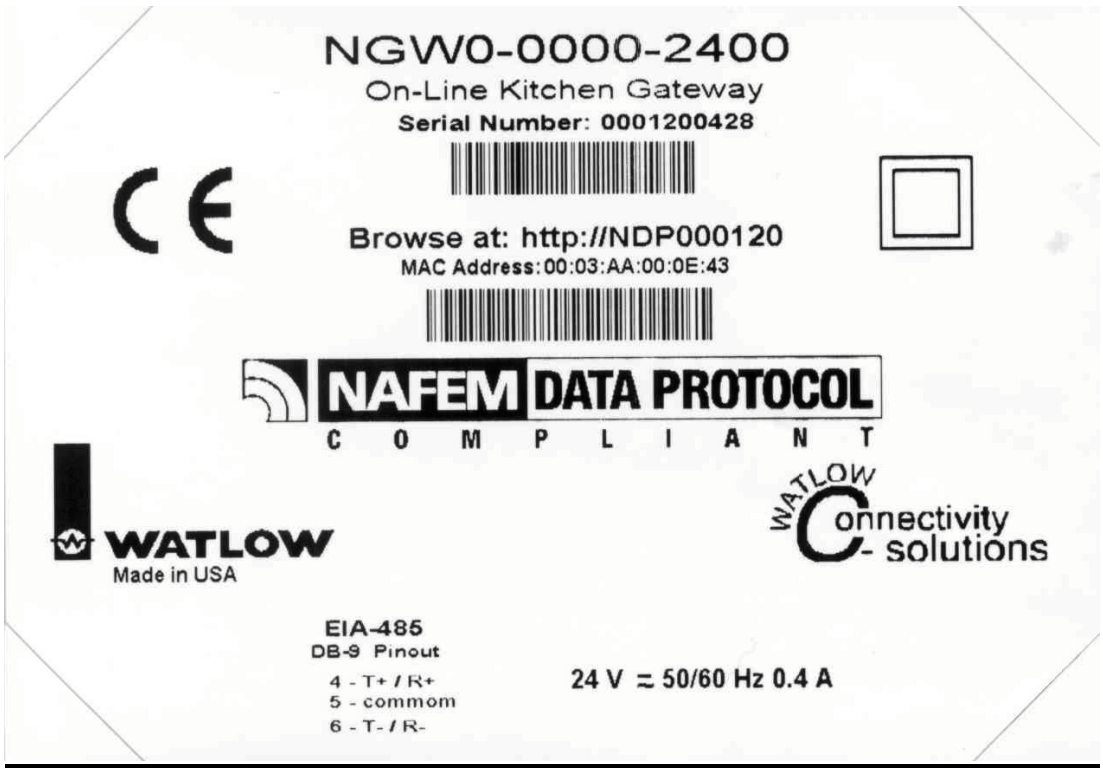
For Models NGWC-0000-0000 and NGW0-0000-0000, connect the 5-volt power supply plug to the power supply jack. The inner terminal of the coaxial plug is positive.

For Models NGWC-0000-2400 and NGW0-0000-2400, connect the 24-volt power supply plug to the power supply jack. The inner terminal of the coaxial plug is positive.

Note: Use proper ESD handling procedures when making connections to unit. A UL Class 2 and CE approved power supply is required for compliance.

Sample Decals





Configuration Overview

Two services are available within the Gateway or configuration. Either an HTTP browser or an MIB browser may be used for configuration. An MIB browser and compiler is available from MG-SOFT Corp. @ web site http://www.mg-soft.com.

Using a Network Browser Client with the on board Web Server provides the ability to configure the NAFEM Gateway. Various HTML formatted pages are embedded within the device to provide a Graphical User Interface (GUI) for configuration and review of the Gateway device.

A maximum of 8 devices may be connected to the EIA-485 port of the NAFEM Gateway. You will need to configure the baud rate and Modbus addresses of the devices from the face of the devices. The choices for baud rate are either 9600 or 19200. All devices must be set to the same baud rate. The addresses can be set from 1 to 247. Each device must have a unique address.

Getting Started

Perform these steps;

1. Connect the NAFEM Gateway to your computer's Ethernet port using a cross wired RJ45 cable or connect the Gateway to a hub or network using a straight wired RJ45 Category 5 cable. The Gateway is limited to a 10BaseT connection and will not work on an Ethernet port set for 100BaseT only. Use of a 10/100 hub will overcome this issue if your PC has only a 100BaseT port.
2. Wire the temperature devices to the Gateway's EIA-485 port.
3. Attach the appropriate power supply (5-volt or 24-volt DC) to the Gateway. The center pin is positive.
4. Configure each device to the same baud rate (9600 or 19200) from the front panel of the device. Set each device's Modbus address to a unique number. As an example, set the first device to address 1, the second to address 2 and so on.
5. Power up the Gateway, devices and PC.
6. Start your Internet browser. Enter the TCP/IP address of the Gateway into the browser's address field. Two different addresses may be used to access the Gateway. Either NDPxxxxxx, where xxxxxx is the first six digits of the serial number, or WATxxxxxx, where xxxxxx is the last six digits of the Gateway's MAC address. The MAC address is printed on a decal in the form xx:xx:xx:xx:xx:xx.
7. Select the Configuration, Gateway setup Page.
8. Configure the Serial Channel Entry, Serial Device Entry, and Serial Point Entry indexes.

The Gateway supports DNS client and Netbios name resolution. Configuration information may be entered at the Configuration, Administration, Administration Network page.

Password

Enter Network Password each time.
The default is:
User Name = new
Password = new

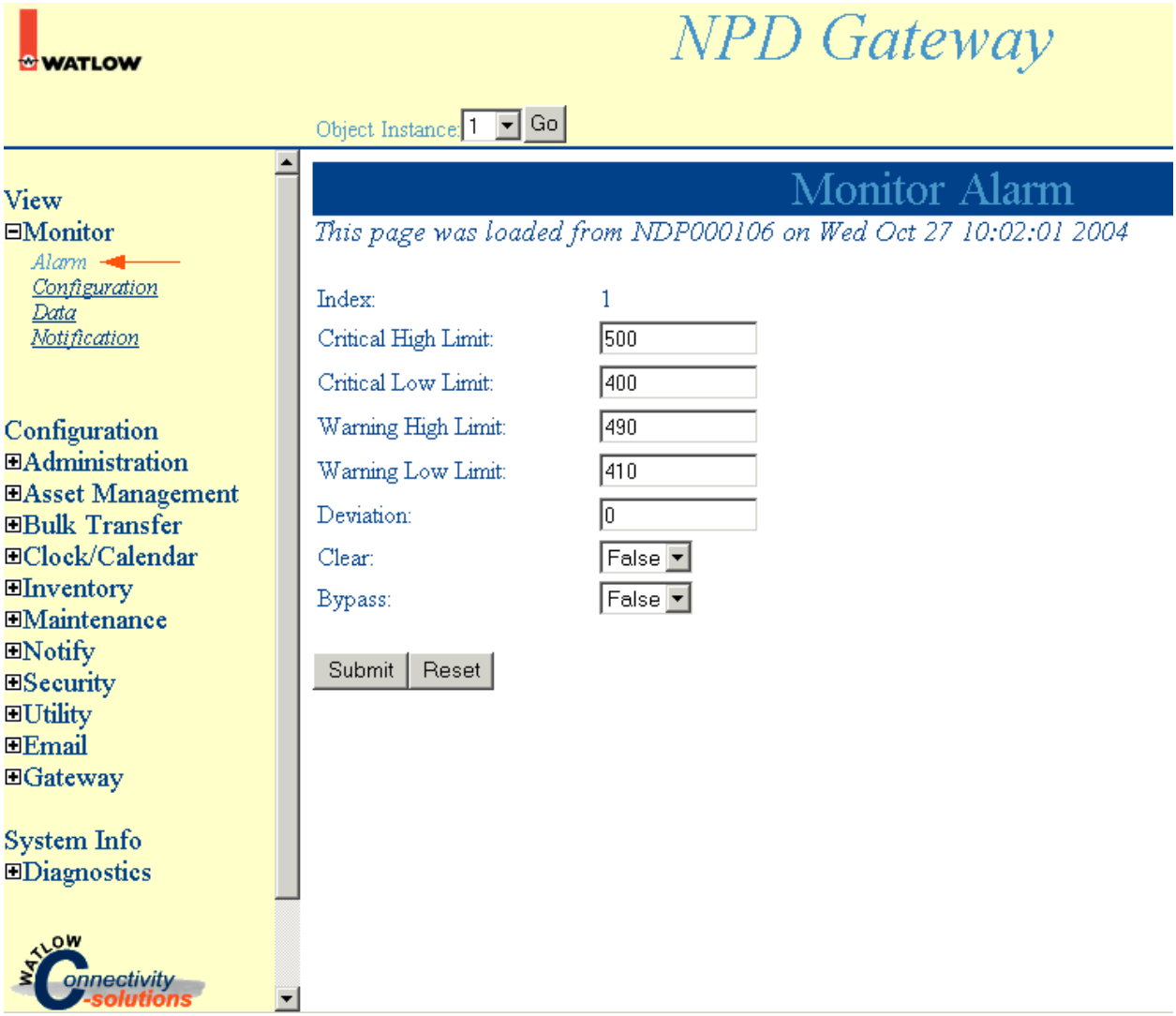
You may change these on the Security User screen.

View

Monitor Alarm

Select Monitor, Alarm to access Monitor Alarm information.

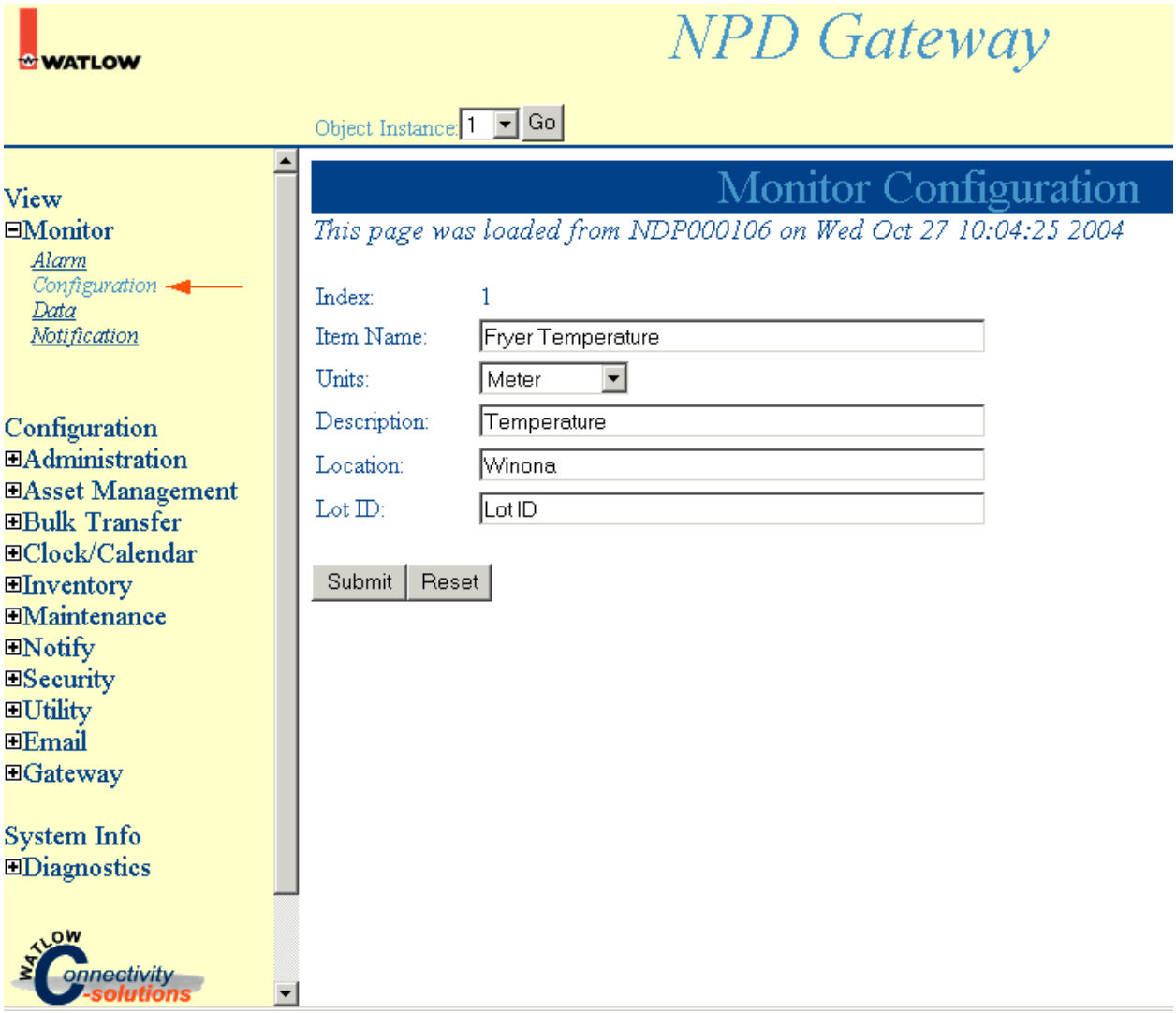
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Monitor Configuration

Select Monitor, Configuration to access Monitor Configuration information.

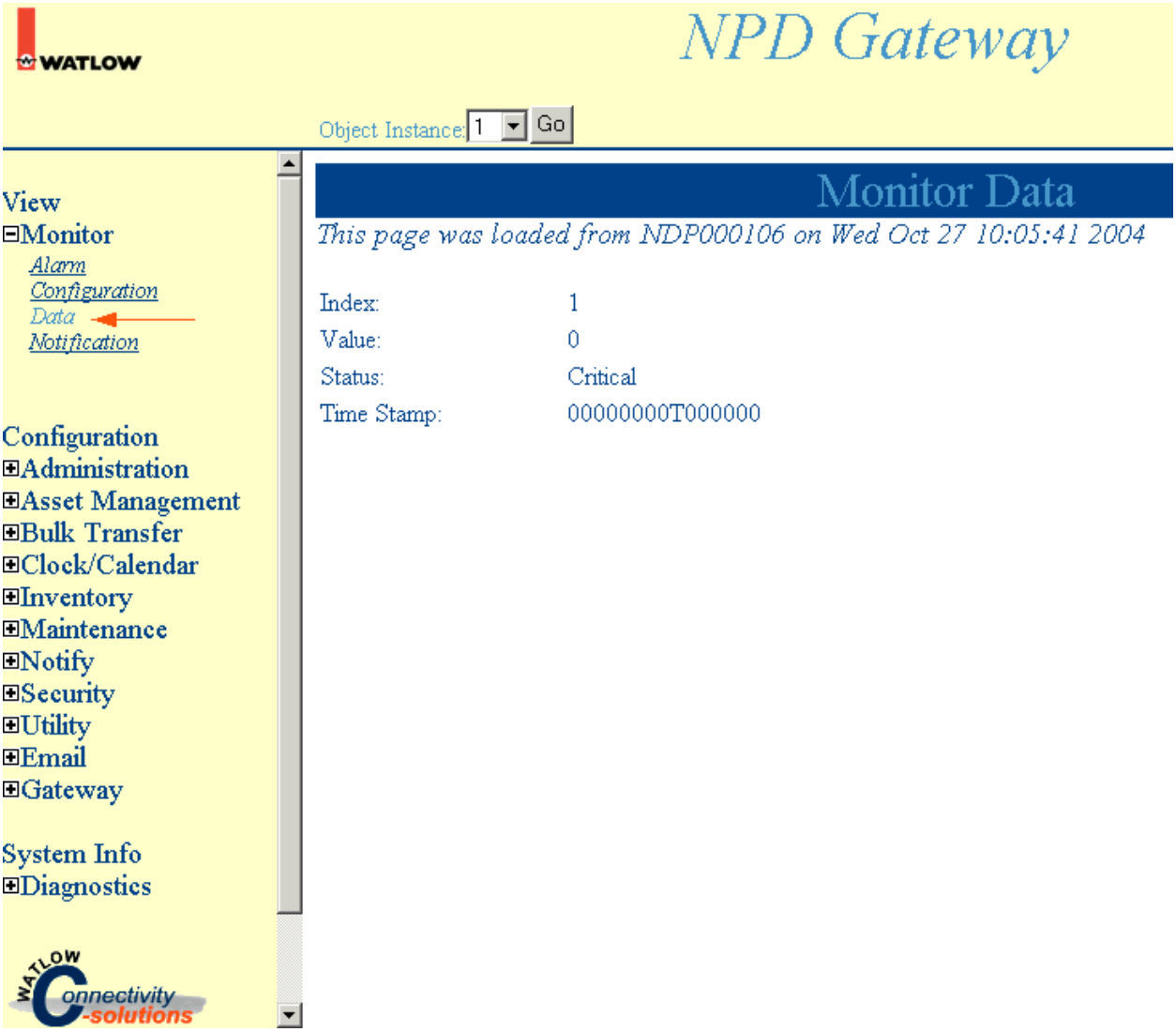
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Monitor Data

Select Monitor, Data to access Monitor Data information.

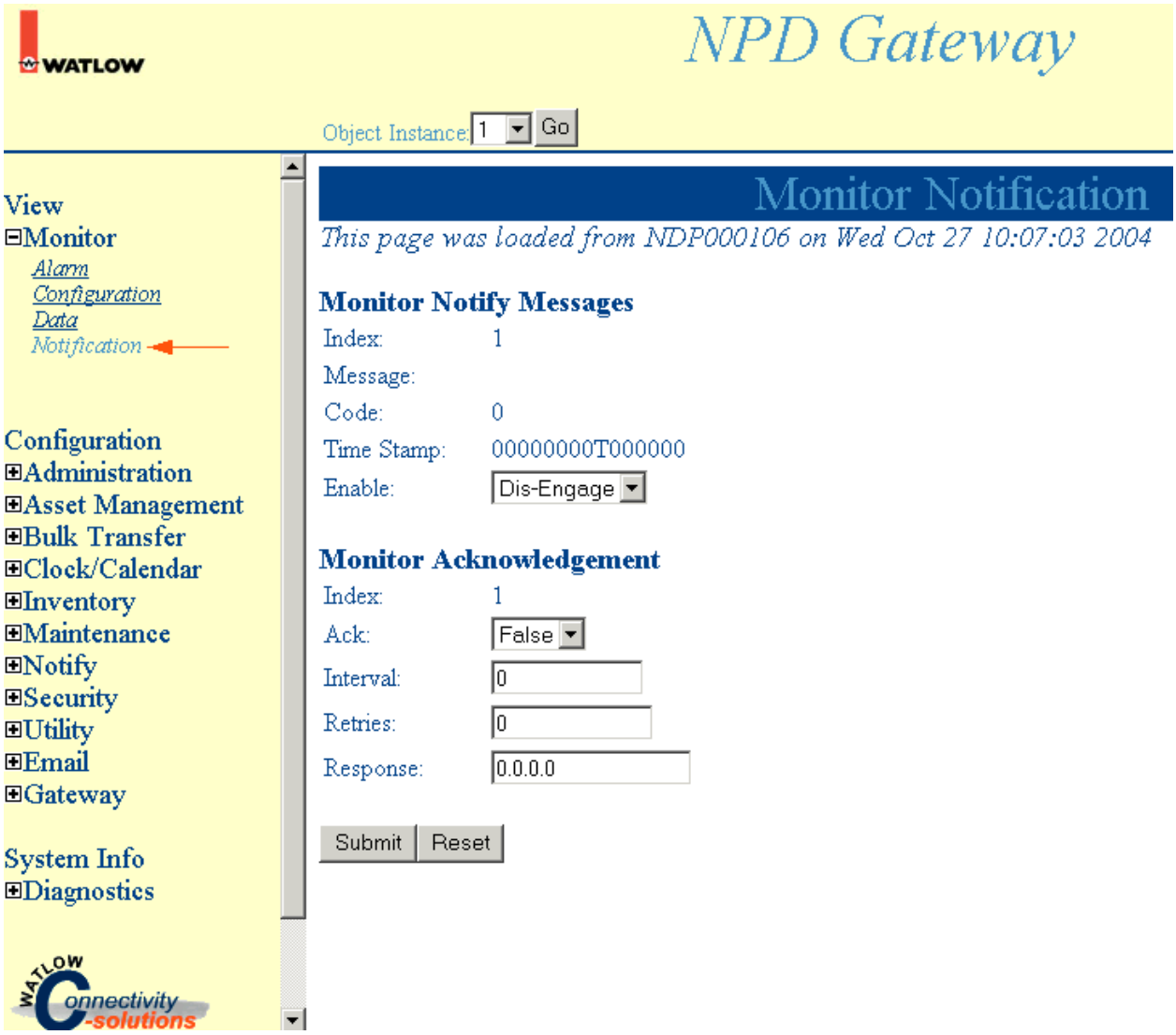
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Monitor Notification

Select Monitor, Notification to access Monitor Notification information.

