SIEMENS

## INSTALLATION AND INSTRUCTION MANUAL

# WAYSIDE INSPECTOR, P/N A81000

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VERSION A

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## DOCUMENT HISTORY

| Version | Release Date | Sections Changed | Details of Change |
|---|---|---|---|
| A | 09/22/16 | | Initial release |
| | | | |

## NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are frequently used to direct the reader's attention to specific information. Use of the three terms is defined as follows:

**⚠ WARNING**

**WARNING**

**INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.**

**⚠ CAUTION**

**CAUTION**

REFERS TO PROPER PROCEDURES OR PRACTICES WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.

***NOTE***

**NOTE**

Generally used to highlight certain information relating to the topic under discussion.

If there are any questions, contact Siemens Industry Inc., Rail Automation Application Engineering.

## ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

Static electricity can damage electronic circuitry, particularly low voltage components such as the integrated circuits commonly used throughout the electronics industry. Therefore, procedures have been adopted industry-wide which make it possible to avoid the sometimes invisible damage caused by electrostatic discharge (ESD) during the handling, shipping, and storage of electronic modules and components. Siemens Industry, Inc., Rail Automation has instituted these practices at its manufacturing facility and encourages its customers to adopt them as well to lessen the likelihood of equipment damage in the field due to ESD. Some of the basic protective practices include the following:

- Ground yourself before touching card cages, assemblies, modules, or components.
- Remove power from card cages and assemblies before removing or installing modules.
- Remove circuit boards (modules) from card cages by the ejector lever only. If an ejector lever is not provided, grasp the edge of the circuit board but avoid touching circuit traces or components.
- Handle circuit boards by the edges only.
- Never physically touch circuit board or connector contact fingers or allow these fingers to come in contact with an insulator (e.g., plastic, rubber, etc.).
- When not in use, place circuit boards in approved static-shielding bags, contact fingers first. Remove circuit boards from static-shielding bags by grasping the ejector lever or the edge of the board only. Each bag should include a caution label on the outside indicating static-sensitive contents.
- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.
- Use integrated circuit extractor/inserter tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Inserter (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

For information concerning ESD material applications, please contact the Technical Support Staff at 1-800-793-7233. ESD Awareness Classes and additional ESD product information are also available through the Technical Support Staff.

## TABLE OF CONTENTS

# CHAPTER 1 – INTRODUCTION

## 1.1 PURPOSE

This manual provides the information needed by field maintainers and crossing installation teams to install and correctly wire the Wayside Inspector (WI) to crossings. This manual provides installation instructions and wiring of the WI to AC power, batteries, battery chargers, crossing warning systems including the Solid State Crossing Controller (SSCC), relay controlled crossing wiring, Grade Crossing Predictor (GCP) connections, the Ground Fault Tester 2, and Wireless Magnetometers.

## 1.2 SCOPE

This manual focuses on installation and connection of the WI. It is useful to crossing installers and field maintenance personnel intending to use the WI in crossing monitoring. This manual does not address any railroad specific crossing guidelines. This manual provides an overview of the programming, but should not be used as a guide to the programming of the WI. For application guidelines, see the Wayside Inspector Application Guideline Manual, SIG-00-16-05.

## 1.3 ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| APPLICATION ENGINEER | Application Engineer |
| AP | Access Point |
| AREMA | American Railway Engineering and Maintenance-of-way Association |
| CFR | Code of Federal Regulations |
| DCE | Data Communication Equipment |
| DHCP | Dynamic Host Configuration Protocol |
| DNS | Domain Name System |
| DTE | Data Terminal Equipment |
| ECD | External Configuration Device |
| GCP | Grade Crossing Predictor |
| GFT | Ground Fault Tester |
| IP | Internet Protocol |
| IPv4 | Internet Protocol version 4 |
| IPv6 | Internet Protocol version 6 |
| MCF | Module Configuration File |
| MCT | MCF Configuration Tool |
| PoE | Power over Ethernet |
| TCP | Transmission Control Protocol |

| | |
|---|---|
| UDP | User Datagram Protocol |
| UI | User Interface |
| WI | Wayside Inspector |
| WiMag | Wireless Magnetometer |

## 1.4 REFERENCES

| Component | Manual Title | Document Number |
|---|---|---|
| Battery Charger | Series SJ Battery Chargers | SIG-00-00-18 |
| Model 4000 Grade Crossing Predictor | Model 4000 Grade Crossing Predictor (Model 4000 GCP) Field Manual | SIG-00-08-10 |
| | Model 4000 Grade Crossing Predictor Plus (Model 4000 GCP Plus) Field Manual | SIG-00-12-68 |
| | Microprocessor Based Model 4000 Grade Crossing Predictor Family Application Guidelines | SIG-00-08-06 |
| Model 5000 Grade Crossing Predictor | Model 5000 Grade Crossing Predictor (Model 5000 GCP) Field Manual | SIG-00-13-03 |
| | Microprocessor Based Model 5000 Grade Crossing Predictor Family Application Guidelines | SIG-00-13-04 |
| Ground Fault Tester | Ground Fault Tester, A80297-01, -02, -03 | SIG-00-03-05-003 |
| | Ground Fault Tester 2 (GFT2), A81010-01, -02 | SIG-00-15-06 |
| Solid State Crossing Controller | Solid State Crossing Controller IIIA (SSCCIIIA) A91160 & 91165 | SIG-00-02-12 |
| | Solid State Crossing Controller III Plus (SSCCIIIPlus) A91190 & 91195 | SIG-00-02-03 |
| | Solid State Crossing Controller IV (SSCCIV) A91210 & 91215 | SIG-00-03-02 |
| Wayside Alarm Management System | Wayside Alarm Management System (WAMS) Test and Inspection Management | SIG-00-07-08 |
| Wayside Inspector | Wayside Inspector Application Guidelines | SIG 00-16-05 |

# CHAPTER 2 - OVERVIEW

**⚠ WARNING**

**WARNING**

**THE WAYSIDE INSPECTOR IS A NON-VITAL PRODUCT. CAUTION MUST BE TAKEN WHEN INTERFACING THE WAYSIDE INSPECTOR TO ANY VITAL SIGNAL OR CROSSING EQUIPMENT AS THE WAYSDE INSPECTOR CANNOT BE USED TO PERFORM, EITHER DIRECTLY OR INDIRECTLY, ANY VITAL FUNCTIONS. ENSURE THE WAYSIDE INSPECTOR IS INSTALLED PER MANUFACTURER'S INSTRUCTIONS, AND/OR ALL EQUIPMENT INTERCONNECTIONS ARE IN COMPLIANCE WITH RAILROAD PROCEDURES AND SPECIFICATIONS.**

The Wayside Inspection system automates periodic inspections for crossings. The system focuses on the following inspections: Grounds (CFR, Title 49, §234.249), Standby Power (CFR, Title 49, §234.251), and Warning Time (CFR, Title 49, §234.259) Inspections.

To achieve those goals, the system uses the Wayside Inspector (WI), installed at the crossing, to test standby power, test for grounds, monitor the crossing, and test warning time,. The Wayside Inspector monitors the state of discrete I/O signals, battery voltages, and AC power at a crossing. From that information, the Wayside Inspector analyzes the operation of the crossing warning system and automatically performs periodic inspections of the crossing warning system. The Wayside Inspector can send alarms and automated inspection results to the backoffice system using several possible communications methods. The inspections are performed by the Wayside Inspector by executing application programmable logic Figure 2-1 shows the context of the WI installed at a crossing.

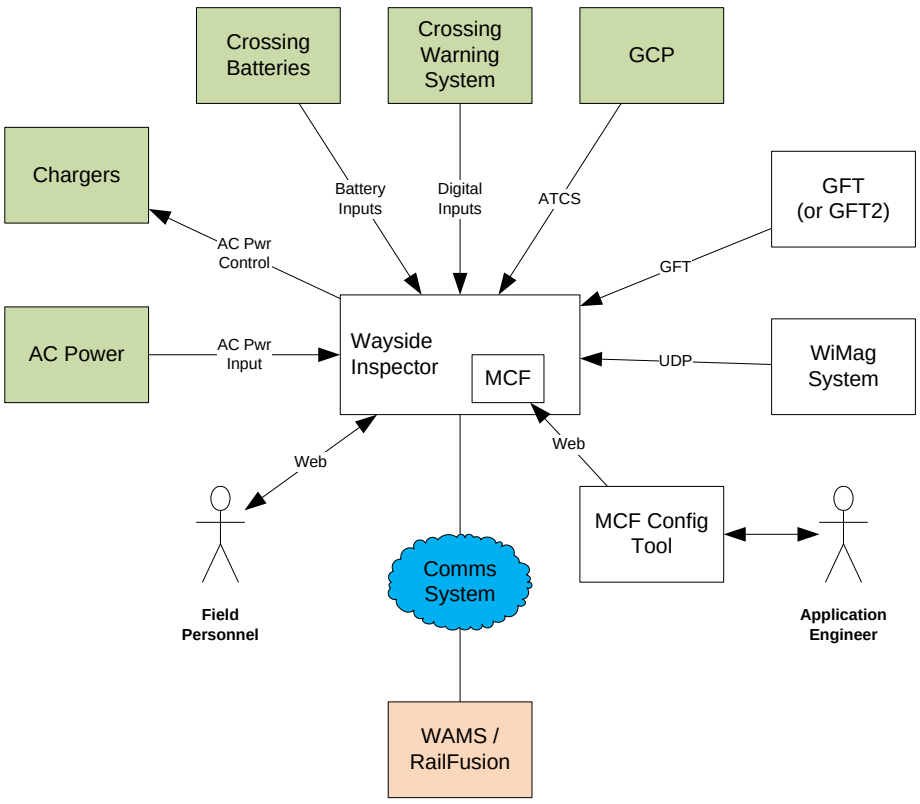



**Figure 2-1: Context of Wayside Inspector Installed at Crossing**

The WI monitors the crossing warning system I/O using digital inputs. The WI monitors the battery system voltages using analog inputs. The WI can turn off the battery chargers using an AC power control relay. The WI monitors the system for ground faults using the Siemens Ground Fault Tester 2(GFT2).

If the crossing uses a Siemens GCP, the WI can receive crossing statuses over a message interface instead of using input wiring. In addition, the WI can receive train speed and direction information in GCP messages.

In situations where the typical crossing I/O cannot provide the direction our route information needed for the warning time test, the installation can add Wireless Magnetometer (WiMag) sensors to detect trains. The WI can receive the WiMag sensor statuses over a network.

Field personnel can interact with the WI using a web browser user interface. The UI allows field personnel to adjust system settings, view status, view inspection results, download logs, etc.

Because each location (or class of locations) is different, the WI uses programmable logic to execute the inspections. The logic is loaded into the WI as a Module Configuration File (MCF). The MCF includes configuration settings and relay logic. An Application Engineer defines the logic and settings using the MCF Configuration Tool (MCT).

# CHAPTER 3 – HARDWARE

The Wayside Inspector (WI) has the following connections and components:

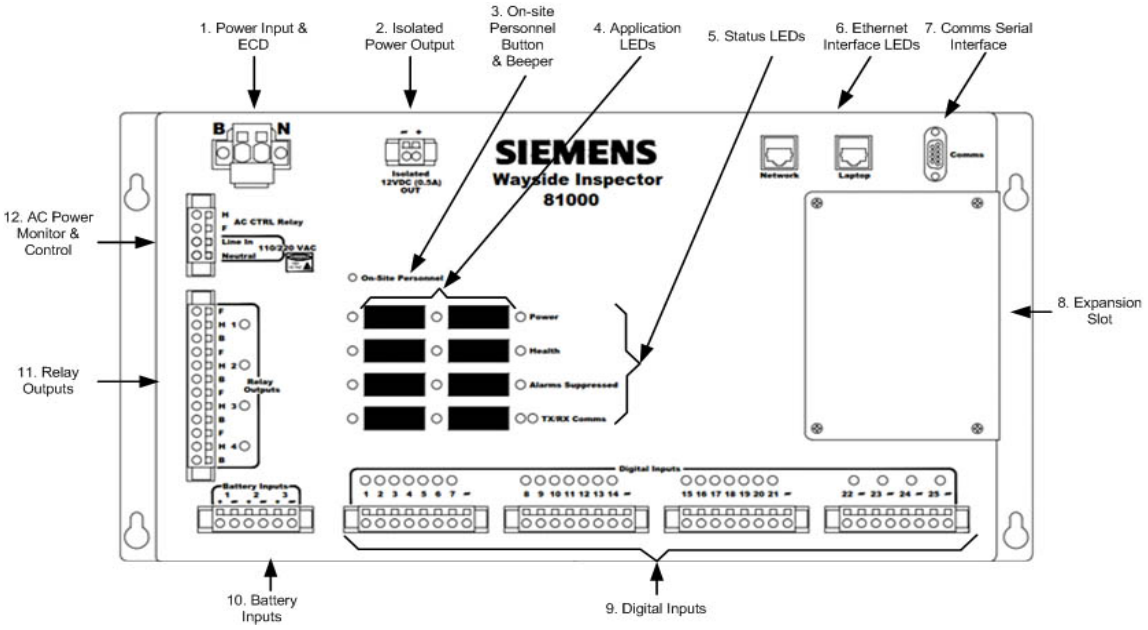



**Figure 3-1: The Siemens Wayside Inspector, A81000 Connectors**

The WI has the following connectors:

**Table 3-1: Wayside Inspector Connectors**

| No. | Name | No. | Name |
|---|---|---|---|
| 1. | Power Input & ECD | 2. | Isolated Power Output |
| 3. | On-site Personnel Button and Beeper | 4. | Application LEDs |
| 5. | Status LEDs | 6. | Ethernet Interface LEDs |
| 7. | Comms Serial Interface | 8. | Expansion Slot |
| 9. | Digital Inputs | 10. | Battery Inputs |
| 11. | Relay Outputs | 12. | AC Power Monitor and Control |

## 3.1 POWER INPUT AND ECD

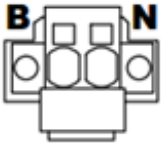



**Figure 3-2: Power Input and ECD Connector**

The WI is connected to the 12 VDC (nominal) battery banks as shown in Section 5. The WI power supply supplies 2000 VRMS isolation and complies with AREMA power supply standards.

The WI monitors the applied power using an internal battery input circuit, which eliminates the need to wire the input power battery bank to an external battery input. Table 3-2 shows the power input specifications.

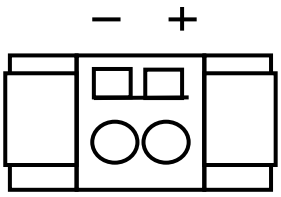
**Table 3-2: Power Input Specifications**

| Parameter | Value Range |
|---|---|
| Input Voltage Range | 8.0 – 20.0 VDC |
| Input Current | 3.0A max @ 13.8 VDC |
| Reverse Polarity Protection | Up to 16 VDC |
| Isolation | 2000 VRMS, 60 Hz, 60 s |

The External Configuration Device (ECD) allows field personnel to replace the WI with a new unit without re-configuring it. The ECD is attached to the power input connector. The WI is compatible with both the original A80519 ECD and the A81006 ECD.

## 3.2 ISOLATED POWER OUTPUT

The WI provides 12VDC (nominal) isolated power output. The isolated power can be used to power external communication equipment such as cell modems.




**Isolated**
**12VDC (0.5A)**
**OUT**

**Figure 3-3: Isolated Power Output**

Table 3-3 lists the specification for the output power.

**Table 3-3: Isolated Power Output Specifications**

| Parameter | Value Range |
|---|---|
| Voltage | 12.0VDC nominal (follows input voltage) |
| Current Limit | 0.5A max at 12.0VDC |
| Short Circuit/Over Current Protection | Yes |
| Isolation | 2000 VRMS, 60 Hz, 60 s |

## 3.3 ON-SITE PERSONNEL BUTTON & BEEPER

The WI has an On-site Personnel button, which field personnel use to active Maintainer on Site mode.

**○ On-Site Personnel**

**Figure 3-4: On-site Personnel Button**

Maintainer on Site mode allows field personnel to test and modify the crossing without sending erroneous alarm messages to the office. When field personnel press the On-site Personnel button, the WI goes into Maintainer on Site mode and starts a timer. The WI will not send alarm messages to the office while in Maintainer on Site mode. The WI returns to normal operation when the timer expires. The Alarms Suppressed LED will be on while the WI is in Maintainer on Site mode. The maintainer may re-start the timer for Maintainer on Site mode by pressing the On-Site Personnel button again, at any time.

The WI has an internal beeper. The beeper will “chirp” when the user presses the On-site Personnel pushbutton to provide audible feedback. The MCF may also control the beeper for application-specific functions.

## 3.4 APPLICATION LEDS

***NOTE***

**NOTE**

During startup, the WI turns on all indicator LEDs, which allows field personnel to check for failed LEDs.

The WI has eight application programmable LEDs available to the program logic. The eight LEDs are red color. The application logic in the MCF determines the function of the Application LEDs. There is space next to each LED to add a sticker or write in the LEDs intended function.

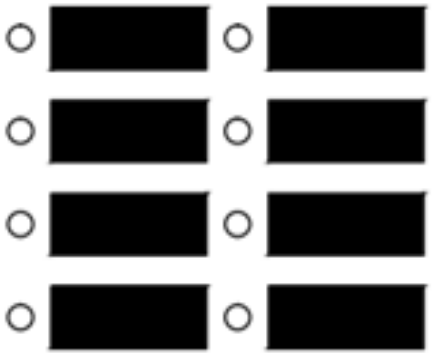


**Figure 3-5: Application LEDs**

## 3.5 STATUS LEDS

The WI has LEDs to display system status information.

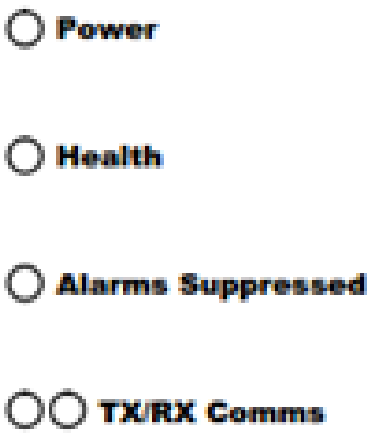



**Figure 3-6: Status LEDs**

The Power LED is green and driven by hardware. It turns on when power is applied to the WI.

The Health LED is green and driven by software. The Health LED turns on for one second and off for one second when the system is healthy. The Health LED flashes faster when there is a detected hardware problem.

The Alarms Suppressed LED is yellow and driven by software. It turns ON while in Maintainer on Site mode and alarms are suppressed. Field personnel activate Maintainer on Site mode by pressing the On-site Personnel button (see section 6-20 for a description of Maintainer on Site mode). The WI software must see the button change from “pressed” to “not pressed” to activate the mode. That prevents a failed button from leaving the unit in Maintainer on Site mode permanently.

The TX/RX Comms LEDs are green and red and driven by software. The green TX LED briefly flashes when the WI sends a data packet on the Comms serial interface. The red RX LED briefly flashes when receiving a valid data packet.

## 3.6 ETHERNET INTERFACE LEDS

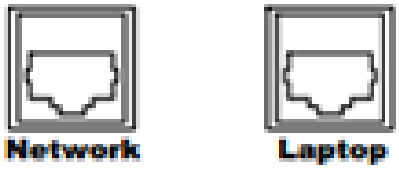



**Figure 3-7: Ethernet Interfaces**

The Laptop and Network Ethernet connectors each include a yellow and a green LED, which are driven by hardware. The network connection is generally used to receive and transmit the status of the WI. The Laptop port is used when field maintenance personnel view the status of tests and equipment via the Web User Interface (web u/i).The yellow LED shows Ethernet link-up status. The yellow LED turns on when Ethernet link-up is established. The green LED shows Ethernet activity. The green LED briefly flashes when Ethernet frames are received or transmitted.

## 3.7 COMMS SERIAL INTERFACE

The WI has one serial interface, which uses a DB9 male connector with a standard DTE pin arrangement. Table 3-4 lists the Comms serial port specifications.