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.

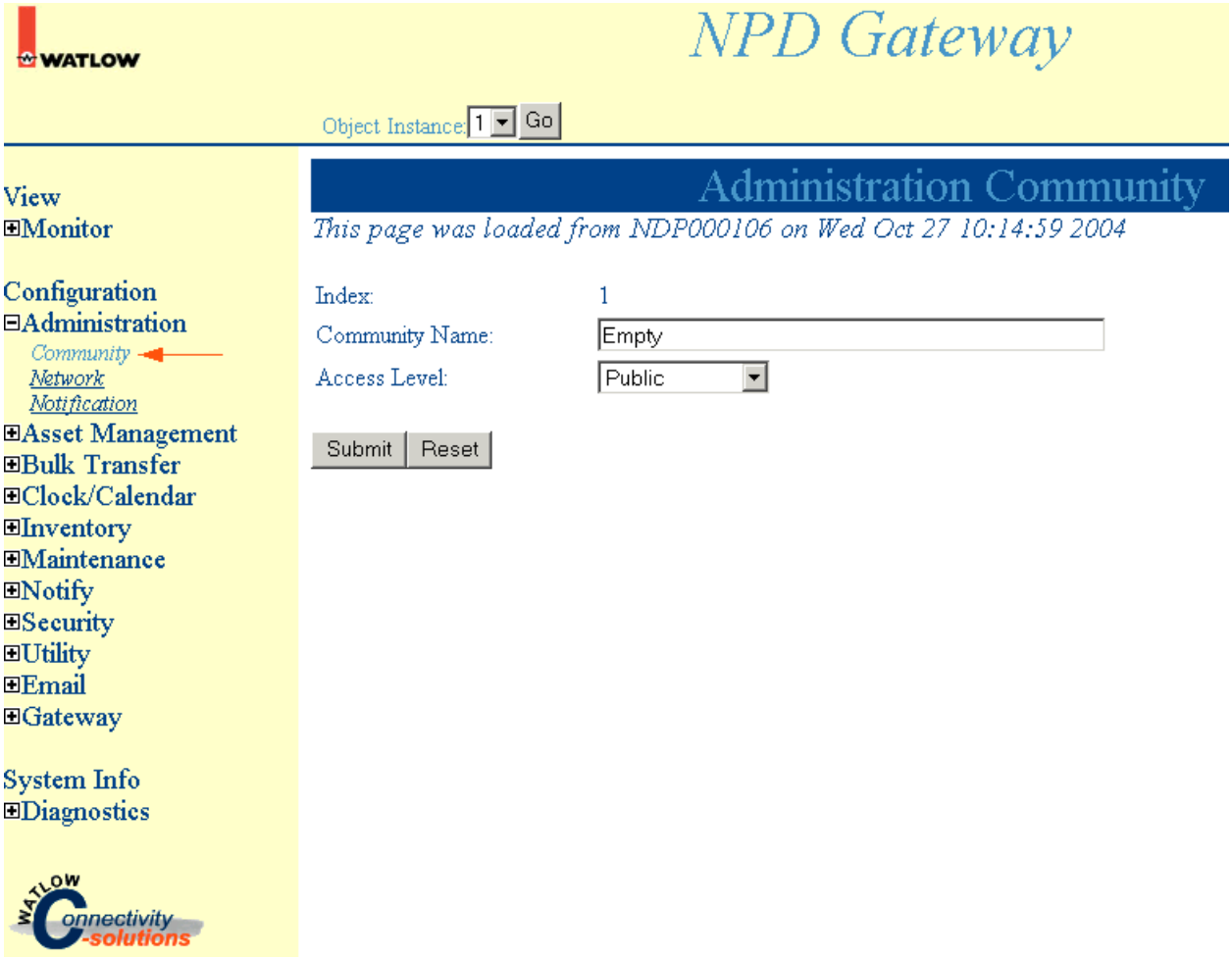


Configuration

Administration Community

Select Administration, Community to access Administration Community information.

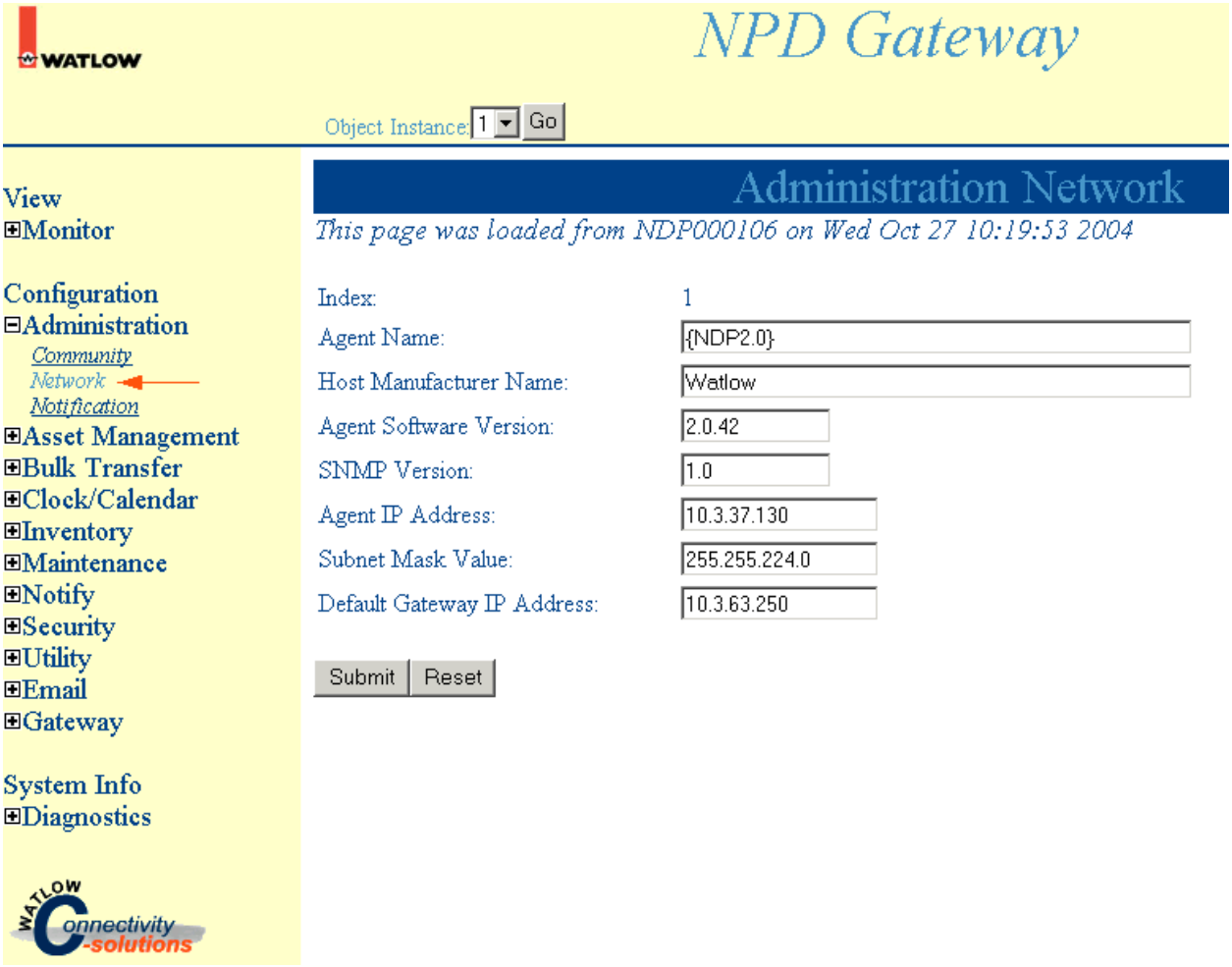
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Administration Network

Select Administration, Network to access Administration Network information.

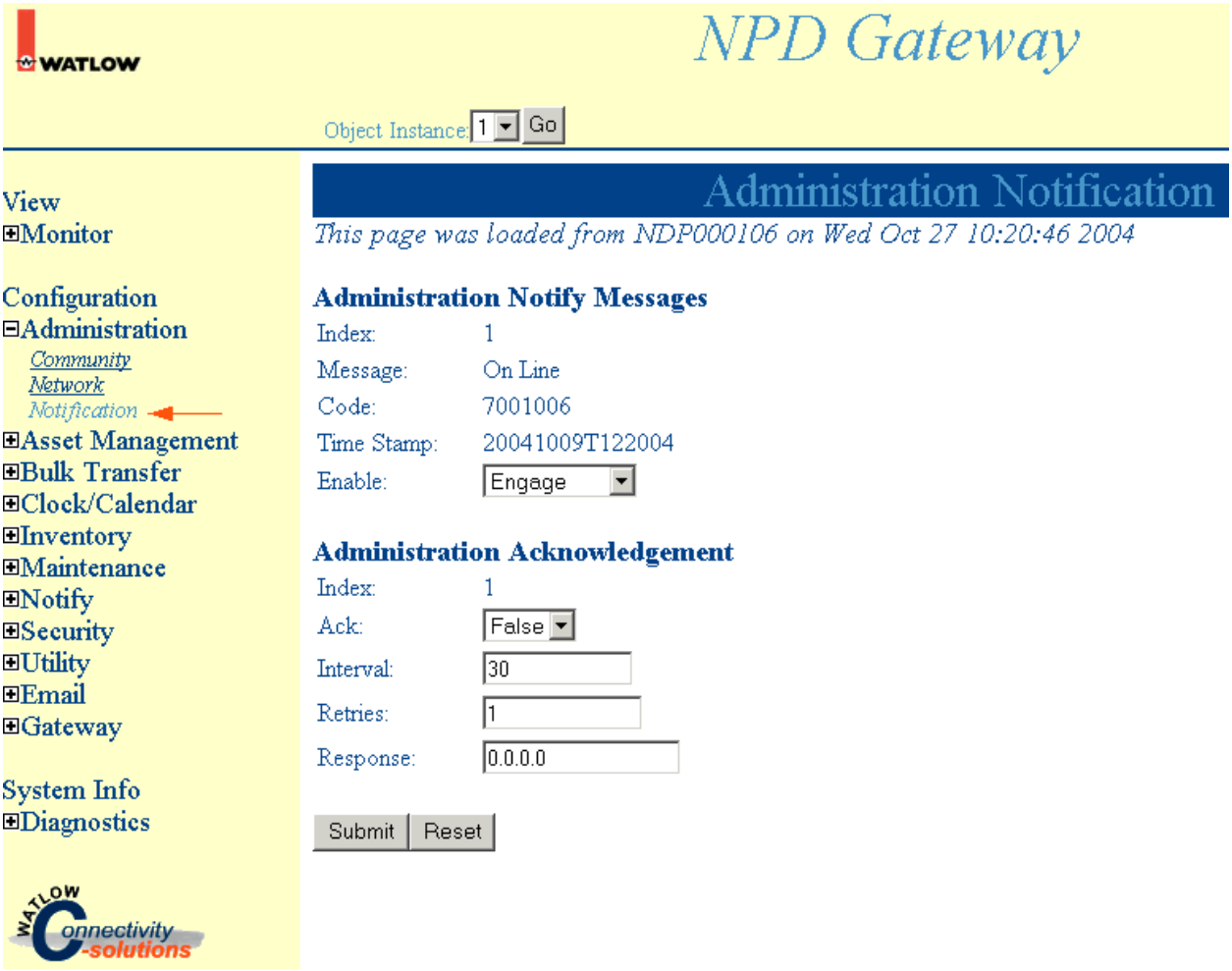
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Administration Notification

Select Administration, Notification to access Notification Network information.

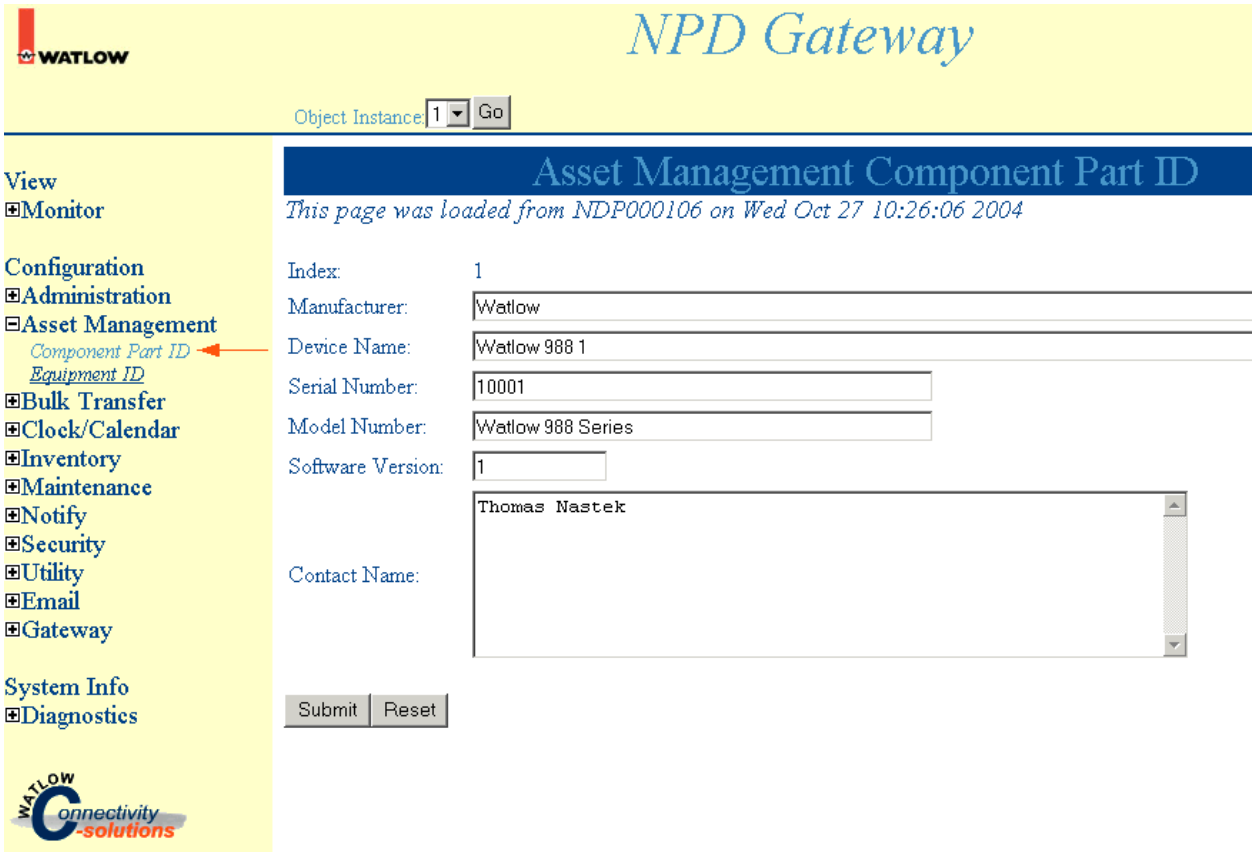
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Asset Management Component Part ID

Select Asset Management, Component Part ID to access Asset Management Component Part ID information.

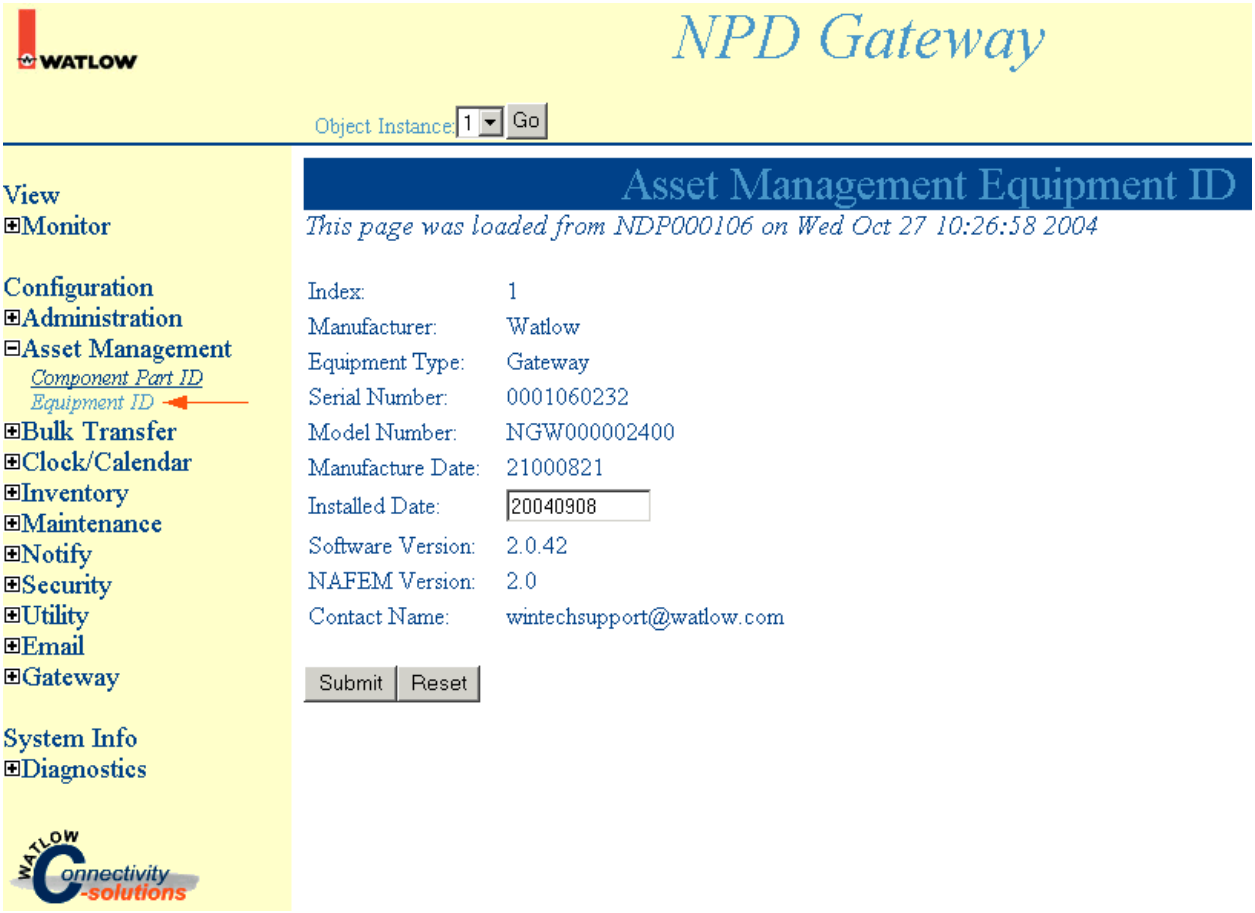
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Asset Management Equipment ID

Select Asset Management, Equipment ID to access Asset Management Equipment ID information.