**Table 3-4: Comms Serial Port Specifications**

| Parameter | Value Range |
|---|---|
| Baud Rate | Up to 115,200 |
| Line Levels | RS-232 only |
| Clock Modes | Asynchronous only |
| Flow Control | RTS/CTS, Modem, XON/XOFF |
| Isolation | 2000VRMS, 60Hz, 60s |

**Table 3-5: Comms Serial Port Pin Configuration**

| Pin | I/O | Function |
|---|---|---|
| 1 | I | Carrier Detect (CD) |
| 2 | I | Receive Data (RXD) |
| 3 | O | Transmit Data (TXD) |
| 4 | O | Data Terminal Ready (DTR) |
| 5 | N/A | Ground (GND) |
| 6 | I | Data Set Ready (DSR) |
| 7 | O | Request To Send (RTS) |
| 8 | I | Clear To Send (CTC) |
| 9 | N/A | *No Connect* |

## 3.8 HARDWARE EXPANSION SLOT

The WI has one hardware expansion slot.

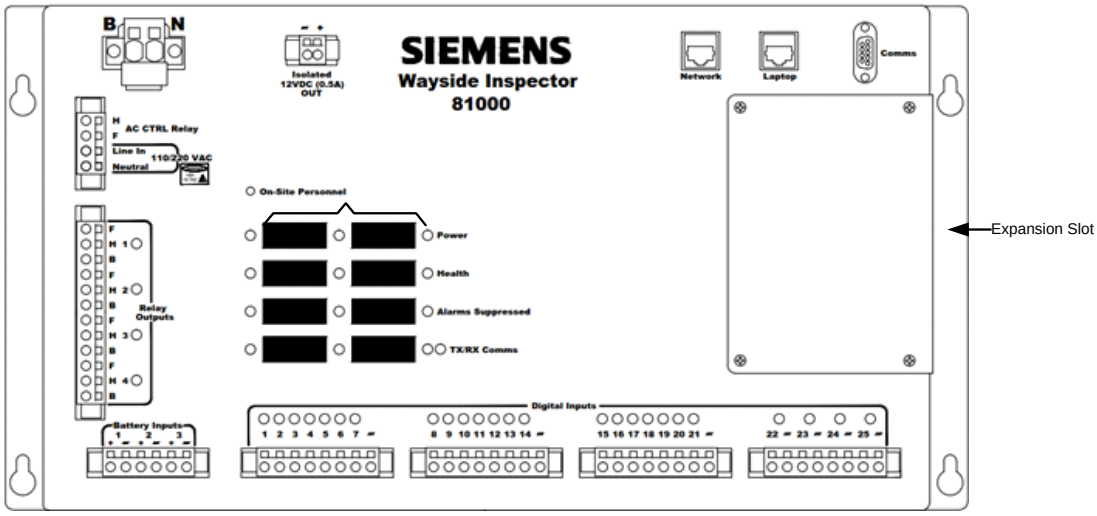



**Figure 3-8: Hardware Expansion Slot**

As of this writing, no expansion cards have been developed. Future expansion options include communication interfaces or specialized I/O.

## 3.9 DIGITAL INPUTS

The WI has 25 digital inputs. The unit has 3 groups of 7 inputs per group. Each group shares a common negative and is isolated from the rest of the system but not to inputs within the same group. There are 4 additional digital inputs, which are individually isolated with independent negatives. The installation may wire vital signals directly to digital inputs as long as the installation follows strict wiring guidelines specified in this manual in CHAPTER 6 .

Each input has its own LED indicator to display the state of that input, as determined by software (the LEDs are not directly hardware driven).

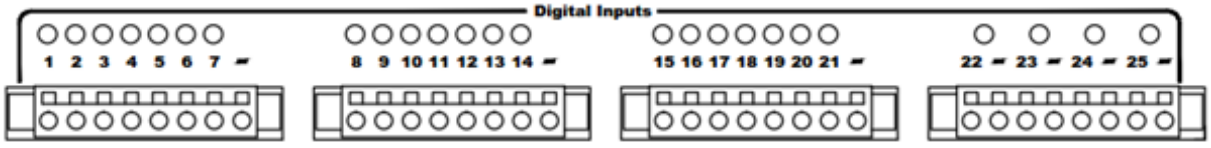



**Figure 3-9: Digital Input Connectors and LEDs**

Table 3-6 lists the specifications for the digital inputs:

**Table 3-6: Digital Input Specifications**

| Parameter | Value Range | Comments |
|---|---|---|
| Voltage Range | 0 – 120V (AC or DC) | |
| ON Threshold | 4.0VDC | See Note |
| OFF Threshold | 1.0VDC | See Note |
| Reverse Polarity Protection | Full input voltage range | Reverse polarity always OFF |
| Isolation | 2000VRMS, 60Hz, 60s | |

***NOTE***

**NOTE**

The specified ON and OFF DC voltage thresholds apply to the input circuit hardware. The WI executive software further samples and de-bounces the input to determine the reported input state. The ON and OFF voltage thresholds do not apply when monitoring AC voltage. The system may not reliably detect AC voltage below about 14.0 VRMS and specific de-bounce settings are required to correctly report AC input states.

See 5.1.2 for a description of digital input processing and programming.

## 3.10 BATTERY INPUTS

The WI has 4 battery inputs. Three battery inputs are externally accessible through a WAGO connector. One battery input is internally connected to the power input. The battery inputs are designed to monitor battery banks with voltages ranging up to 36VDC.

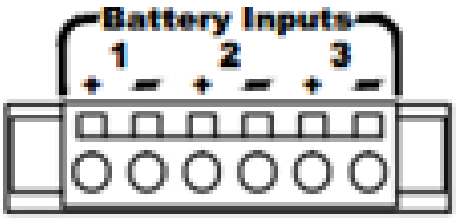



**Figure 3-10: Battery Input Connector**

Table 3-7 lists the specifications for the battery inputs.

**Table 3-7: Battery Input Specifications**

| Parameter | Value Range |
|---|---|
| Voltage Range | 0 – 36VDC |
| Isolation | 2000VRMS, 60Hz, 60s |

## 3.11 RELAY OUTPUTS

The WI has 4 general purpose non-vital relay outputs. Each relay includes both the front (F) and back (B) contacts for normally open (H to F) or normally closed (H to B) wiring options. LED indicators display the status of each relay, as commanded by software (the LEDs are not directly hardware driven).

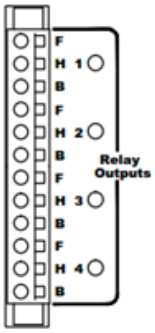



**Figure 3-11: Relay Output Connector and LEDs**

Figure 3-12 shows the internal relay hardware:

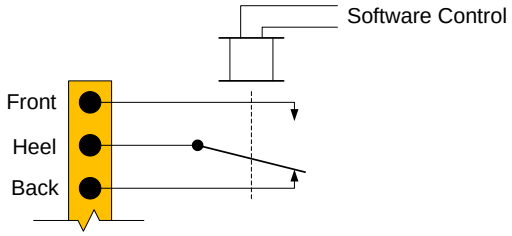



**Figure 3-12: Relay Output Hardware Internals**

Table 3-8 lists the specifications for the relay outputs.

**Table 3-8: Relay Output Specifications**

| Parameter | Value Range |
|---|---|
| Current Limit | 5A @ 30VDC |
| Isolation | 2000VRMS, 60Hz, 60s |

## 3.12 AC POWER MONITOR AND CONTROL

The WI has a dedicated input for monitoring AC power and a dedicated relay output to control the AC power to battery chargers.

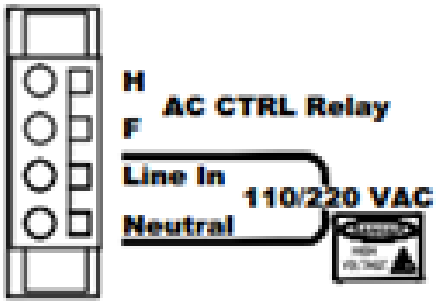



**Figure 3-13: AC Power control and Input Connector**

The “Line In” pin is for connection to the AC power line wire and the “Neutral” is for connection to the AC power neutral.

The AC CTRL Relay is intended to control an external relay that removes AC power from the installed battery chargers. That is needed to perform the standby power test. The AC CTRL relay is normally open. The contacts will close to control external AC disconnect relays for each battery charger.

Siemens recommends using a 12V relay with 10 Ohms or greater Relay Resistance Value for the AC CTRL Relay.

The WI AC power input is the same as the digital input, but has different default de-bounce settings in the software. The AC CTRL relay is the same as the general purpose relays, except only the Front contact is available, and it has a Relay Resistance Value of XX ohms.

## 3.13 DIAGNOSTIC SERIAL INTERFACE

The WI has a diagnostic serial port intended for use by Siemens personnel. This serial port provides access to the underlying Linux command line, which should be used by properly trained or instructed personnel only.

The diagnostic serial port is accessible only after removing the hardware expansion plate. The user must connect the Siemens 53255 cable to the 4-pin header on the back side of the printed circuit board. The 53255 cable provides a DB9 female DCE connector suitable for connection to a PC using a standard, straight though, RS-232 serial cable.

Table 3-9 shows the pin assignments on the 4 pin header. All signals are TTL-level at the header. The 53255 cable has a built-in RS-232 level converter.

**Table 3-9: Diagnostic Serial Port Pin Assignment**

| Pin | I/O | Function |
|---|---|---|
| 1 | O | +5VDC |
| 2 | I | Receive Data (RXD) |
| 3 | O | Transmit Data (TXD) |
| 4 | N/A | GND |

## 3.14 MOUNTING

The WI is mounted on a wall, a shelf, or a 19-inch rack. All WI connector and indicators are front facing.

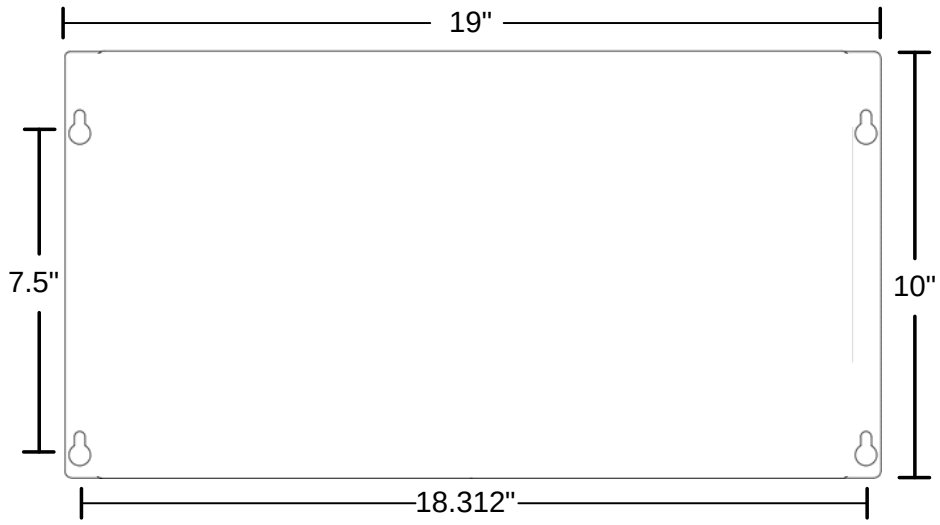



**Figure 3-14: Wayside Inspector Mounting Dimensions**

# CHAPTER 4 – ANCILLARY EQUIPMENT

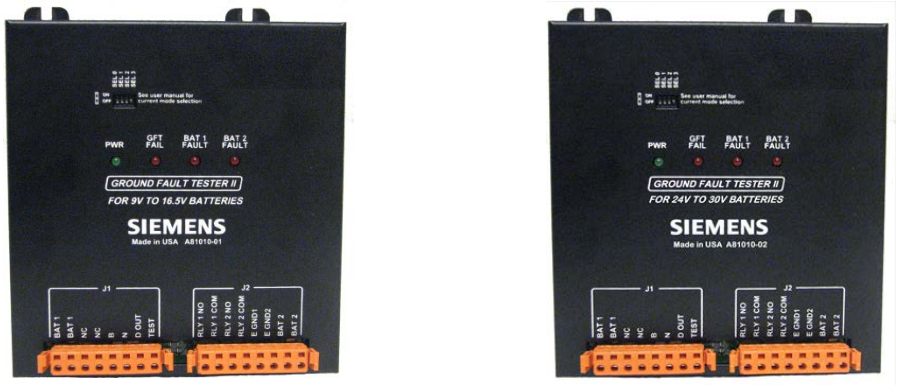
The following programs and external hardware are used with Wayside Inspector (WI):

## 4.1 WAYSIDE INSPECTOR APPLICATION GUIDELINES & MCF CONFIGURATION TOOL

This document provides guidance to field personnel to install and setup the WI. The Siemens Wayside Interface Application Guidelines, SIG-00-16-05, provides a reference to the Application Engineer for all WI configuration settings and their purpose. The Module Configuration File Configuration Tool provides a means for the Application Engineer to program all WI logic states, which are then available as optional pull down values in the MCF logic.

An Application Engineer tailors the functionality of the WI by writing an MCF. The MCF includes configuration settings and the relay logic. The Application Engineer uses the MCT to create the MCF. The MCT presents screens to define the MCF configuration settings, configure timers and logic states, and write the logic using relay logic diagrams. For data regarding the MCF and the MCT, see SIG-00-16-05.

## 4.2 GROUND FAULT TESTER 2 (GFT2)




**A** **B**

**Figure 4-1: The Ground Fault Tester 2,**
**A) A81010-01 (9V - 16.5V) & B) A81010-02 (24V – 36V)**

**⚠ WARNING**

**WARNING**

**THE GROUND FAULT TESTER 2 (GFT 2) SHOULD ONLY BE USED IN APPLICATIONS DESCRIBED IN THIS MANUAL.**

**AN INTERNAL FAILURE OF THE GFT 2 MAY RESULT IN A GROUND OF UP TO 0.8 mA ON THE BATTERY BEING MONITORED. THEREFORE, THE GFT 2 SHOULD NOT BE USED IN SAFETY CRITICAL APPLICATIONS THAT COULD BE ADVERSELY AFFECTED BY A GROUND OF UP TO 0.8 mA.**

**THE GFT 2 CANNOT BE GUARANTEED TO CORRECTLY DETECT AND/OR REPORT GROUND FAULTS UNDER ALL FAILURE CONDITIONS.**

***NOTE***

**NOTE**

Periodic independent ground fault testing should be performed during routine maintenance of the system.

The A81010 Ground Fault Tester 2 (GFT 2) is a user configurable device used to monitor the leakage resistance between battery terminals and earth ground. The unit can be operated in a stand-alone mode, with a SEAR II device, with a Wayside Inspector (WI) or with any 3rd party equipment that can be configured to accept **dry** contact relay inputs.

The GFT 2 is available in two hardware configurations, A81010-01 and A81010-02. The –01 configuration is used with 9 to 16 volt batteries. The –02 configuration is used with 24 to 30 volt batteries. See Figure 4-1A and Figure 4-1B.

The unit can also be placed in test mode where a simulated ground fault of 1 mA is placed internally on an isolated battery input to verify that the unit is properly detecting faults.

A separate internal circuit is used to verify the GFT 2's health, as indicated by the status of the GFT FAIL LED on the front panel. The GFT 2 can be powered by a 9-30 VDC (12 VDC nominal) operating battery independently from the batteries being monitored.

The GFT 2 has an internal de-bounce circuit that monitors the channel faults for 10+/- 1 sec from the instant the GFT 2 detects the presence or removal of the fault before confirming the status of the fault visually via LED indicators on the front panel and via a serial interface to the SEARII or to the WI via any unused WI digital input, or via dry relay contacts to 3rd party equipment

The GFT 2 has been designed using fail-safe design principles to ensure that in the event of a failure, no more than a 0.8 mA ground can be placed on the battery being monitored.

For additional information regarding the GFT2, please see Siemens Ground Fault Tester 2 (GFT2), A81010 -01, -02 User's Guide, SIG-00-15-06.

## 4.3 CROSSING BATTERIES

**Figure 4-2: Typical Crossing Battery Banks**

The WI monitors the battery system voltages using analog inputs. The WI can turn off the battery charger using the AC power control relay. The WI also monitors the system for ground faults using the Ground Fault Tester 2 (GFT2).

## 4.4 BATTERY CHARGERS


**Figure 4-3: Siemens SJ20 20 Amp Battery Charger**

By placing a relay between the WI and the Battery Charger, the WI can command the battery charger off to perform required battery testing.

## 4.5 AC POWER

The local AC Power in the shelter used to power the battery charger is also routed through the WI so that the battery charger can be commanded off for required battery testing.

## 4.6 GRADE CROSSING PREDICTOR MODEL 4000 OR 5000 (MODEL 4000/5000 GCP)

**Figure 4-4: The Model 4000/5000 Grade Crossing Predictor (GCP)**

### 4.6.1 System Configurations

The Model 4000/5000 Grade Crossing Predictor (GCP) is a modular microprocessor-controlled predictor system that is deployed to continually monitor the approach(es) to railroad grade crossings and to control the lamps, gates and bells associated with those crossings. It also has provision for an optional plug-in SEAR event recorder. The Model 4000/5000 GCPs are available in several case configurations. The Model 4000 GCP communicates with the Wayside Inspector (WI) using the GCP's Echelon communication protocol thru the Wayside Access Gateway (WAG), and from the WAG to the WI via the Ethernet. The Model 5000 GCP has Ethernet connectivity already built in to pass information via the Ethernet.

### 4.6.2 Standard Features

The Model 4000/5000 GCP can have up to 6 Track Modules for train detection, with each Track Module having nine track predictors that are configurable as motion sensors or predictors. The Track Module Prime Predictor is generally used for control of local crossings. The Track Module DAX A through DAX G Predictors are generally used for control of remote crossings. The Track Module Preempt Predictor is generally used for interconnection with traffic signal systems. Each track module has two vital inputs and two vital outputs. In addition to predictors, each track module is capable of providing a multifrequency island circuit.

Using internal crossing controller(s), the GCP can control the bells and gates of a crossing and up to 40 amps of lights. Each SSCC IIIi module has 5 vital outputs. The GCP can utilize internal PSO Modules that have the ability to detect train direction on a bidirectional track circuit that allows the control of remote crossings (DAXing) and also to perform mandatory testing of crossings in conjunction with the WI. Each PSO Module has three vital outputs and two vital inputs. The GCP can utilize RIO modules to extend I/O capability via the RIO's four vital inputs and four vital outputs. The GCP has redundant Main/Standby operation for CPU, Track, PSO, and RIO modules.

The GCP can perform independent event recording, using the SEAR2i. The SEAR2i options include programmable alarms and automated performance of crossing test functions. The GCP generates test

result reports in several formats. The GCP also interfaces to the Wayside Alarm Management System (WAMS) and the Wayside Inspector (WI).

The Model 4000 GCP utilizes Echelon communications for vital communications to other locations via Ethernet spread spectrum radio (ESSR) and single person calibration and monitoring using VHF communicator. The GCP has a color display module for configuration, monitoring and troubleshooting the system. The Model 5000 GCP uses internet connectivity for vital communications to the WI as well as other locations via the Ethernet.

For further information regarding the Model 4000 GCP, see Siemens Microprocessor Based Grade Crossing Predictor Model 4000 Family Application Guidelines, SIG-00-08-06 and for the Model 5000 GCP see Siemens Microprocessor Based Grade Crossing Predictor Model 5000 Family Application Guidelines, SIG-00-08-06.

## 4.7 CROSSING WARNING SYSTEM (CROSSING CONTROLLER OR RELAY BASED)

In a Relay Based Crossing, take one output wire from the relay concerned (XR, ISL, Appr1, Appr2, etc.), and connect it to a digital input per the approved Railroad/Agency site wiring diagram.

## 4.8 WIRELESS MAGNETOMETER (WIMAG) SYSTEM

The WI can receive status information from a Wireless Magnetometer (WiMag) system. The WiMag system is made up of an Access Point (or base station) and at least one sensor. Optionally, the system may use a repeater to increase the RF range of the sensors. Figure 4-5 shows an example system.