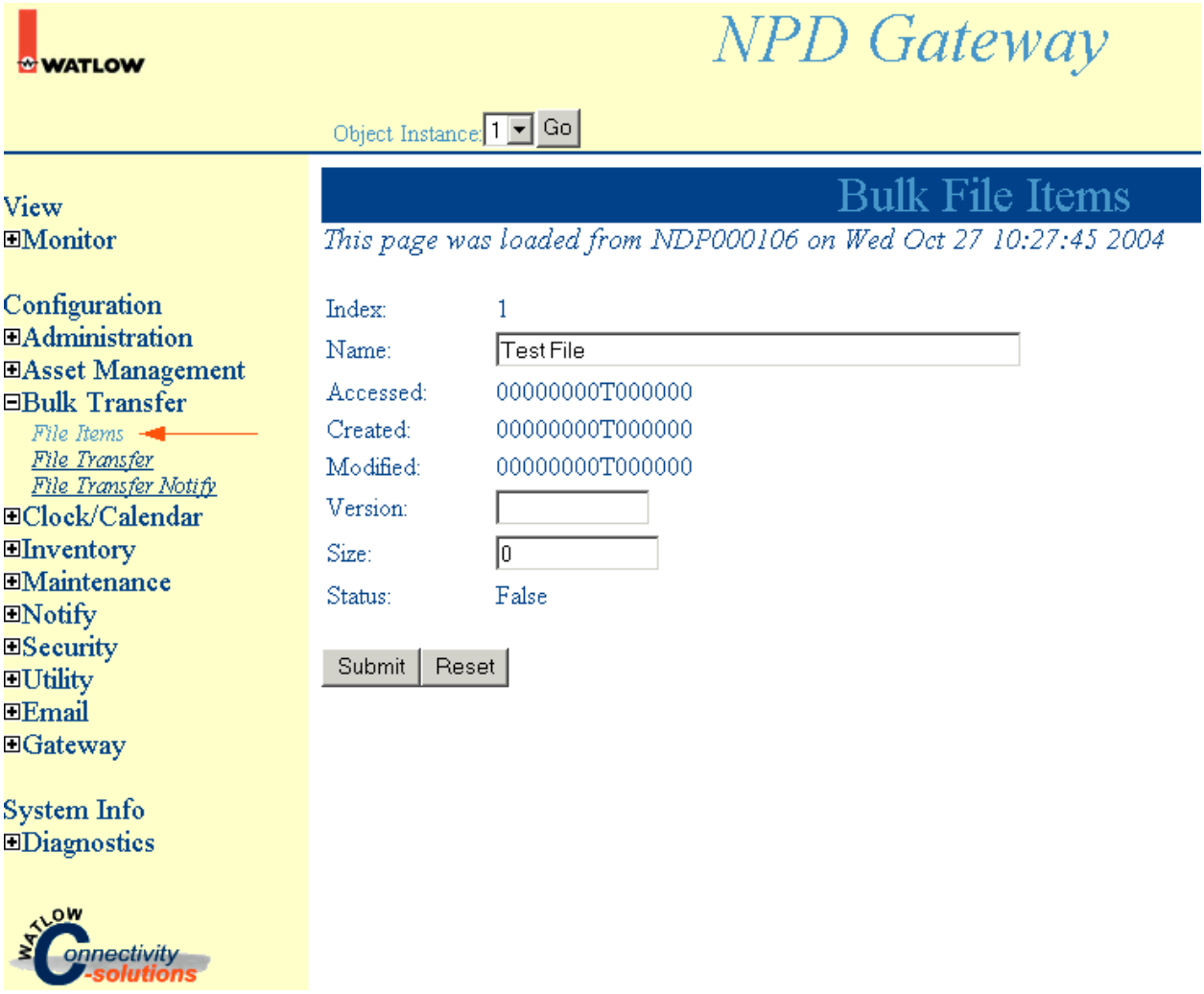
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Bulk Transfer File Items

Select Bulk Transfer, File Items to access Bulk Transfer, File Items information.

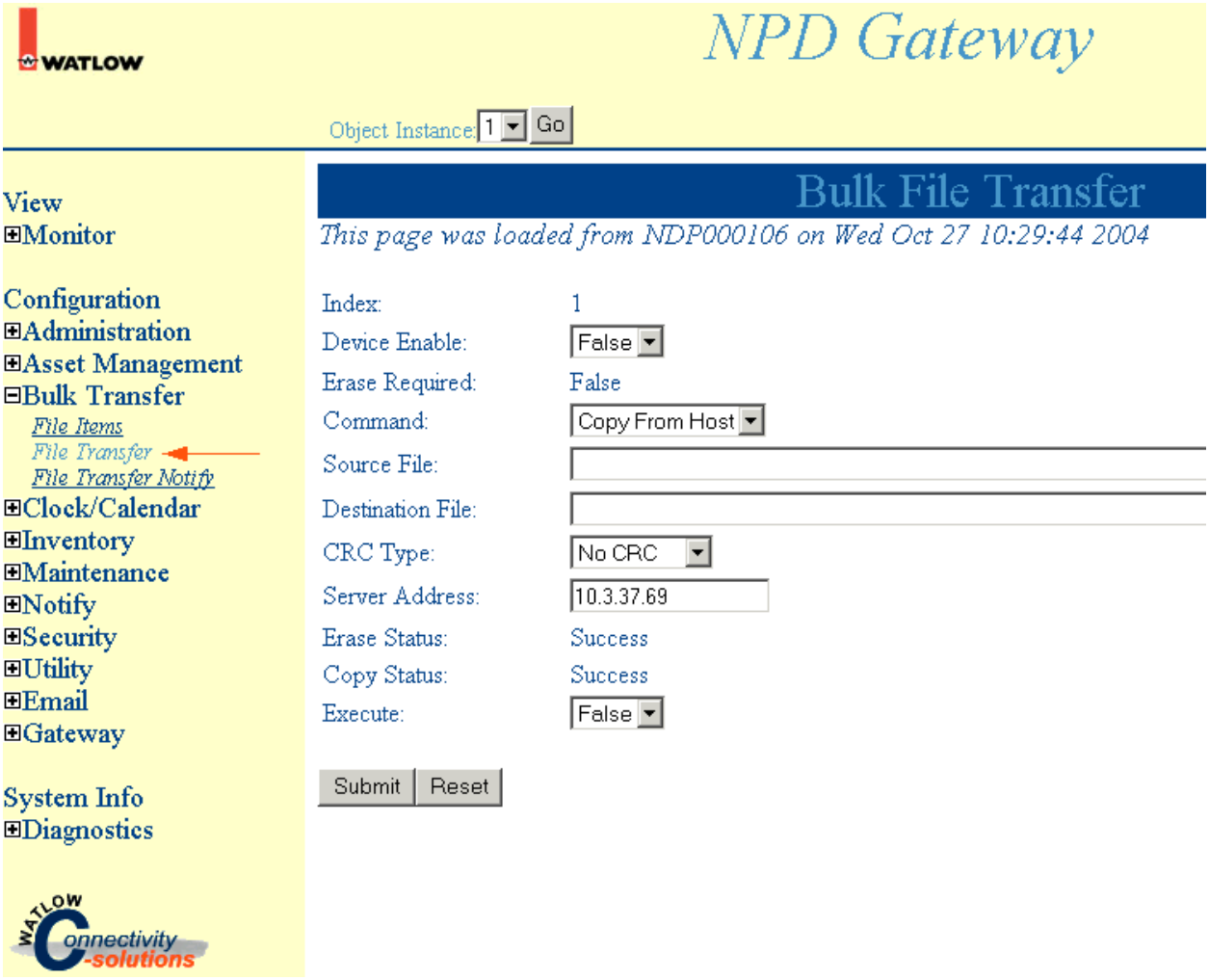
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Bulk Transfer File Transfer

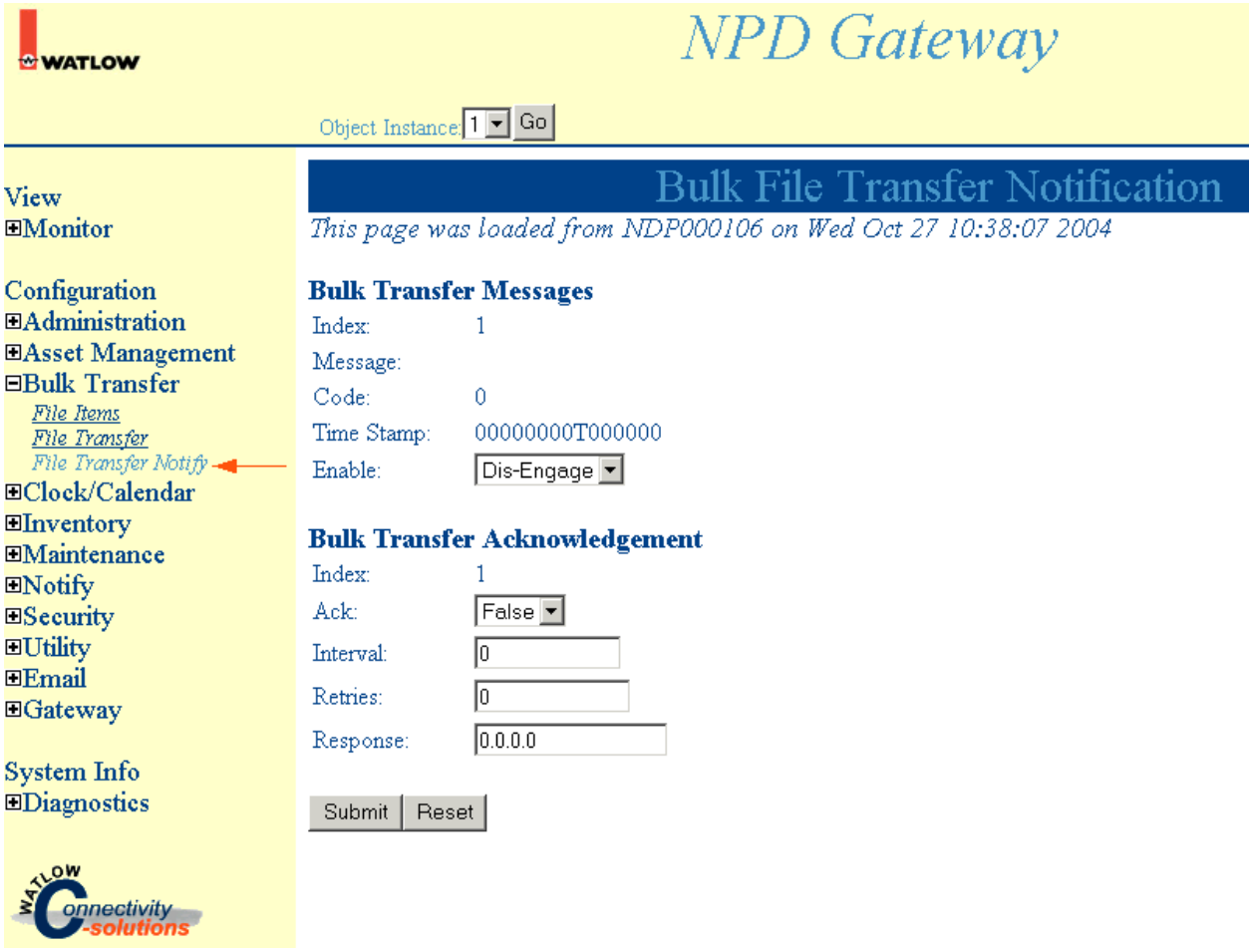
Select Bulk Transfer, File Transfer to access Bulk Transfer, File Transfer information.

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



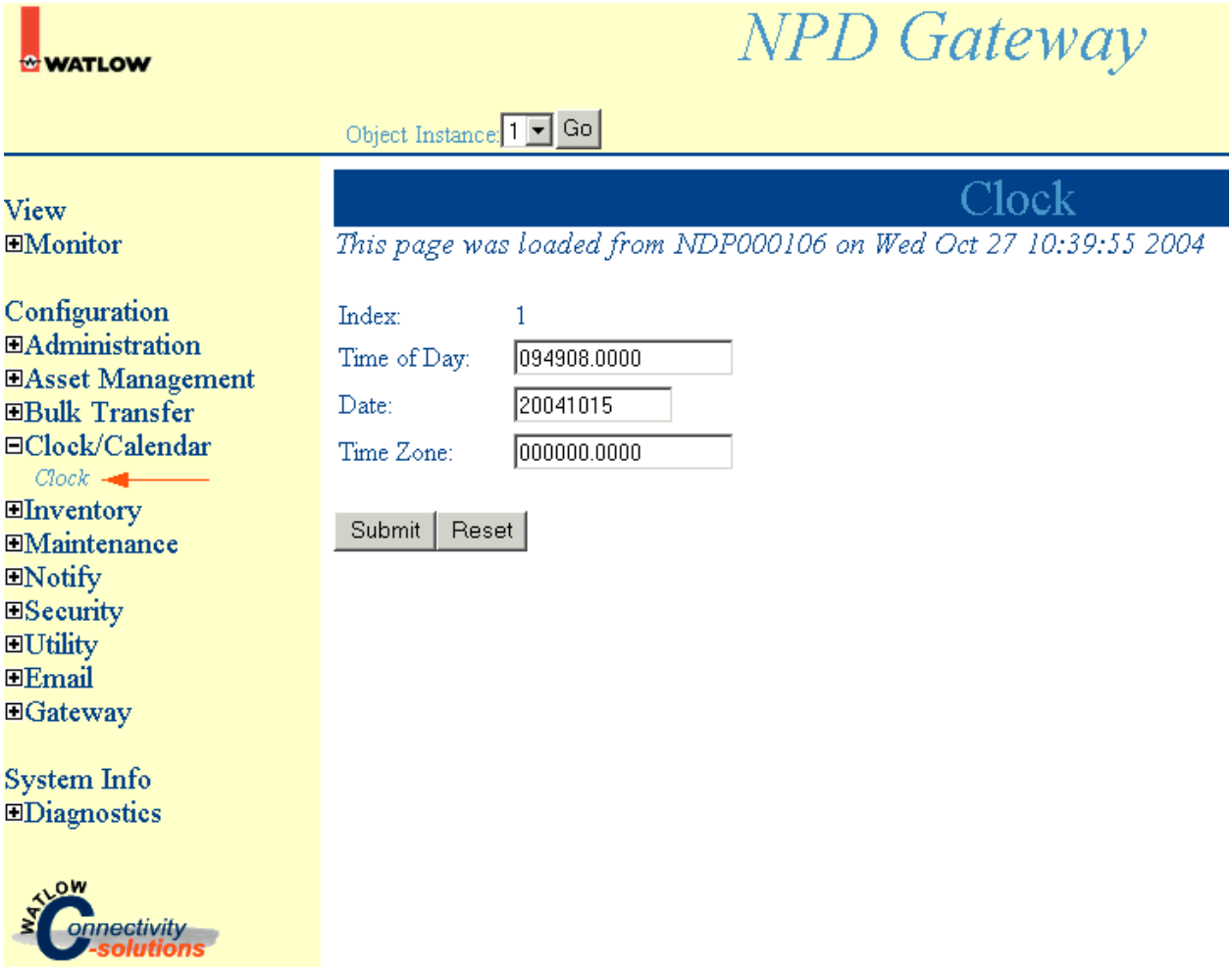
Bulk File Transfer Notification

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



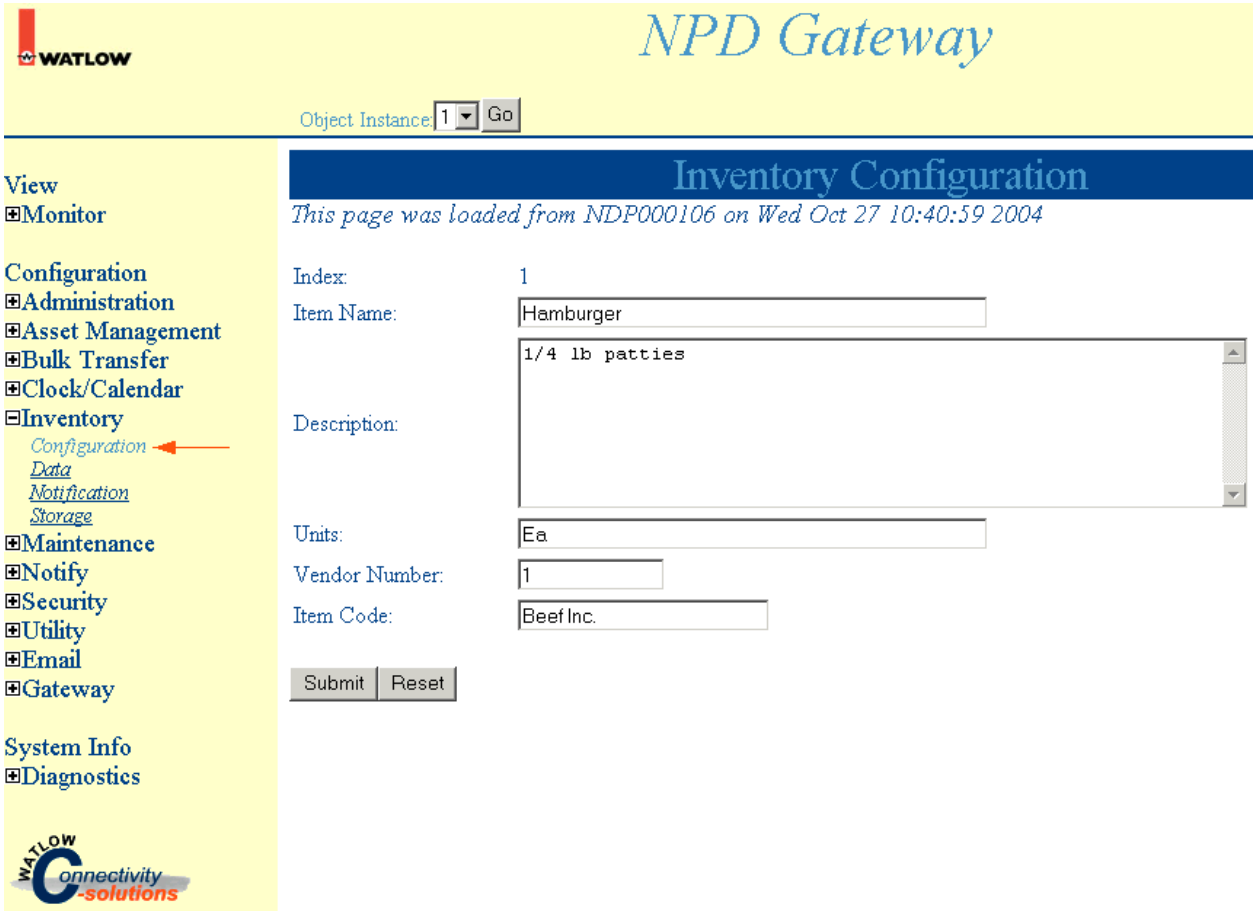
Clock/Calendar Clock

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



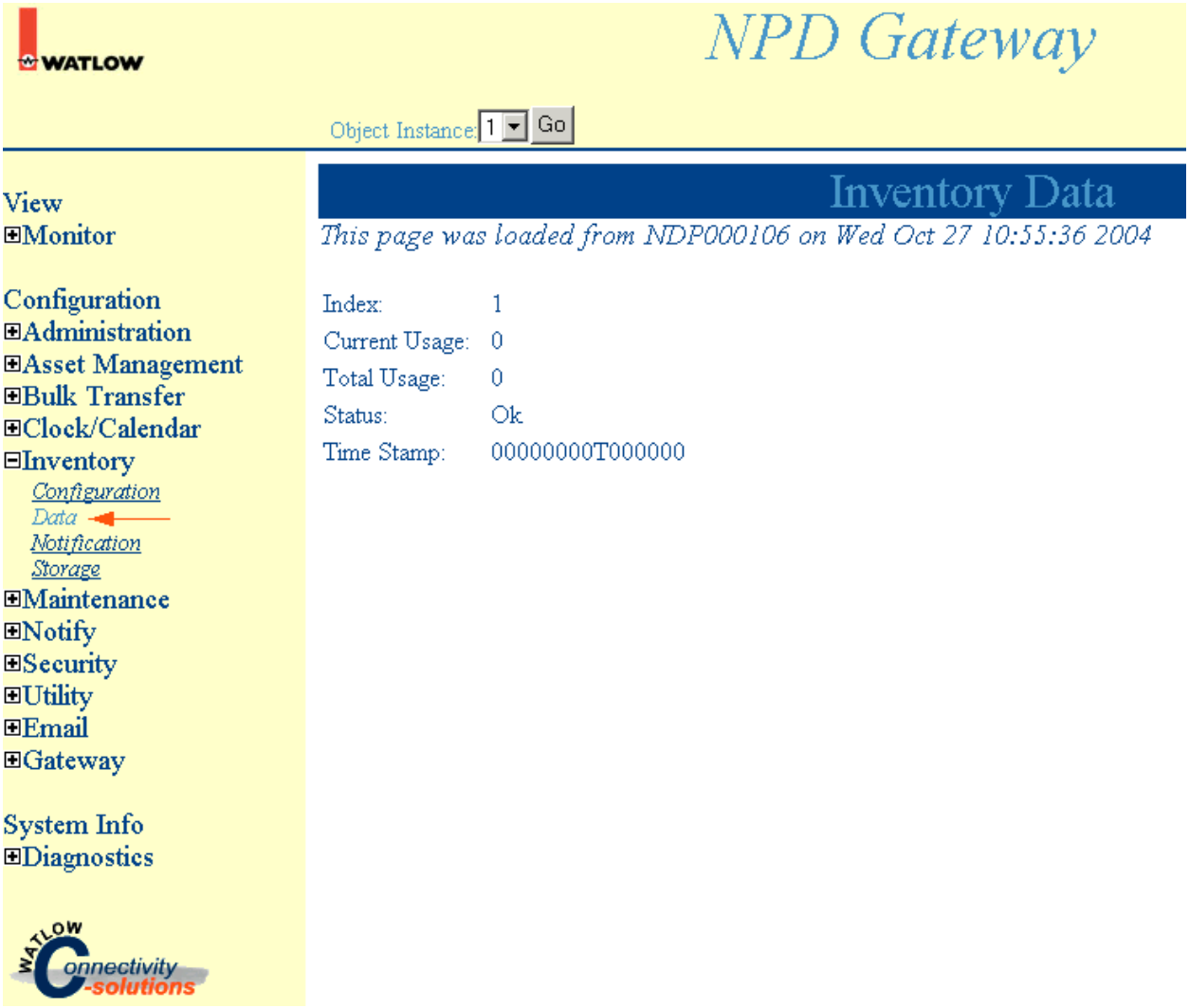
Inventory Configuration

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



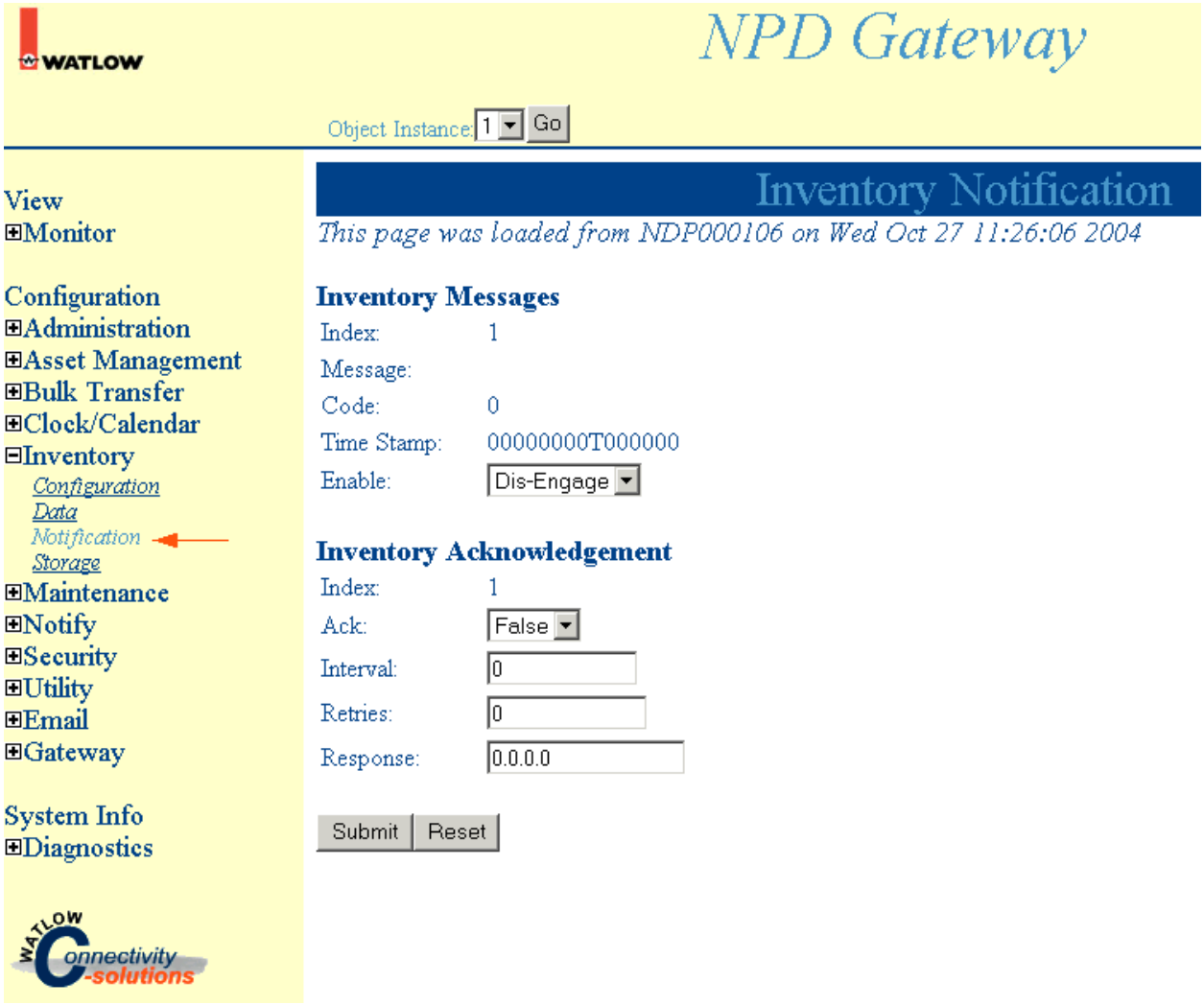
Inventory Data

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



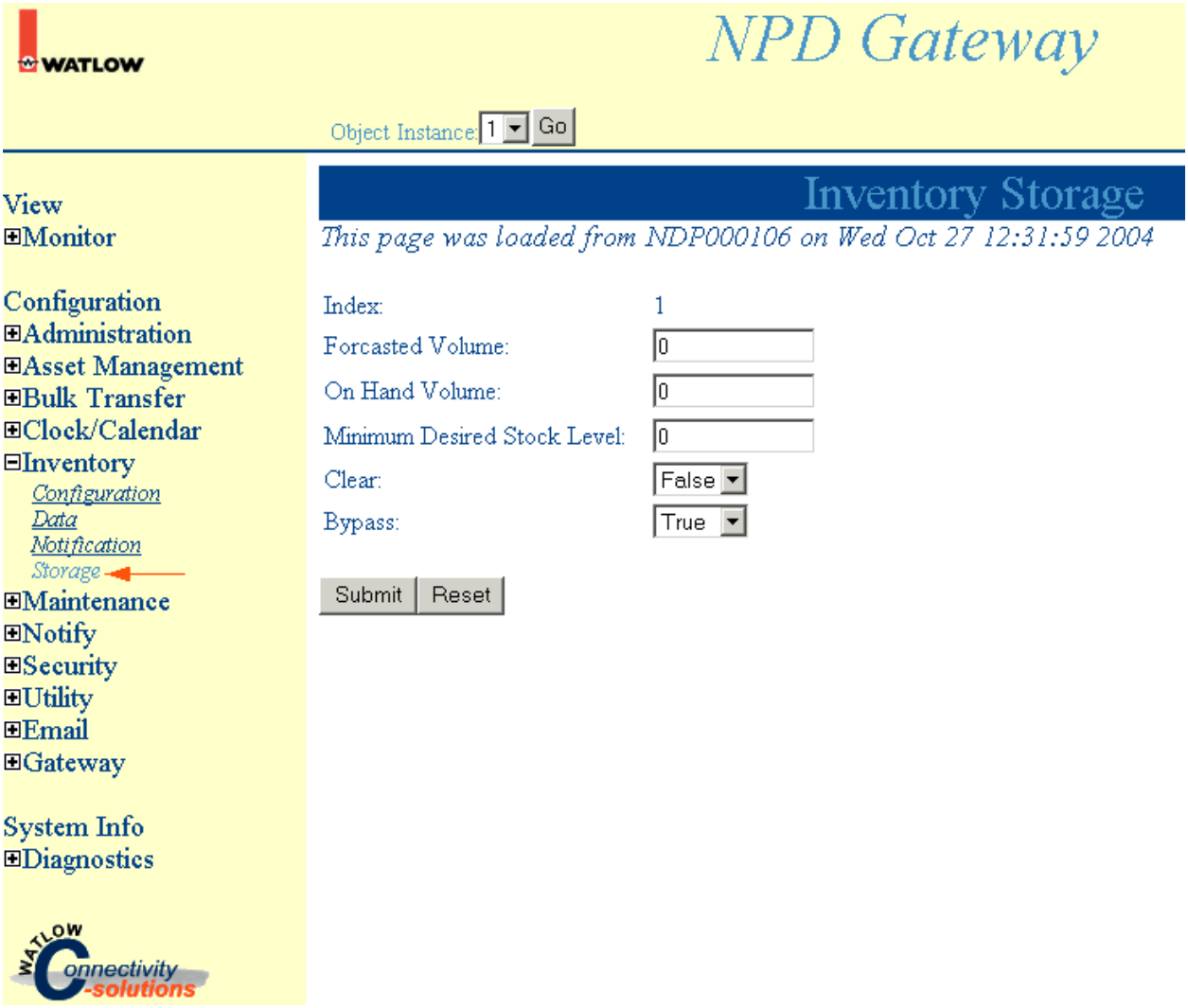
Inventory Notification

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



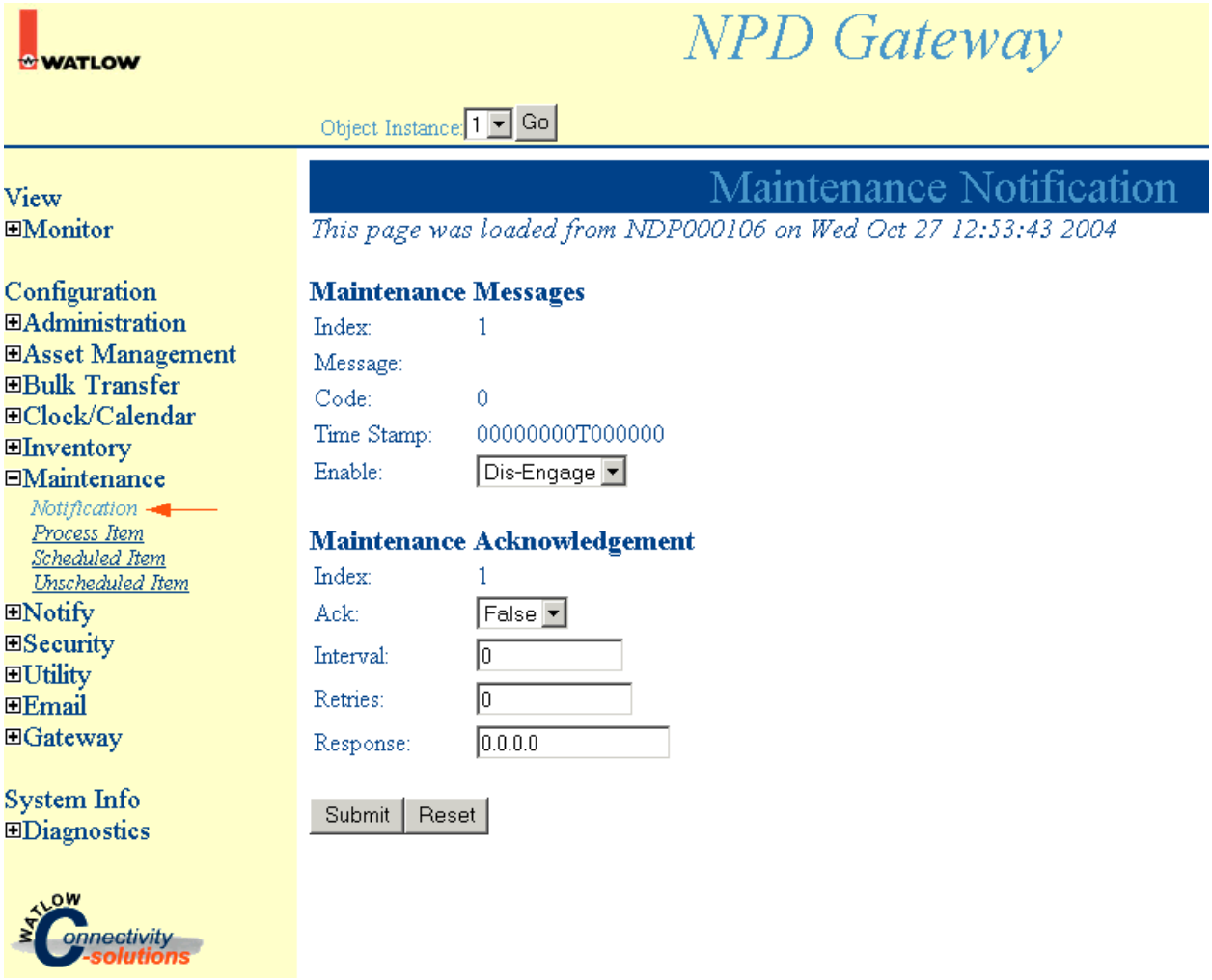
Inventory Storage

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



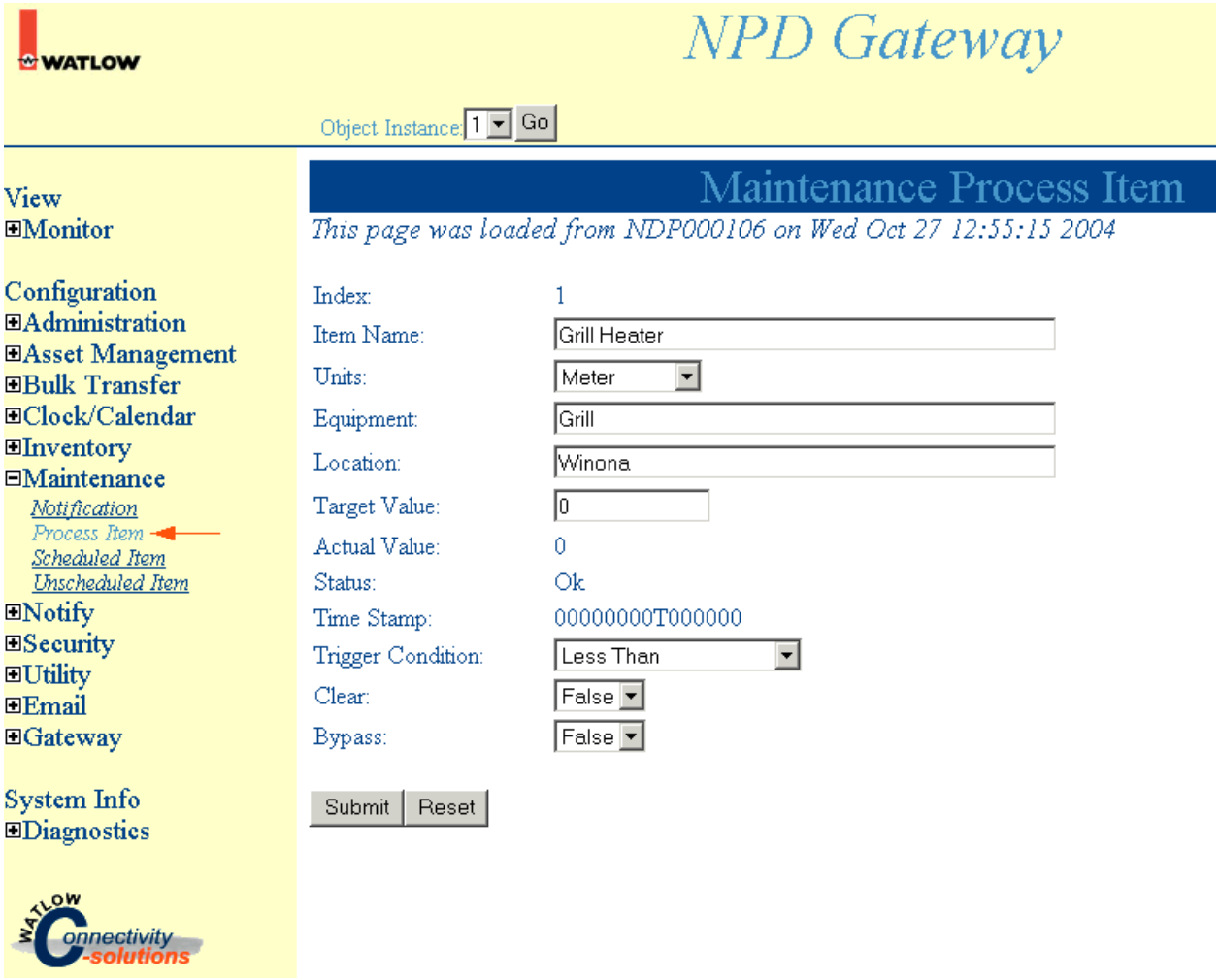