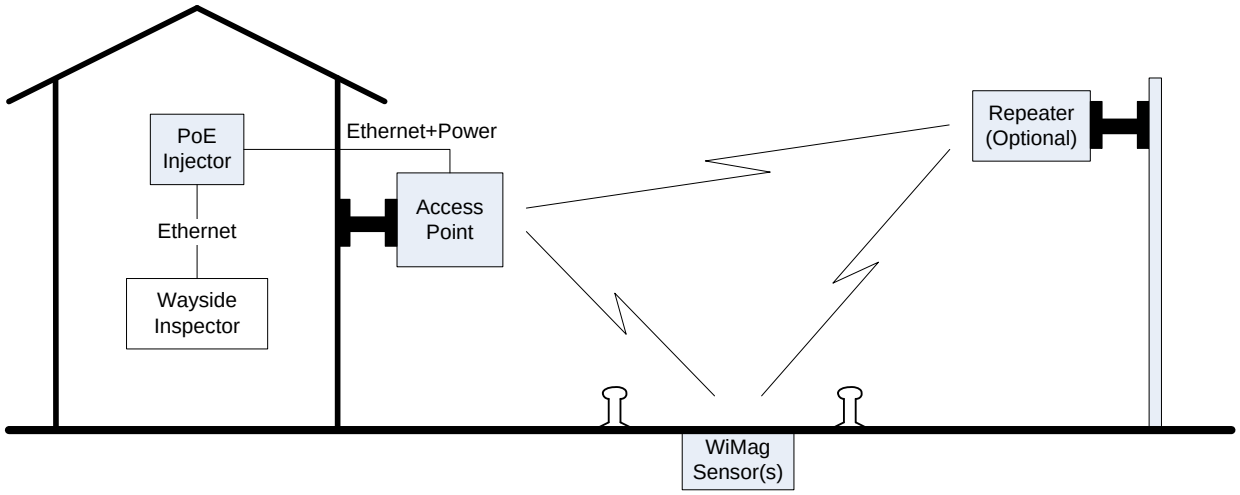



**Figure 4-5: The Wireless Magnetometer (WiMag) Sensor System**

The Access Point reports the status of each sensor in the system to the WI over a network using UDP messages. The sensor statuses are reported at a periodic rate. The sensor reports “detected” or “not detected” status and an error status. When a train is above a WiMag sensor, it will report “detected”.

The user may set the UDP port number and a timeout value for the Access Point messages. The timeout is used to report the health of the link with the Access Point.

The user can set a channel name, OFF name, and ON name for each sensor. The user can also set ON and OFF de-bounce values for each sensor (just like discrete digital inputs). These names are used when adding state change entries to the Event Log.

The WI can receive statuses from only 1 Access Point and at most 20 WiMag sensors.

The Application Engineer may use the “detected” and “error” statuses of each sensor and the “link OK” status of the Access Point in the MCF logic.

For a more detailed description of the WiMag Sensor System, see Siemens WiMag Vehicle Detection System General Handbook, Part No. 667/HB/47200/000.

## 4.9 WEB USER INTERFACE

The field maintainer will connect a laptop computer to the Laptop connector to perform required maintenance, upload software, and download reports. An Application Engineer may monitor the status of the WI remotely using the Network port on the face of the WI. The Application Engineer could also reprogram and install software updates remotely.

## 4.10 BACK OFFICE INTERFACE

The Wayside Inspector reports via the Ethernet to the Back Office links to the Wayside Alarm Management System (WAMS), the Office Control Gateway, (OCG), and/or the A-Server. Soon, Rail Fusion will take in the reports as well.

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# CHAPTER 5 – MENUS & PROGRAMMING

This chapter provides information regarding each of the menu screens used to program the Wayside Inspector.

**NOTE**

**NOTE**

Except for the top level Configuration screen, all parameters and parameter values are set by the Application Engineer for each MCF. Field Maintainers can neither create nor add values that do not already appear in pull down entry lists.

Typically, Field Maintainers are not required to make changes to the parameters of the Wayside Maintainer, but the capability to do so is built into the equipment. Field Maintainer's that make such entries will ensure that the entries are in accordance with the Railroad/Agency's approved site drawings.

## 5.1 CONFIGURATION

The following screens are found under the Configuration Button

### 5.1.1 Site Configuration

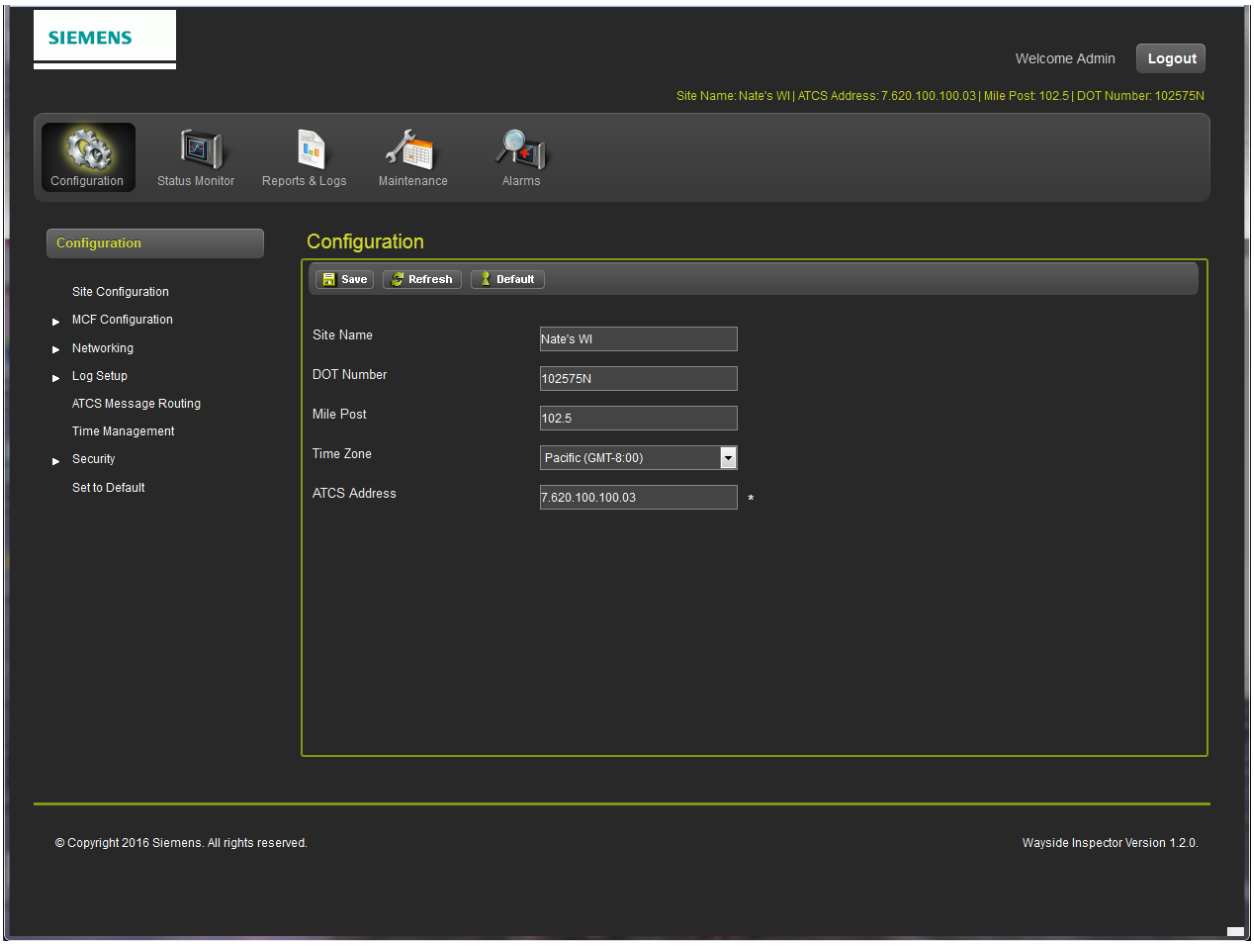



**Figure 5-1: Top Level Configuration Screen**

**NOTE**

**NOTE**

The Field Maintainer will ensure all parameter values set on-site conform to the values specified in the approved Railroad/Agency's site drawings.

The top-level Configuration screen allows the Field Maintainer to enter the following parameter's values:

- Site Name
- DOT Number
- Mile Post
- Time Zone
- ATCS Address

**Table 5-1: Site Configuration Screen**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Site Name | 20 characters | Inspection Site | The name of the site printed on reports and downloads. |
| DOT Number | 7 characters | 000000A | The DOT number assigned to the installation |
| Mile Post | 20 characters | 000.0 | The mile post location of the installation. |
| Time Zone | Greenwich Mean Time (GMT), Eastern, Central, Mountain, Pacific, Alaska, Atlantic, Arizona (no DST), Newfoundland | Eastern | The time zone of the installation. |
| ATCS Address | Type 7 ATCS address | 7.620.100.100.03 | The ATCS address of the installation. |

### 5.1.2 MCF Configuration

The MCF Configuration screen opens tabs concerning:

1. General Configuration
2. Digital Input Configuration
3. Battery Input Configuration
4. Relay Output Configuration
5. WiMag Configuration
6. GCP Interface Configuration
7. Speed Measurement
8. Logic Configuration
9. State Names
10. Set to Default

### 5.1.2.1 *General Configuration*

The General Configuration screen opens tabs concerning:

- Maintainer On Site
- AC Power

### *Maintainer On Site*

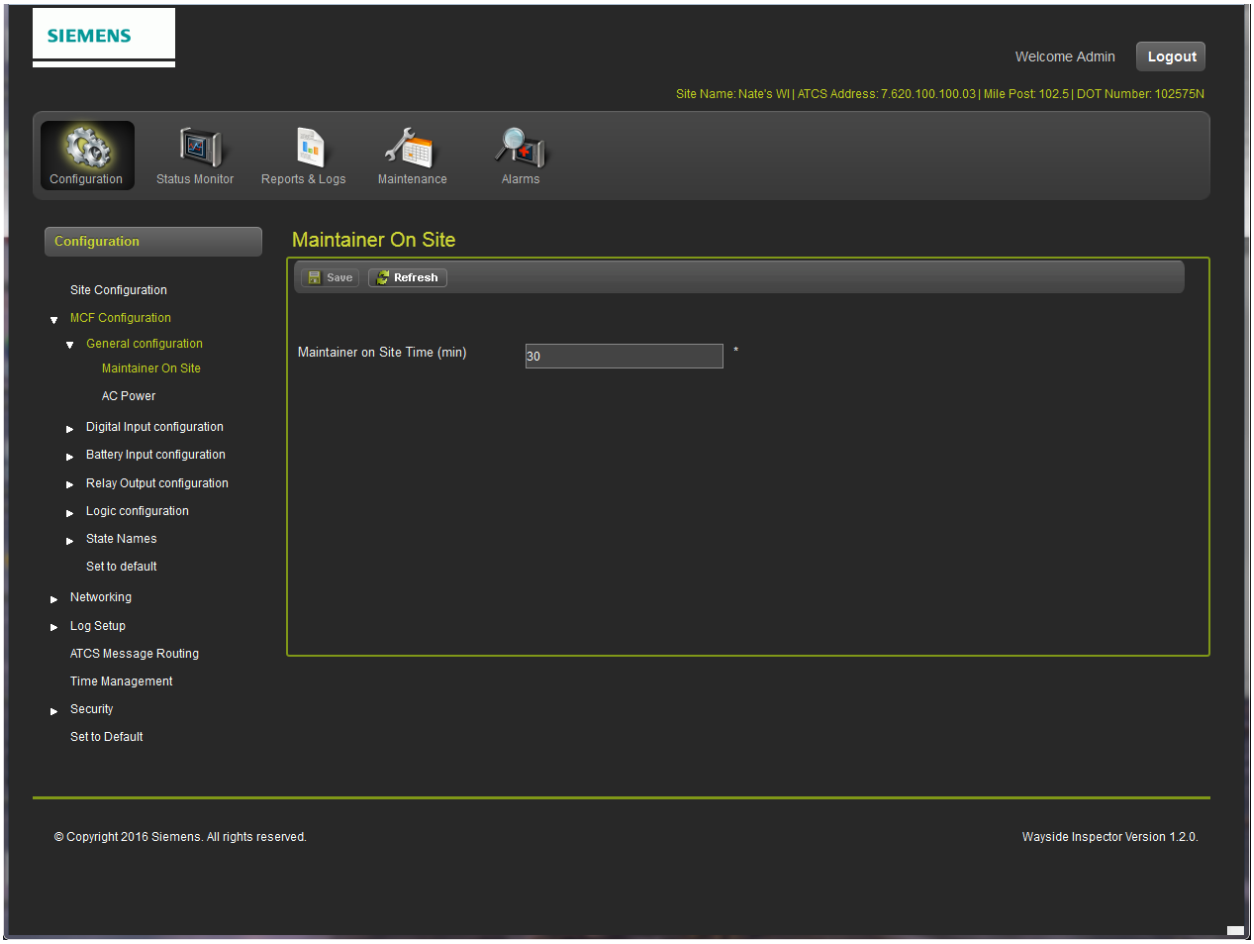



**Figure 5-2: Maintainer On Site Screen**

**Table 5-2: General Configuration Parameter Data**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Maintainer On Site Time | 10 minutes to 3 hours | 30 minutes | This value determines the length of time the WI will remain in Maintainer On Site mode when Field Personnel press the On-Site Personnel button. |

## *AC Power*

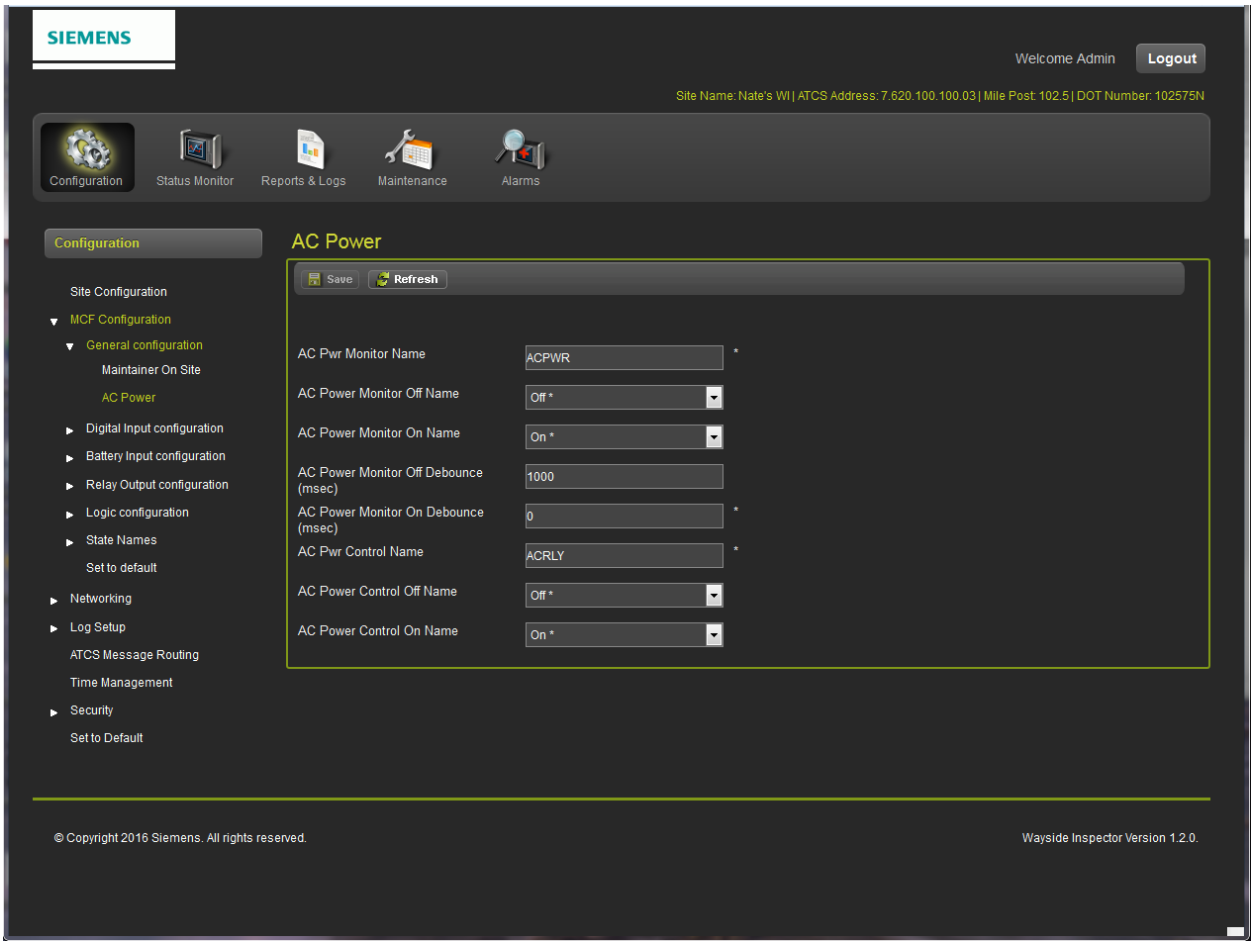



**Figure 5-3: The AC Power Screen**

**Table 5-3: AC Power Parameter Data**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| AC Pwr Monitor Name | 20 characters | ACPWR | Name used when logging state changes in the event log and included on the configuration report. |
| AC Pwr Monitor Locked | No,<br>Yes | No | If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel. |
| AC Pwr Monitor On Name | On state name list | On | Name used for the ON state when logging state changes in the event log. Name is selected from a user definable list of possible ON state names. |
| AC Pwr Monitor Off Name | Off state name list | Off | Name used for the OFF state when logging changes in the event log. Name is selected from a user definable list of possible OFF state names. |

| | | | |
|---|---|---|---|
| AC Pwr Monitor Off Debounce | 0 to 60,000 ms | 1000 | Debounce timer to declare the input OFF. If the input is ON, the WI must not detect energy on the input for this period of time, continuously, before declaring it OFF. |
| AC Pwr Monitor On Debounce | 0 to 60,000 ms | 0 | Debounce timer to declare the input ON. If the input is OFF, the WI must detect energy on the input for this period of time, continuously, before declaring it ON. |
| AC Pwr Control Name | 20 characters | ACRLY | Name used when logging commanded state change in the event log and included on the configuration report. |
| AC Pwr Control Locked | Yes or No | No | If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel |

#### 5.1.2.2 *Digital Input Configuration*

The WI monitors the crossing using digital inputs. The user can set each digital input to operate in one of three modes: Not Used, Discrete, or GFT.

### *Not Used Inputs*

In some cases, the user may wish to ignore inputs without removing external wiring connected to that input. The user may set the input to “Not Used”. In that case, the WI will not process the input or log events for that input.

### *Discrete Inputs*

The WI considers discrete digital inputs to be in one of the following states: OFF, ON, or TOGGLING. When the software detects a state change, it adds an entry to the event log. The log entry includes the name of the input and a name for the state.

> For example, an input named “XR” with an OFF state name of “DOWN” and an ON state name of “UP would be logged as “XR DOWN” when the input turns off. The software would log “XR UP” when the input turned back on. The following is an example from an Event report:
>
> ```
> B85F  07-Apr-2016 13:42:50.35  DI     XR UP
> ```

The software determines the input’s state by sampling the input hardware. The inputs are de-bounced to prevent logging state changes caused by noise and to prevent application logic from acting on transient states. Before the software declares the input is ON, it must have consecutive energized samples for the on de-bounce time.

The software implements toggle detection to prevent filling up the log if external relays or equipment fails. When the software detects the input is toggling, it will log one single event rather than a long sequence of ON/OFF entries. If the software sees 4 or more changes on the input within the toggle period, it will declare the input as toggling.

The input state is available to the MCF for use in relay logic.

### *GFT Inputs*

The WI can process the pulsed data signal used by the GFT. There are 4 bits of data sent by the GFT on the pulsed data signal: GFT Health (Good or Bad), GFT Mode (Normal or Test), Battery 1 Status (Fault/No Fault), Battery 2 Status (Fault/No Fault). The WI can also detect the “stuck low” and “stuck high” errors on the connection. The WI will log changes to each GFT status bit and the line status. Each status bit and the line status is available to the MCF for use in relay logic.

## *Digital Input 1 – 25*

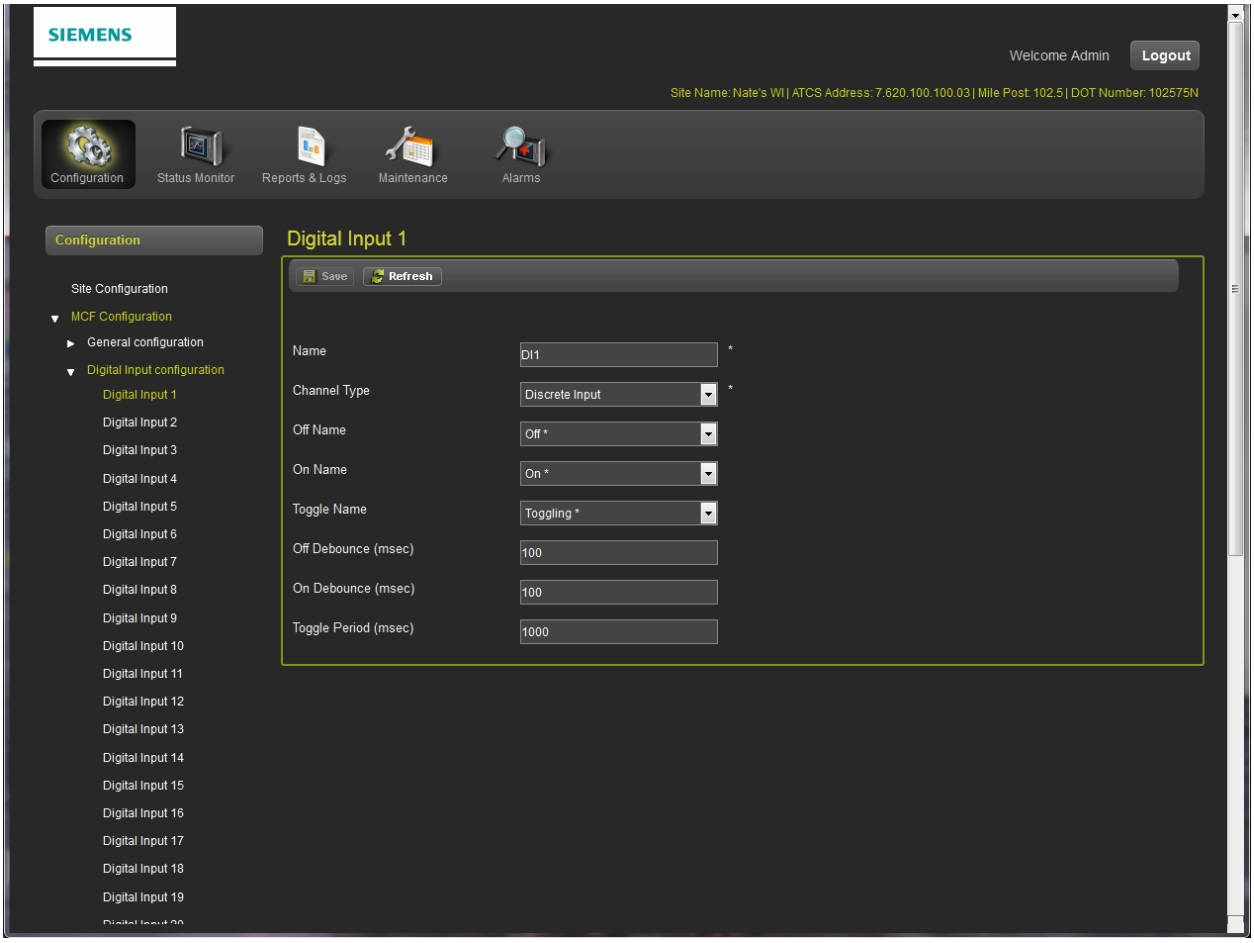



**Figure 5-4: The Digital Input "N" Screen**

There are 25 separate Digital Inputs. If not preset in the MCF, the Field Maintainer will enter the values as specified in the Agency/Railroad's approved site diagram. Alternatively, the MCF may have some or all of the fields locked, thereby preventing changes to the channel name and state names of that channel.

**Table 5-4: Digital Input Parameter Data**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Name | 20 characters | DI*xx* | Name used when logging state changes in the event log and included on the configuration report. This name is NOT used in the relay logic (see section 3.4). |
| Channel Type | Discrete Input,<br>GFT,<br>Not Used | Discrete Input | Selects the type of function the input used for. If Discrete Input, logs OFF, ON, or TOGGLE states. If GFT, the input is wired to an external Ground Fault Tester and individual ground fault states are logged. If Not Used, the input channel is ignored and nothing will be logged, regardless of physical changes on the input. |

| | | | |
|---|---|---|---|
| Locked | Yes or No | No | If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel |
| On Name | On state name list | On | Name used for the ON state when logging state changes in the event log. Name is selected from a user definable list of possible ON state names. |
| Off Name | Off state name list | Off | Name used for the OFF state when logging changes in the event log. Name is selected from a user definable list of possible OFF state names. |
| Toggle Name | Toggle state name list | Toggle | Name used for the TOGGLE state when logging changes in the event log. Name is selected from a user definable list of possible TOGGLE state names. |
| Off Debounce | 0 to 60,000 ms | 100 | Debounce timer to declare the input OFF. If the input is ON, the WI must not detect energy on the input for this period of time, continuously, before declaring it OFF. |
| On Debounce | 0 to 60,000 ms | 100 | Debounce timer to declare the input ON. If the input is OFF, the WI must detect energy on the input for this period of time, continuously, before declaring it ON. |

### 5.1.2.3 *Battery Input Configuration*

### *Battery Input 1-4*

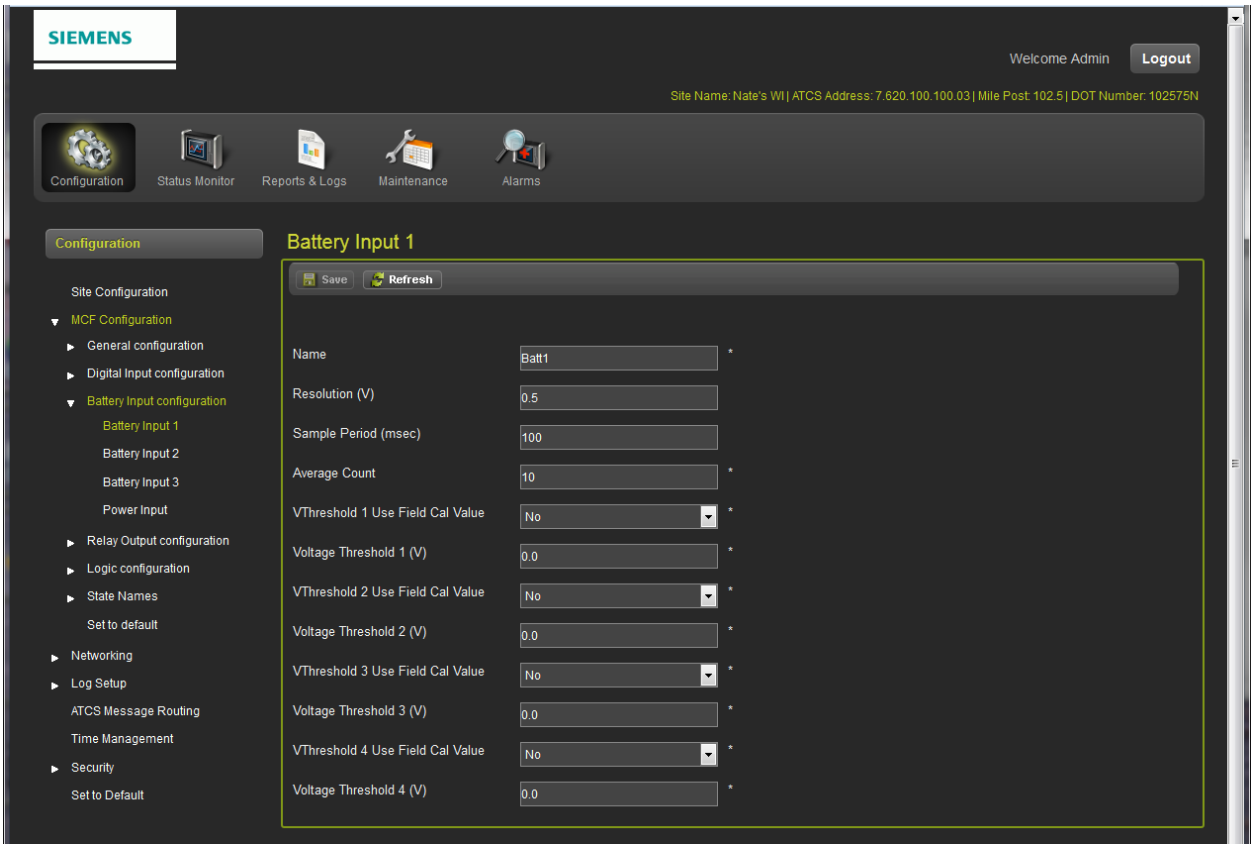



**Figure 5-5: The Battery Input "N" Screen**

The WI monitors the battery banks at the crossing using the battery inputs (a.k.a analog inputs). The software measures the voltage on the input by sampling the input every Sample Period. After sampling, the software averages the last Average Count samples to determine the voltage. If the voltage differs from the last logged voltage by the Resolution setting or greater, the software adds an entry to the Event Log. The log entry includes the user-configured name of the battery bank and averaged voltage to the tenth of a volt. (e.g. OB 13.8V).

The software can compare the last logged voltage to up to 4 voltage thresholds. If the voltage is greater than or equal to the threshold, the software sets a logic state, which the MCF can use in relay logic rungs for inspections or alarm logic.