Maintenance Notification

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



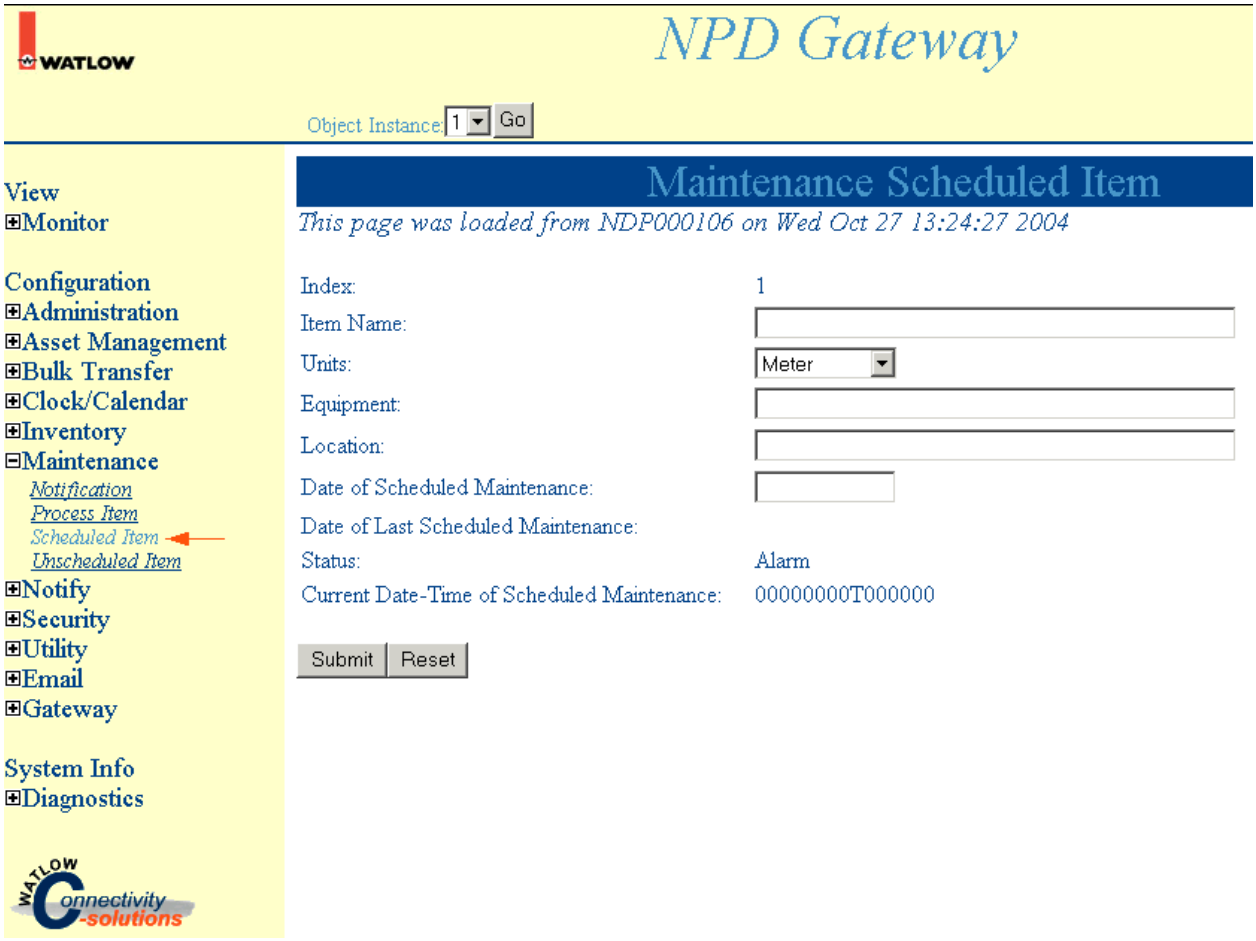
Maintenance Process Item

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



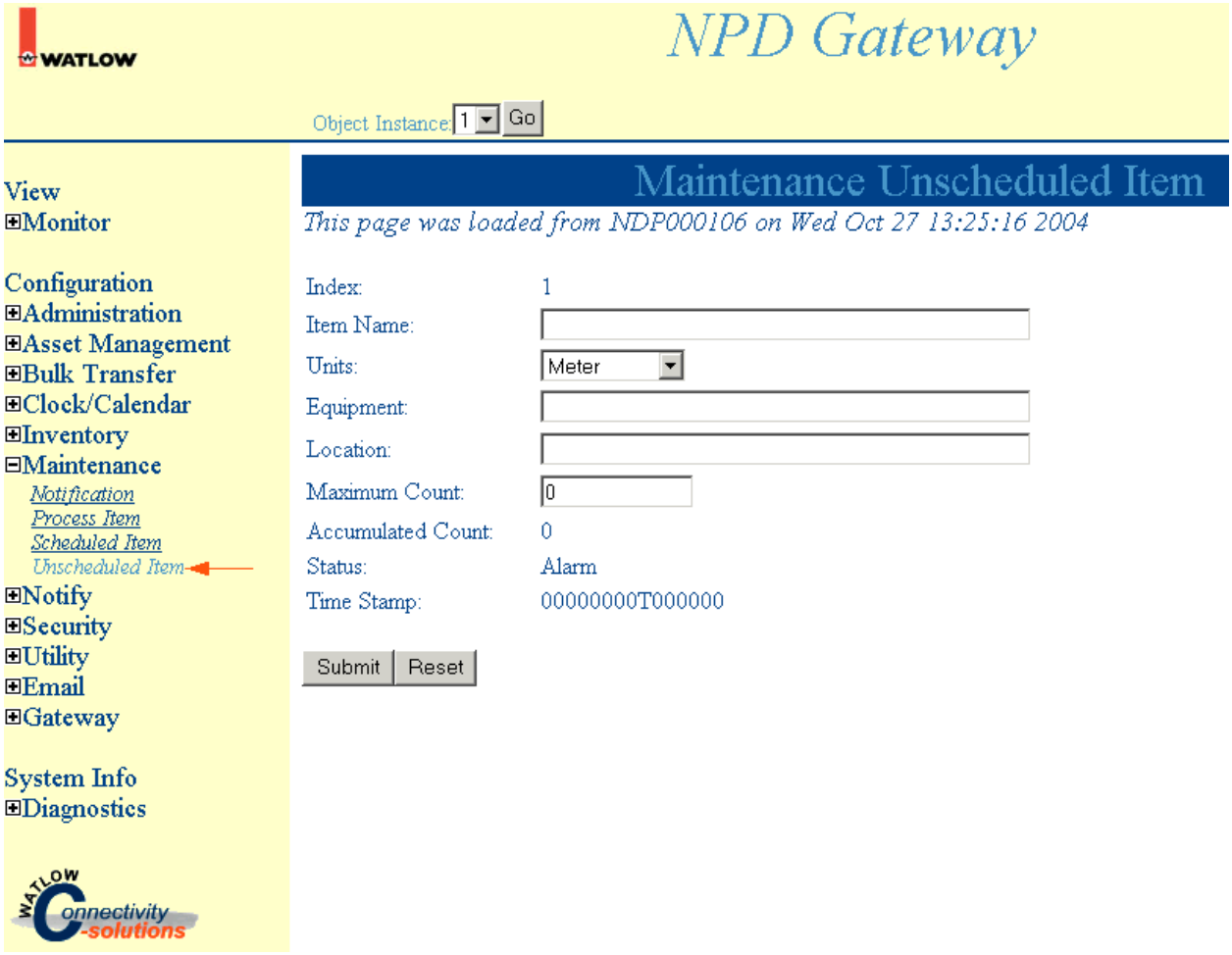
Maintenance Scheduled Item

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



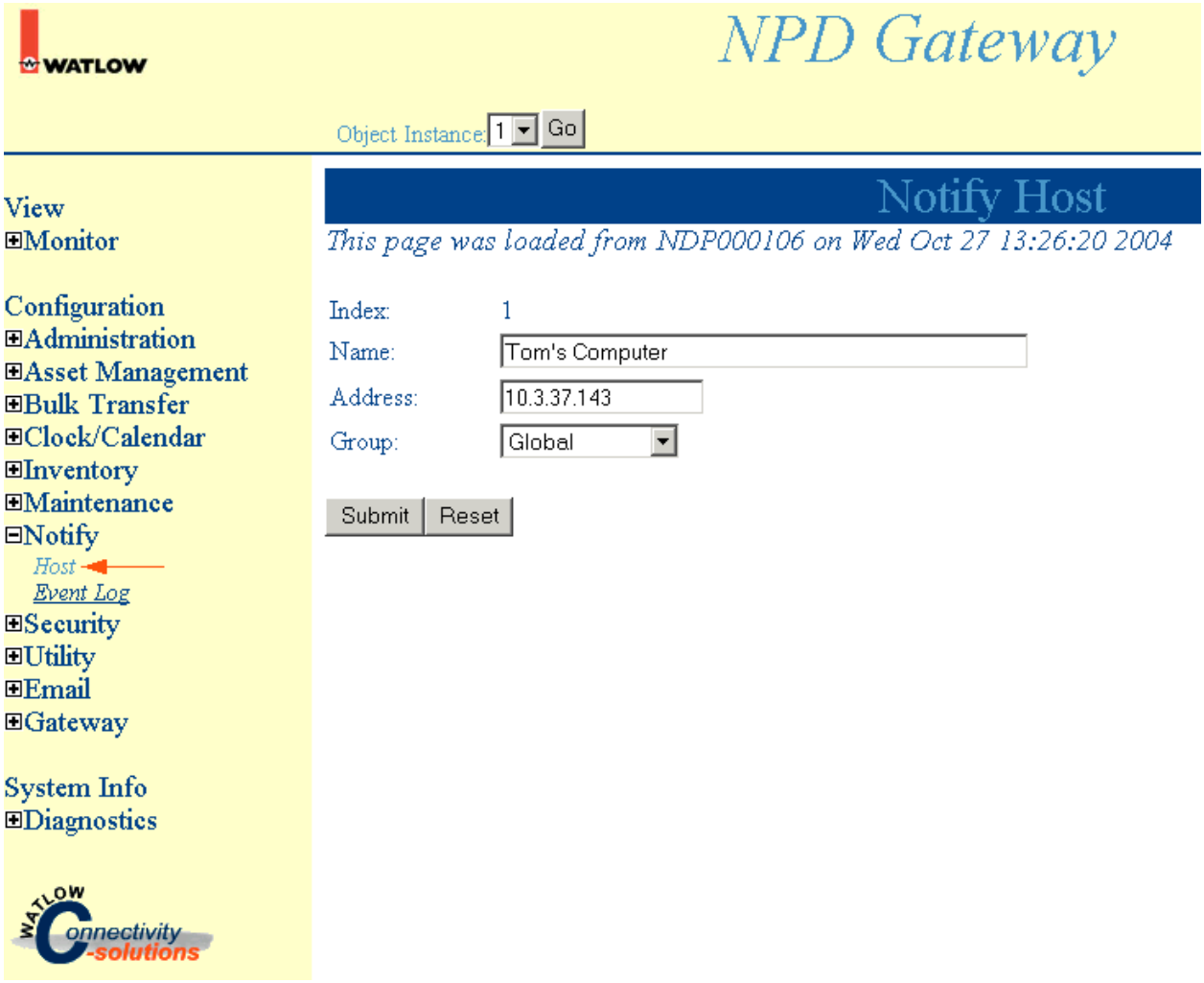
Maintenance Unscheduled Item

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



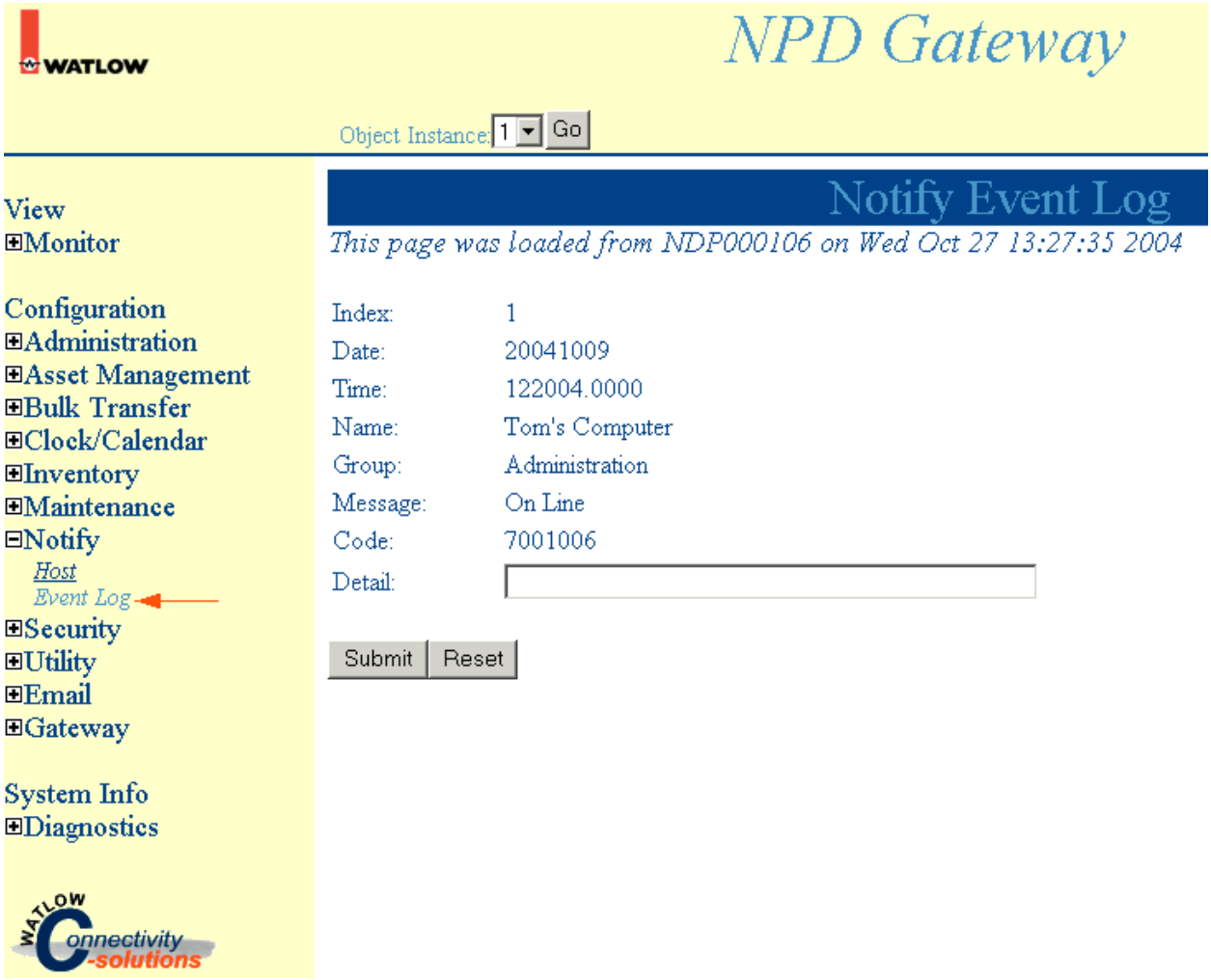
Notify Host

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



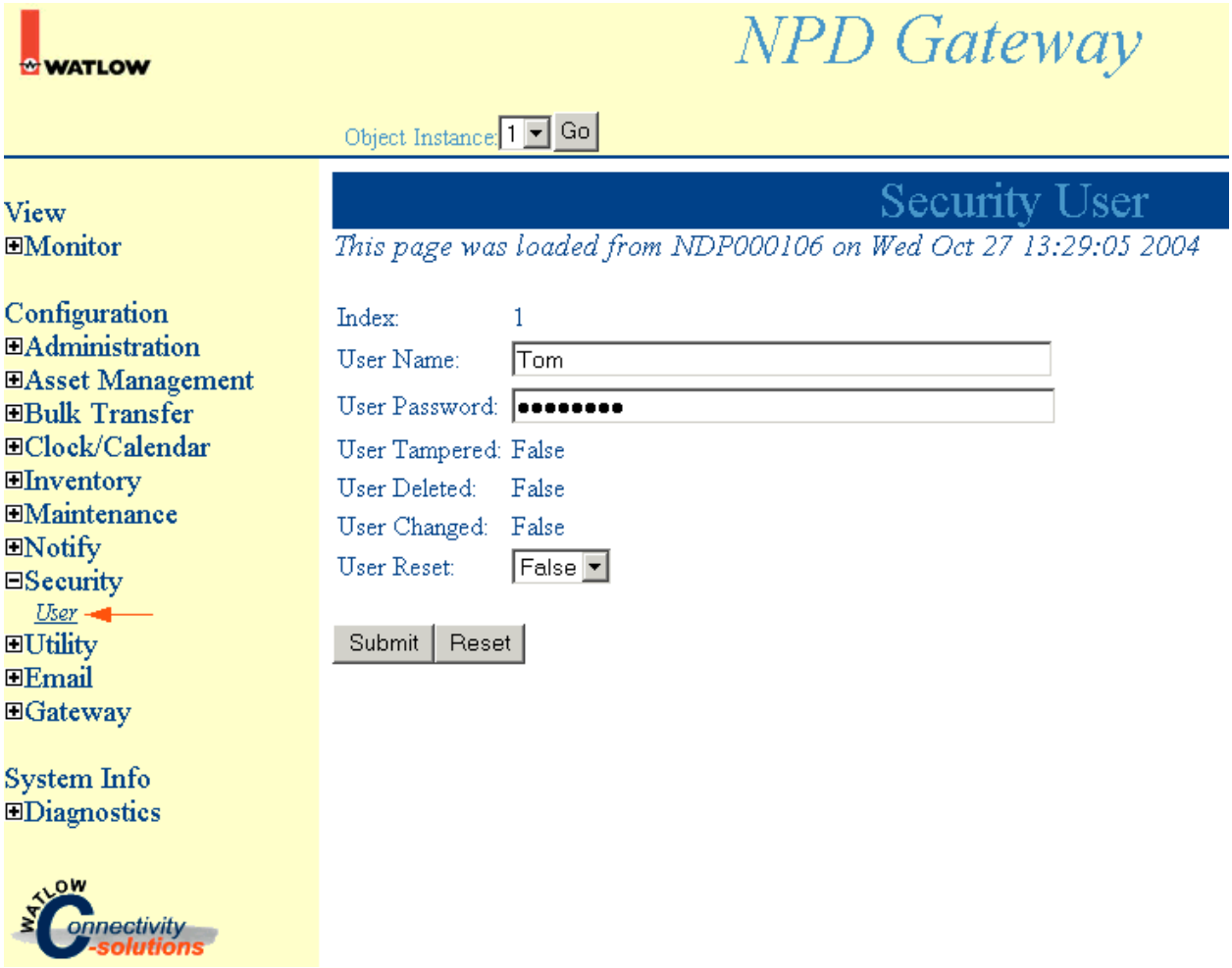
Notify Event Log

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



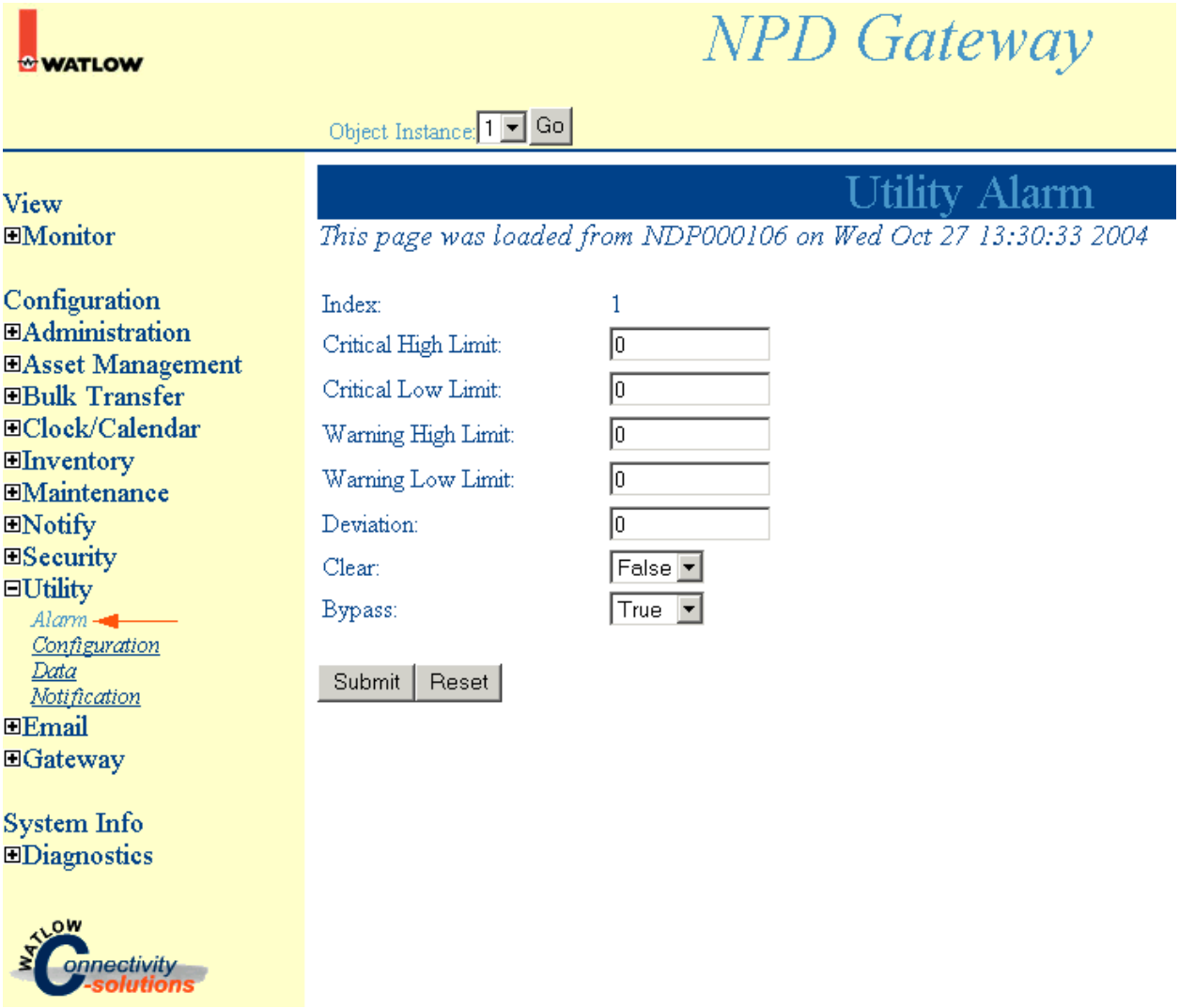
Security User

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



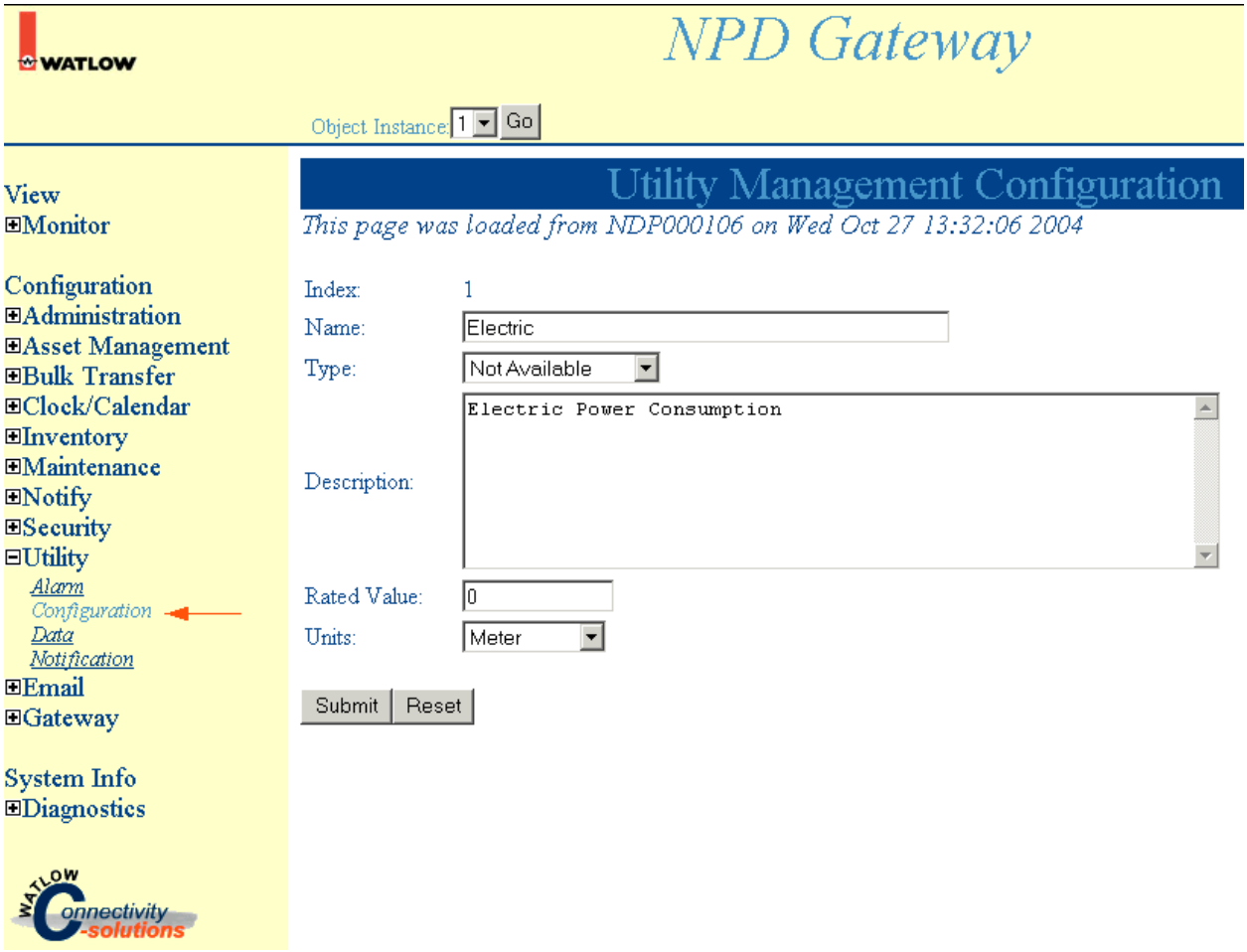
Utility Alarm

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



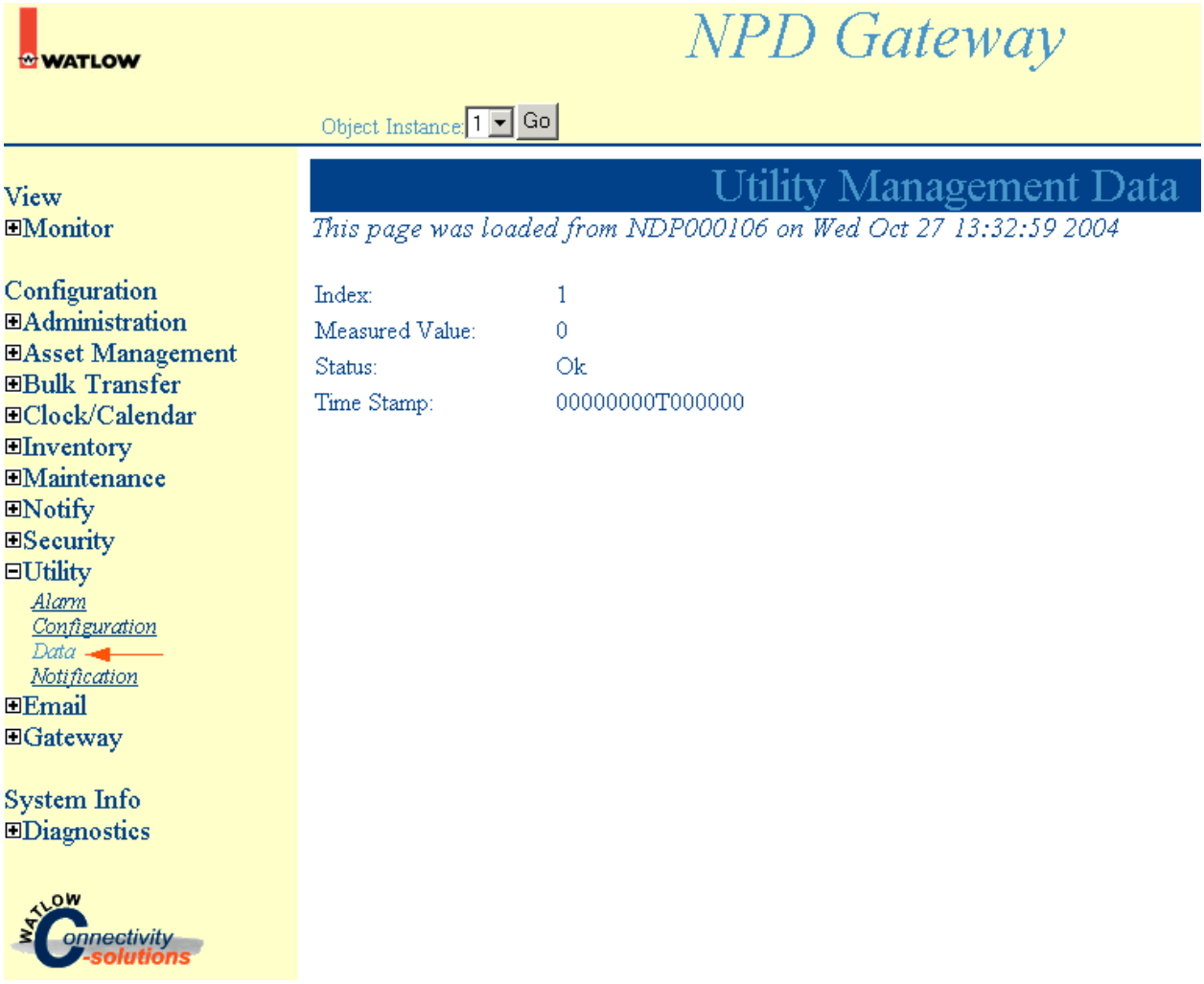
Utility Management Configuration

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



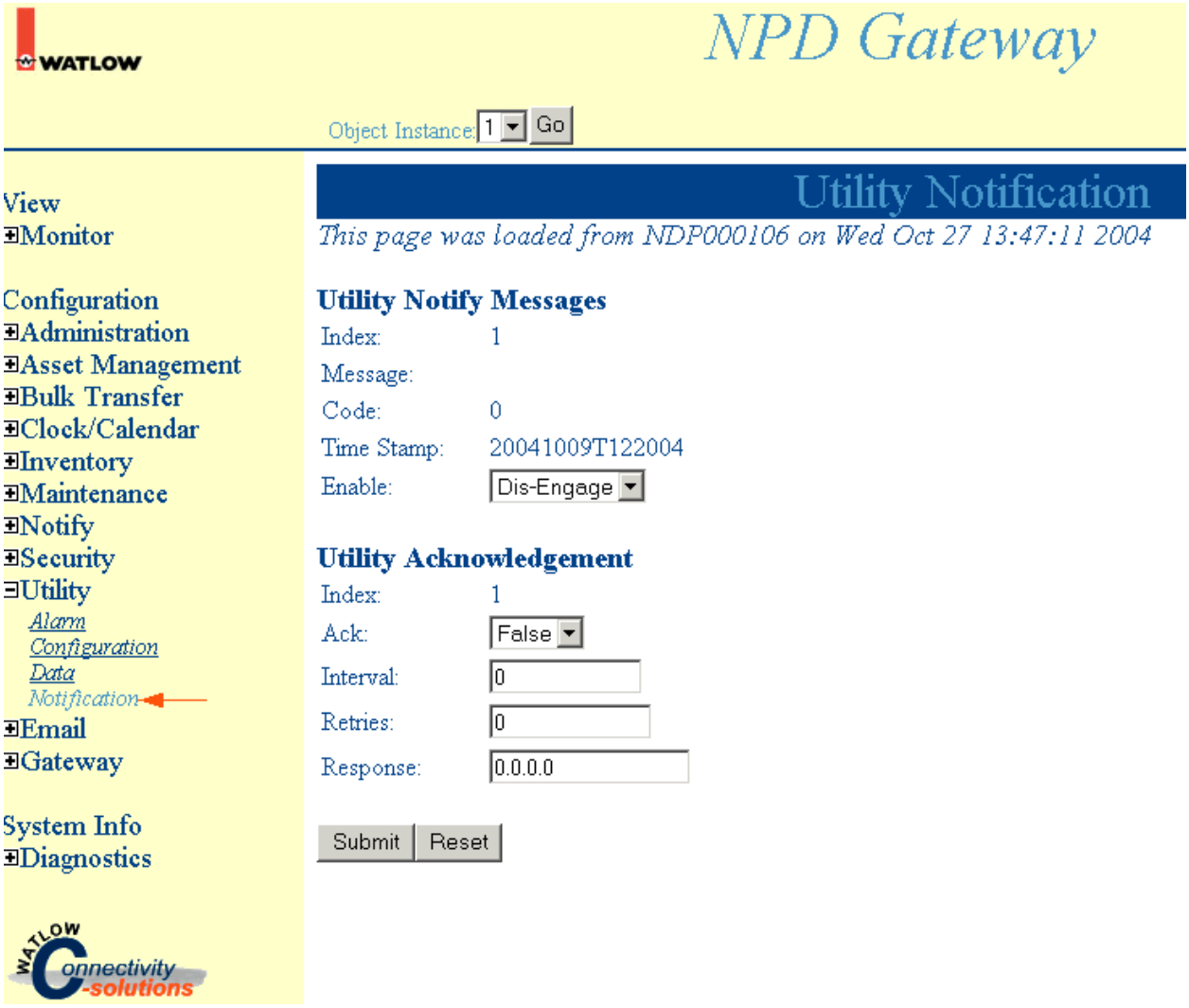
Utility Management Data

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



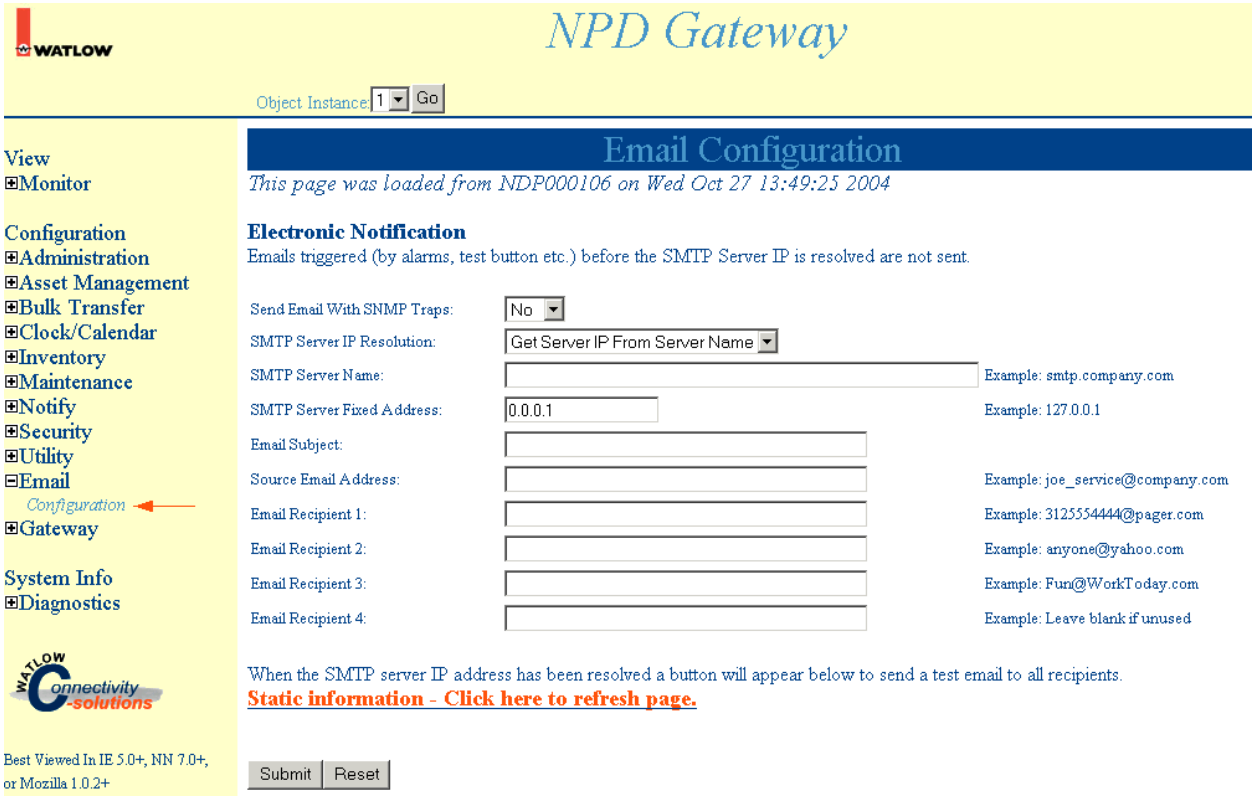
Utility Notification

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Email Configuration

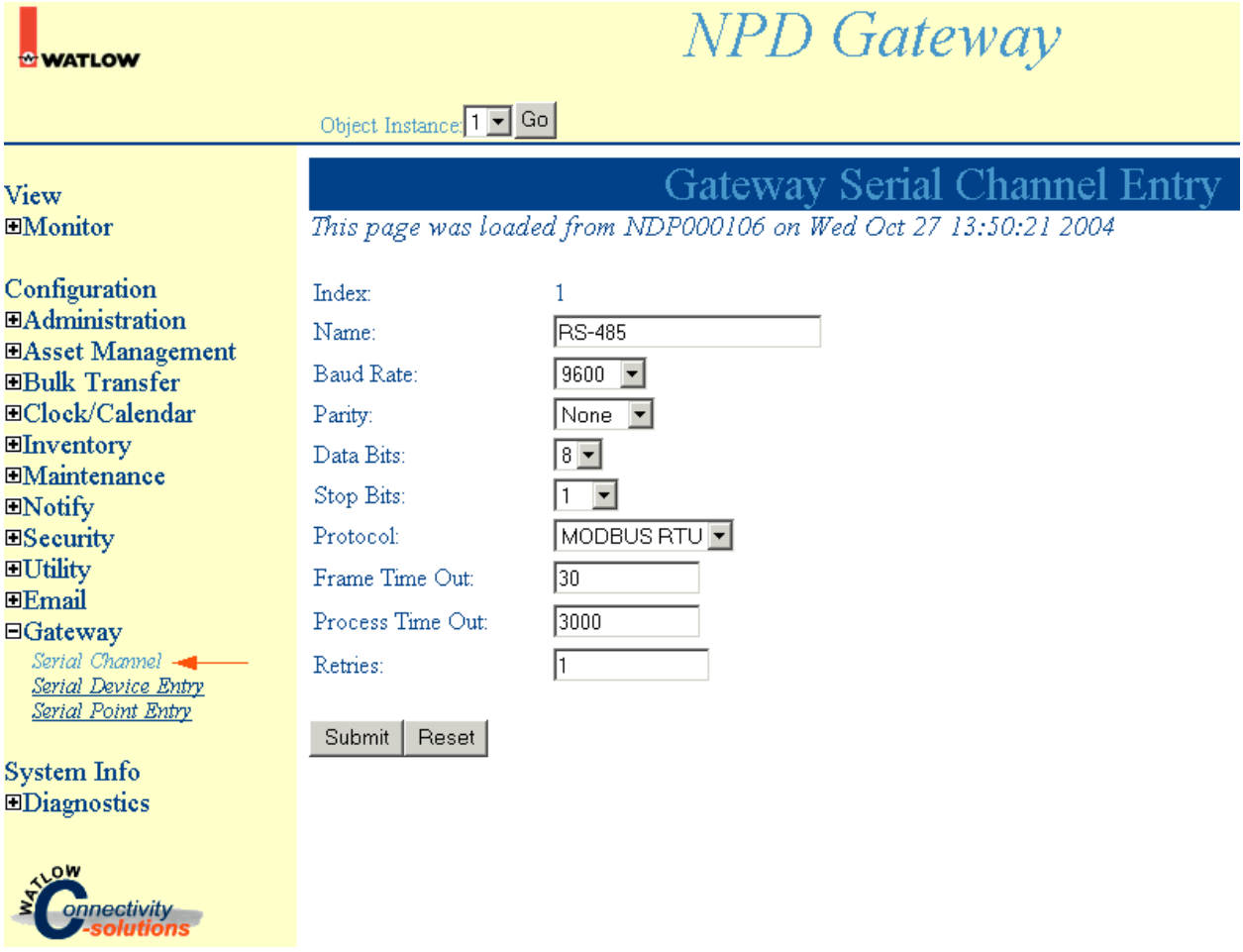
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Gateway Serial Channel Entry

- Select Configuration, Gateway, Serial Channel, and Object Instance 1 to access this page. Configure each serial channel entry. The baud rate, parity data bits, stop bits and protocol must match the devices on the bus.

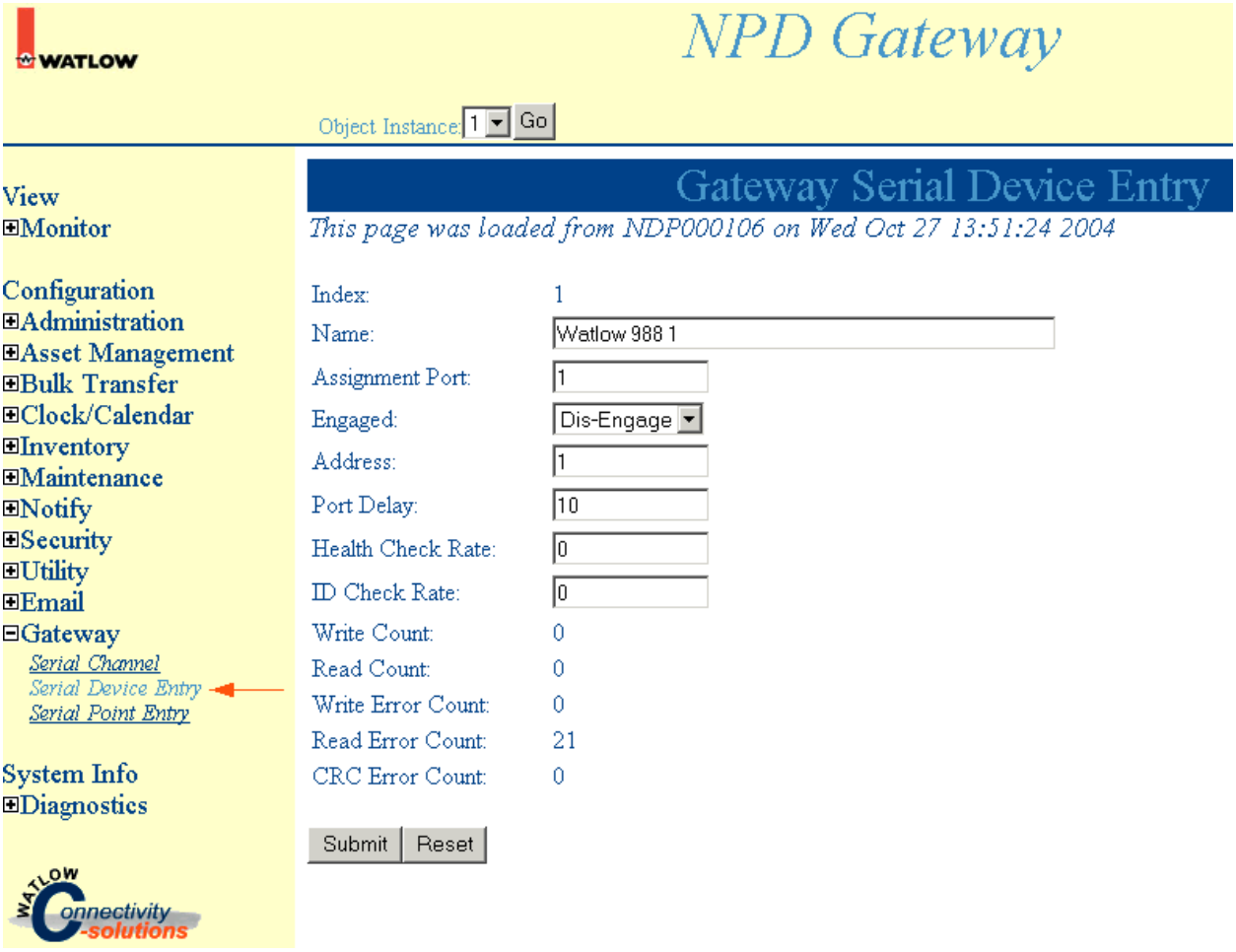
Note: *Submit* changes to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Gateway Serial Device Entry

- Select Configuration, Gateway, Serial Device Entry, and Object Instance 1 to access this page. Configure a serial device entry for each device. A maximum of 8 devices can be configured.
- Enter a Name for reference. Set the Assignment Port to 1.
- Engaged must be set to Engage to have the device active.
- Enter the Address of the Modbus device. The range is 1 to 247.
- Set Port Delay, Health Check Rate and ID Check Rate to 0.
- Write and Read Count indicates the number of attempted write and read instructions to this device.
- The Write Error and Read Error Count are the number of failed attempts at writing and reading to this device. The CRC Error Count is the number of packets returned with corrupted data within the packet.

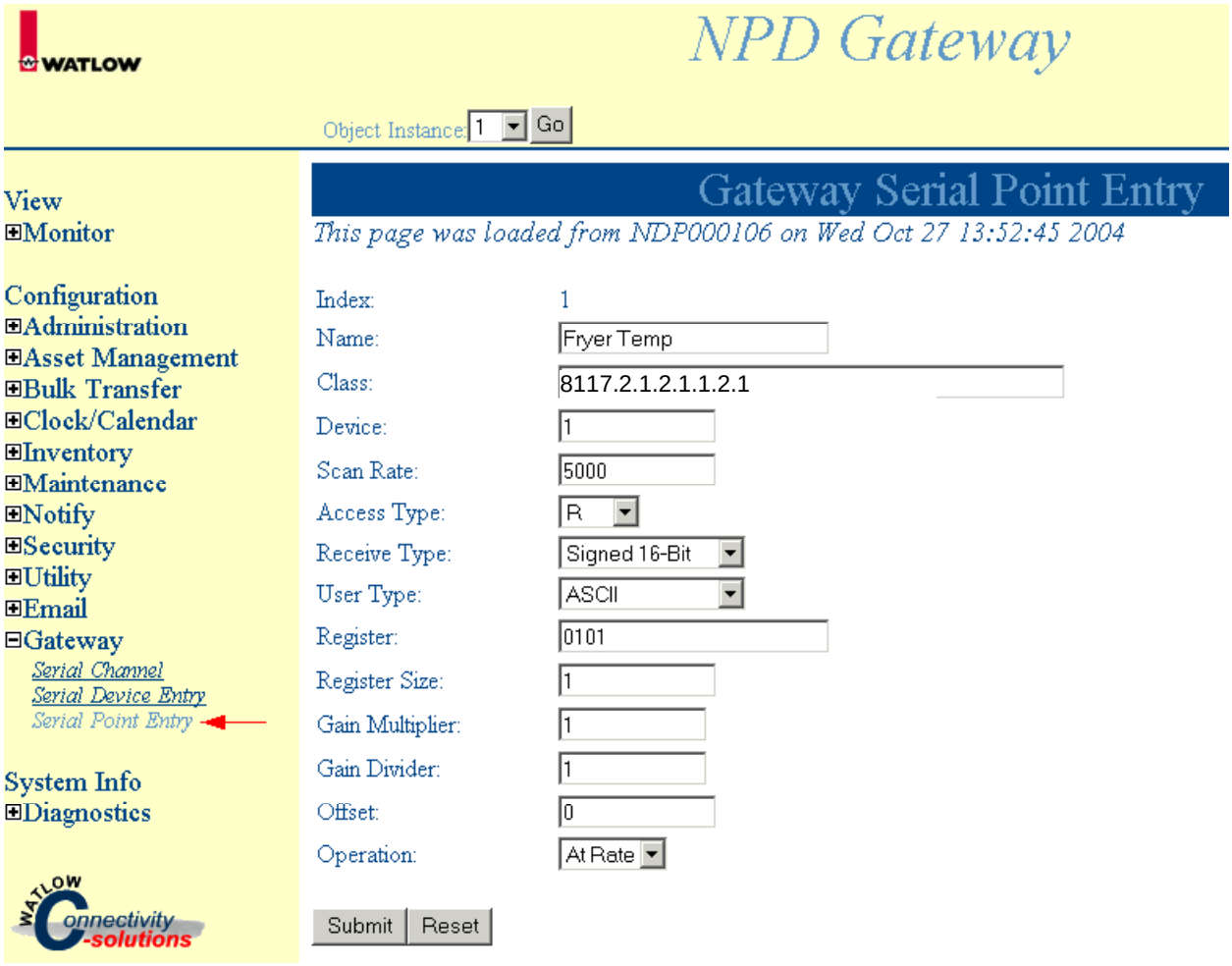
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Gateway Serial Point Entry

- Select Configuration, Gateway, Serial Point Entry, and Select Object Instance 1 to access this page. Configure each serial point entry. A serial point entry represents a data point or parameter of the device.
- Enter a Name to identify the data point. In this example it has been named Fryer Temp.
- Class is the location to copy the data to from the data point.
- Device is the index of the device where the data point resides.
- Scan Rate is the frequency to acquire this data point in milliseconds. This value is added to the maximum scan rate. A value of 5000 would add five seconds of time to the scan.
- Receive Type should be set to Signed 16 bit for Modbus register from Watlow devices.
- User Type determines the formatting of the data point for your application.
- The Register is the data point with in the device, entered as an absolute register number. Add 40001 to relative register numbers to obtain the absolute register number. See the appropriate device user's manual for a list of Modbus registers.
- Register Size is the length in bytes that are returned from the register.
- Gain Multiplier and Gain Divider are used to scale the returned data point value.
- Offset is used to shift the returned data point value in a positive or negative direction.

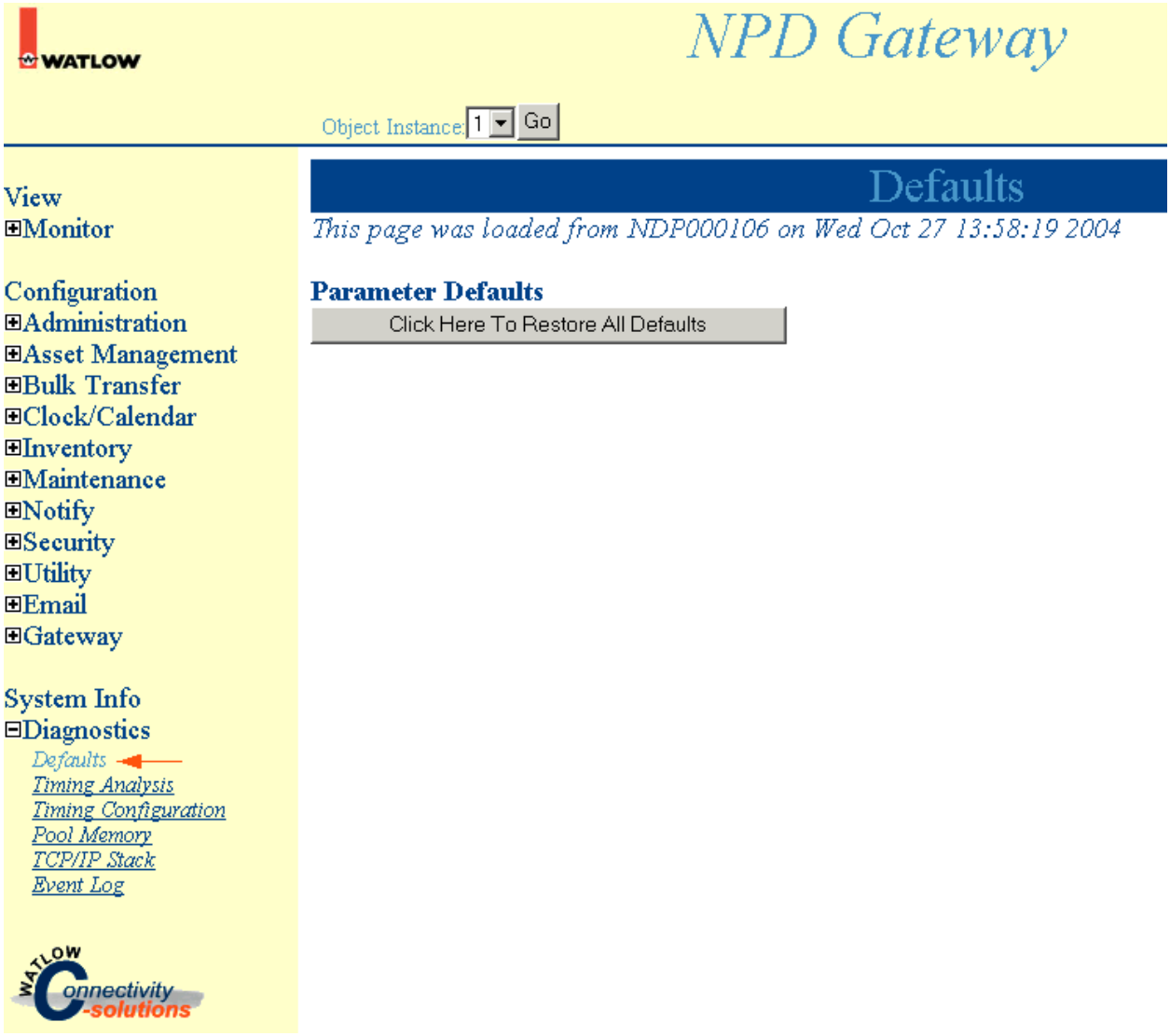
Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



System Info

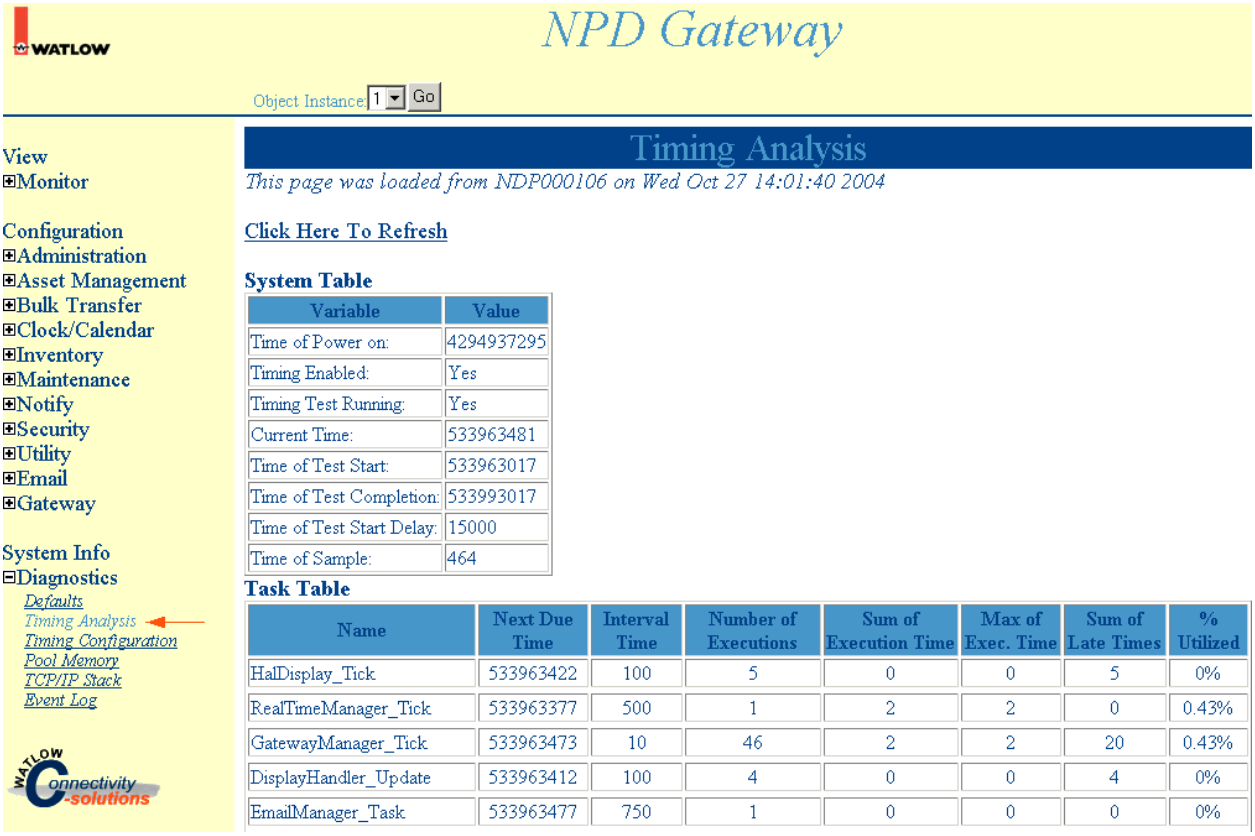
Diagnostics Defaults

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



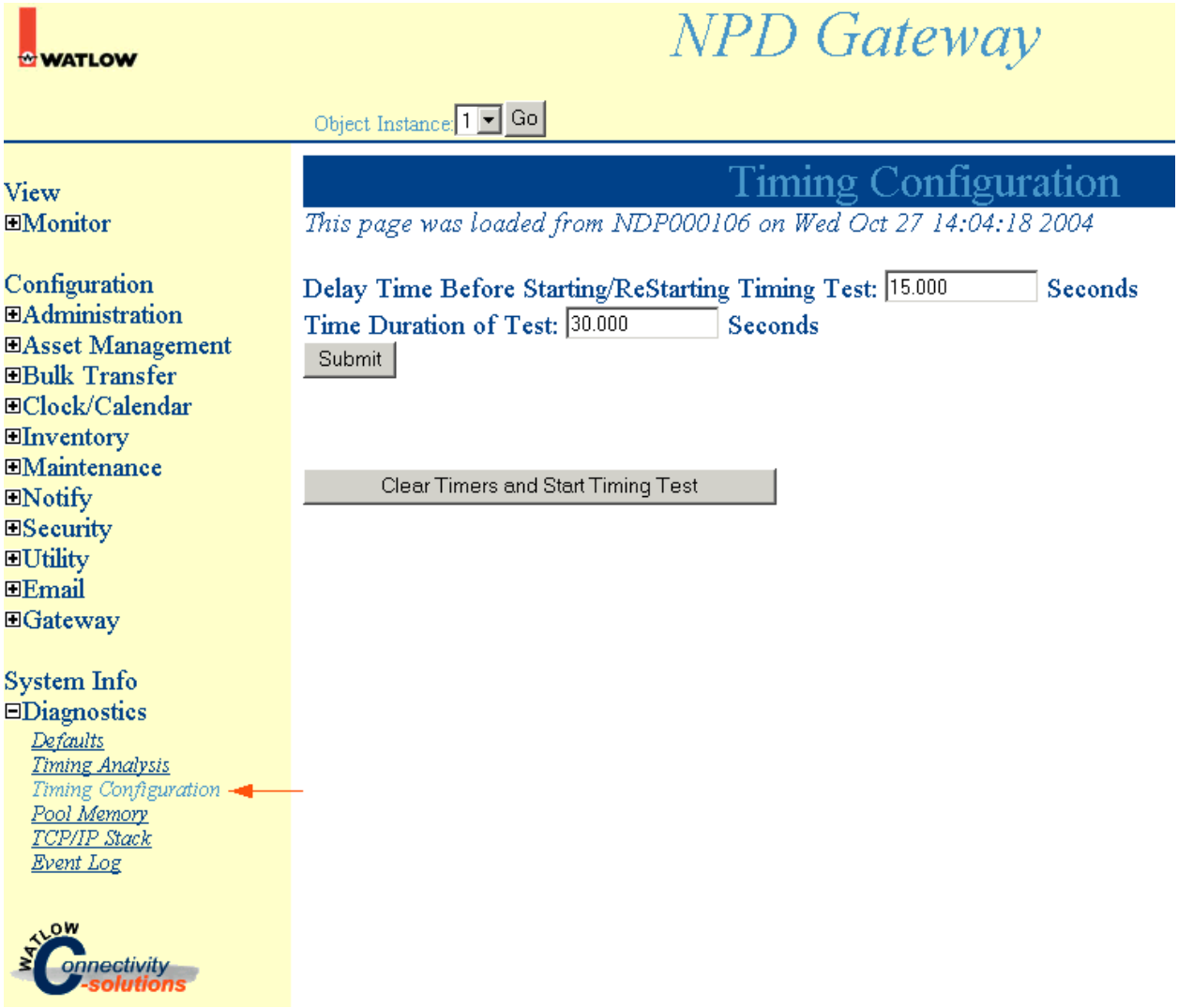
Diagnostics Timing Analysis

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



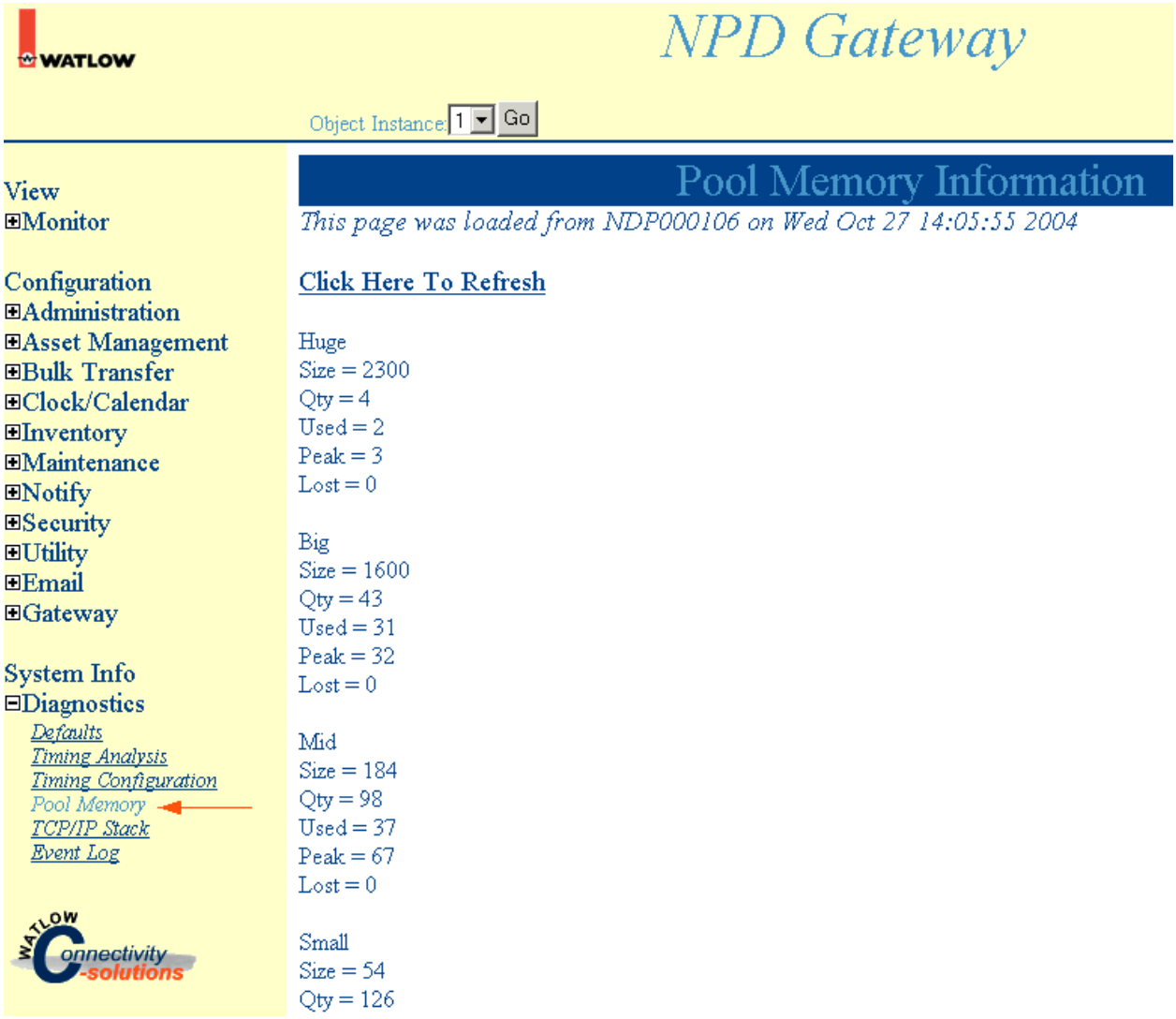
Diagnostics Timing Configuration

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



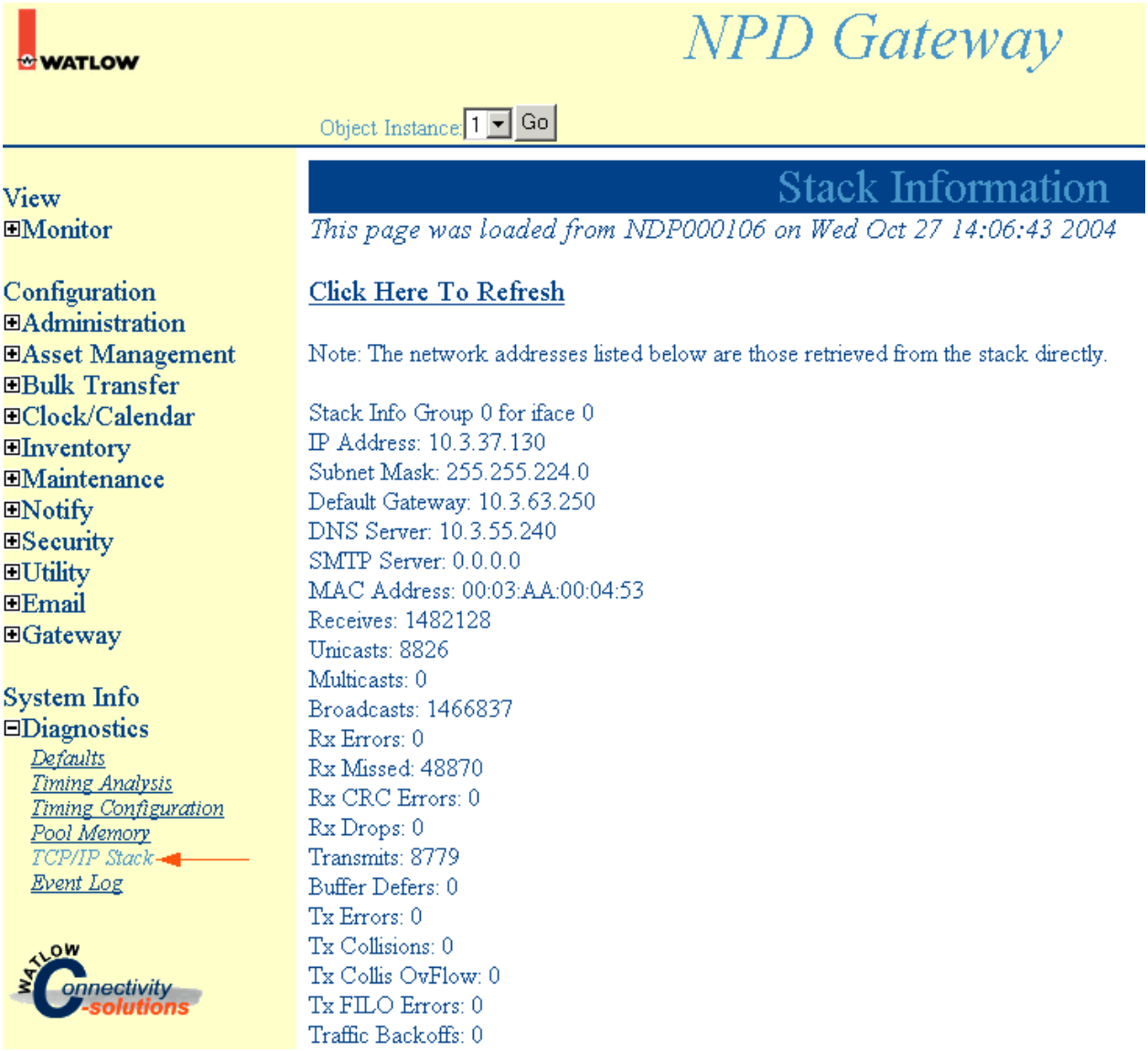
Diagnostics Pool Memory

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



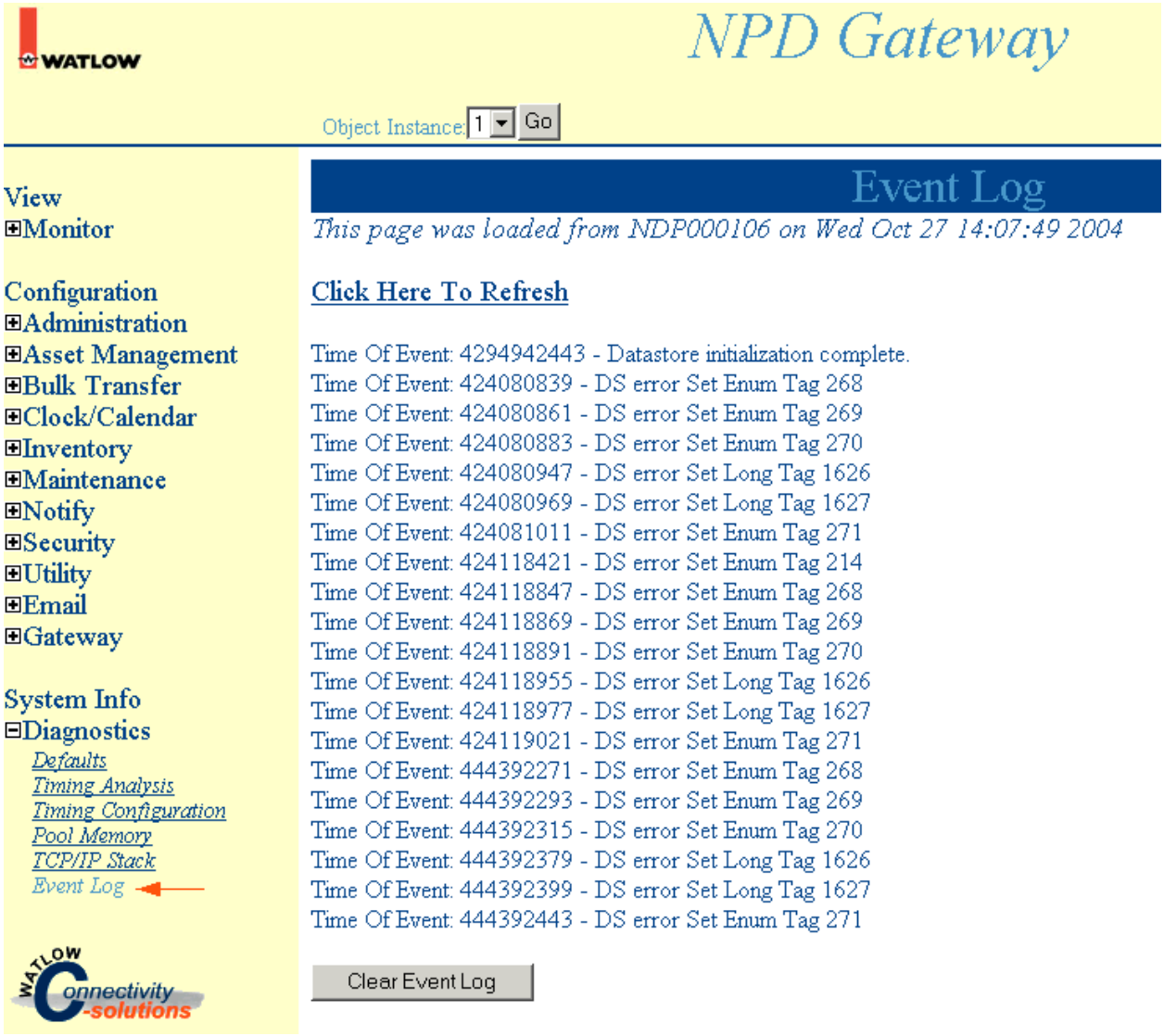
Diagnostics TCP/IP Stack

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Diagnostics Event Log

Note: Click *Submit* to save changes. *Reset* will return these settings to the previous values if you have not pressed the *Submit* button.



Specifications

Operation

Notification Handling per NAFEM PROTOCOL MANUAL for Alarm and Notification handling.
The Alarm Module performs the checking of parameter status and trigger notification events within 500 milliseconds.

Gateway accommodates a reading of all 64 remote device attributes from a single device in one-second and all connected devices' attributes in four seconds.

SNMPv1Agent performs the interaction between the Gateway and the remote networked User's Application running an SNMP manager. The SNMP v1 Agent will respond to the remote manager (User application initiated) requests at a rate of 40 Hz - Reference RFC 1157.
TFTP Client - Reference RFC 1350.

Web Server performs the interaction between the Gateway and the remote networked User's Browser. The Web Server will serve web pages to the remote browser (User initiated) at a rate of one page every five seconds.

Poll Engine
The Poll Engine initiates communications between the Gateway and the remote devices. Individual SCAN RATES are user programmable in one-second intervals. The Poll Engine performs these polls in an asynchronous manner thereby eliminating the remote devices response time from time considerations of internal events. The poll rate of the Poll Engine is 10 Hz assuming a 20 Hz remote device response time, 19200-baud rate, and no retry requirement.

Real-time Clock

The on board Real Time Clock circuit provides the Gateway with time reference and is read for Gateway time clock updates on a one-minute interval. Accuracy is ± 4 minutes per year and provides timing accuracy of ± 0.5% over a range of 0 to 999 seconds. Battery Backup provides a minimum of 6 years service.

Serial Communications

Complies with EIA-485 standards - supports 19200 and 9600-baud rates.

Connectors

RJ45 for Ethernet connection interface per IEEE 802.3
Coaxial power connector with positive center post
DB9 connector for Serial connection

Power

Input Voltage Ratings
5VDC for Wall Transformer interface with coaxial plug
UL⁄ approved, Class II power supply required
Input Power Ratings 10 Watts Maximum
Real-time Clock backed by 3v-lithium battery – RAYOVAC BR1225

Environmental Conditions

Operating temperature range:	0 to 60°C
Storage temperature range:	-40 to 70°C
Operating and storage humidity:	0 to 90% non-condensing

Declaration of Conformity

Gateway Products

CE

Watlow Winona, Inc.
1241 Bundy Blvd.
Winona, MN 55987 USA

Declares that the following product:

Model Numbers:	EM(XX)-GATE-(XXXX), *NGW(X)-(XXXX)-(XXXX) X = any number or letter
Classification:	Communications interface card, Installation Category I, Pollution degree II
Rated Voltage:	24V≂ (ac or dc) or 5V⎓ (dc)
Rated Frequency:	50/60 Hz or dc
Rated Power:	10VA maximum

**NGW with 5V power option requires use of a Ferrico NF130 Clamp on ferrite on all lines to pass Class B emissions. Depending on end use setup, this bead may or may not be necessary.*

Meets the essential requirements of the following European Union Directives by using the relevant standards show below to indicate compliance.

89/336/EEC Electromagnetic Compatibility Directive

EN 61326:1997 +A1:1998	**Electrical equipment for measurement, control and laboratory use – EMC requirements (Industrial Immunity, Class B Emissions).**
EN 61000-4-2:1996 +A1, 1998	Electrostatic Discharge Immunity
EN 61000-4-3:1997	Radiated Field Immunity
EN 61000-4-4:1995	Electrical Fast-Transient / Burst Immunity
EN 61000-4-5:1995 +A1, 1996	Surge Immunity
EN 61000-4-6:1996	Conducted Immunity
EN 61000-4-11:1994	Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-3-2:1995 +A1-3:1999	Harmonic Current Emissions
EN 61000-3-3:1995 +A1:1998	Voltage Fluctuations and Flicker

Use of an appropriately approved class 2 power source is required for compliance.

2001/95/EC General Product Safety Directive

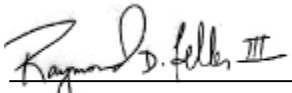
EN 61010-1:2001	**Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements**

Raymond D. Feller III
Name of Authorized Representative

Winona, Minnesota, USA
Place of Issue

General Manager
Title of Authorized Representative

July, 2003
Date of Issue



Signature of Authorized Representative

How to Reach Us

Technical Assistance

If you encounter a problem with your NAFEM Gateway, review all of your wiring and configuration information to verify that your selections are consistent with your application. If the problem persists after checking the above, you can get technical assistance from your local Watlow representative, or by dialing (507) 454-5300. An applications engineer will discuss your application with you.

Warranty

This product is warranted free from defects in material and workmanship for 24 months after delivery to the first purchaser for use, providing that the units have not been misapplied. Since Watlow has no control over their use, and sometimes misuse, we cannot guarantee against failure. Watlow's obligations hereunder, at Watlow's option, are limited to replacement, repair or refund of purchase price, and parts that upon examination prove to be defective within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

Returns

- Call or fax Customer Service for a Return Material Authorization (RMA) number before returning any product.
- Put the RMA number on the shipping label, and provide a written description of the problem.
- A restocking charge of 20% of the net price is charged for all standard units returned to stock.

Your Feedback

Your comments or suggestions on this manual are welcome, please send them to: Technical Writer, Watlow Winona, 1241 Bundy Blvd., P.O. Box 5580, Winona, MN 55987-5580, Phone: (507) 454-5300, Fax: (507) 452-4507.