**Table 5-5: Analog Inputs Parameter Data**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Name | 20 characters | BATT*x* | Name used when logging state changes in the event log and included on the configuration report. This name is NOT used in the relay logic (see section 3.5). |
| Resolution | 0.1V to 36.0V | 0.5V | Required change in voltage before the executive will log an entry. |
| Sample Period | 100ms to 60,000ms | 100ms | How often the executive will sample the input voltage. |
| Average Count | 1 to 32 | 10 | The number of consecutive samples the executive will average together to determine the input's voltage. |
| Voltage Threshold 1 | 0V to 36V | 0V | If the last logged voltage is greater than or equal to this value, the executive will set the "Above Threshold 1" logic state for this battery channel. |
| Voltage Threshold 2 | 0V to 36V | 0V | If the last logged voltage is greater than or equal to this value, the executive will set the "Above Threshold 2" logic state for this battery channel. |
| Voltage Threshold 3 | 0V to 36V | 0V | If the last logged voltage is greater than or equal to this value, the executive will set the "Above Threshold 3" logic state for this battery channel. |
| Voltage Threshold 4 | 0V to 36V | 0V | If the last logged voltage is greater than or equal to this value, the executive will set the "Above Threshold 4" logic state for this battery channel. |

There are four separate Battery Inputs. If not preset in the MCF, the Field Maintainer will enter the values as specified in the Agency/Railroad's approved site diagram. Typically, the following values are entered: Name, Resolution (V), Sample Period (msec), Average Count, VThreshold 1 Use Field Cal Value, Voltage Threshold 1 (V), VThreshold 2 Use Field Cal Value, Voltage Threshold 2 (V), VThreshold 3 Use Field Cal Value, Voltage Threshold 3 (V), VThreshold 4 Use Field Cal Value, Voltage Threshold 4 (V). Alternatively, the MCF may have some or all of the fields locked, thereby preventing changes to the channel name and state names of that channel.

#### 5.1.2.4 *Relay Output Configuration*

The WI commands the relay outputs to states as defined by the MCF. Like discrete digital inputs, each relay output has a channel name, OFF name, ON name and TOGGLE name. When relay outputs are commanded to change state, the software adds an entry into the Event log showing the channel name and newly commanded state (e.g. TLITE FLASH).

The software automatically toggles the relay output at a user-programmable toggle rate and duty cycle when commanded to the TOGGLE state. The Application Engineer does not need to write MCF timer logic to turn the relay off and on.

### *Relay Output 1 – 4*

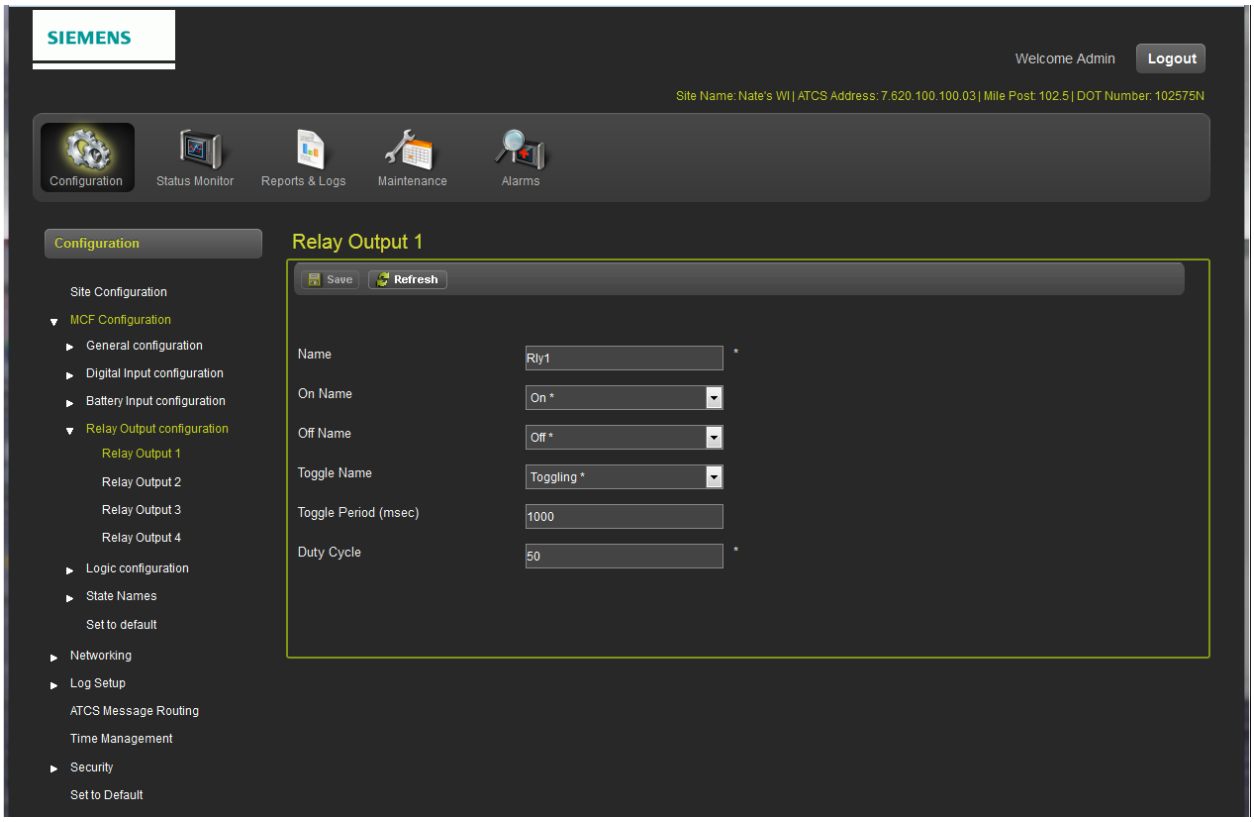



**Figure 5-6: The Relay Output "N" Screen**

There are four separate Relay Outputs. If not preset in the MCF, the Field Maintainer will enter the values as specified in the Agency/Railroad's approved site diagram. Typically, the following values are entered: Name, On Name, Off Name, Toggle Name, Toggle Period (msec), Duty Cycle. Alternatively, the MCF may have some or all of the fields locked, thereby preventing changes to the channel name and state names of that channel.

**Table 5-6: Relay Outputs Parameter Data**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Name | 20 characters | RLY*x* | Name used when logging state changes in the event log and included on the configuration report. This name is NOT used in the relay logic (see section 3.6). |
| Toggle Period | 100ms to 60,000ms | 1000ms | If commanded to toggle, this is the period of time for each toggle cycle. |
| Duty Cycle | 5% to 95% | 50% | If commanded to toggle, the percentage of the toggle cycle for the relay output to be ON. |

| | | | |
|---|---|---|---|
| On Name | On state name list | On | Name used for the ON state when logging state changes in the event log. Name is selected from a user definable list of possible ON state names. |
| Off Name | Off state name list | Off | Name used for the OFF state when logging changes in the event log. Name is selected from a user definable list of possible OFF state names. |
| Toggle Name | Toggle state name list | Toggle | Name used for the TOGGLE state when logging changes in the event log. Name is selected from a user definable list of possible TOGGLE state names. |

### 5.1.2.5 *GCP Interface Configuration*

### *General*

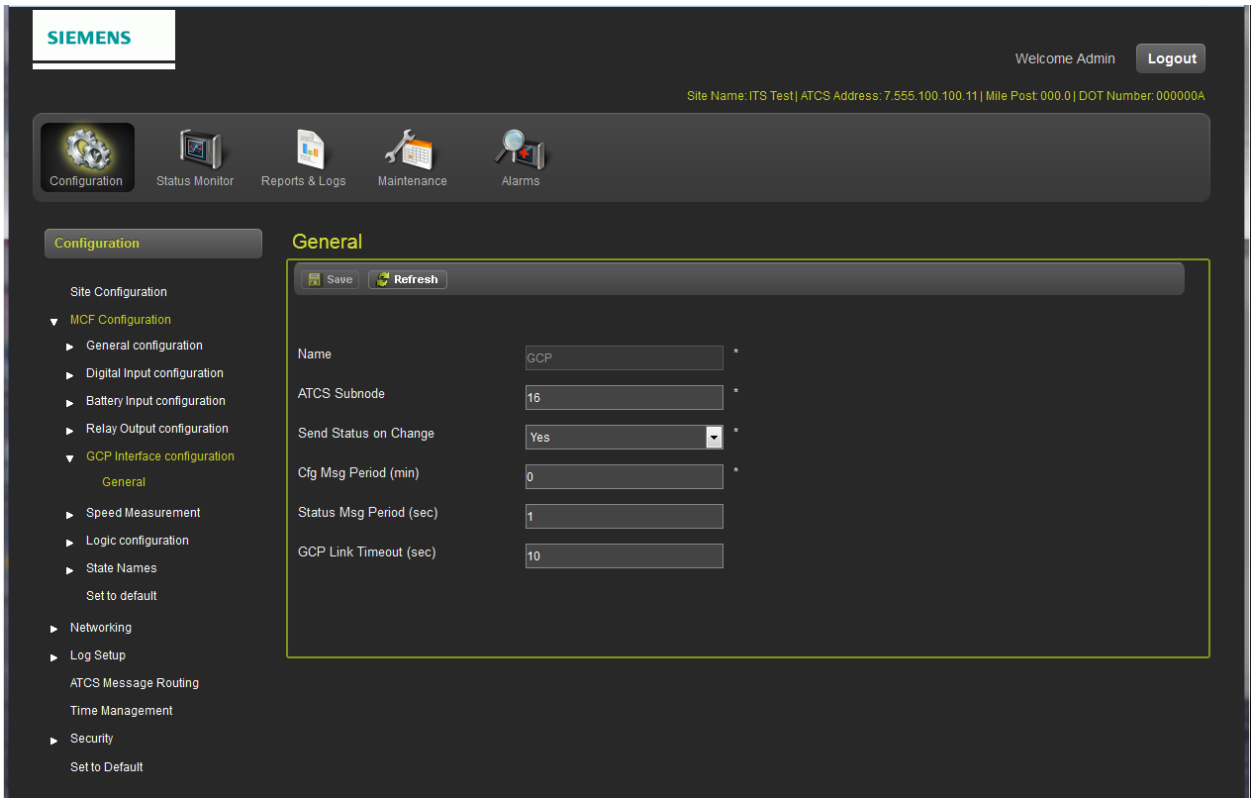



**Figure 5-7:The General GCP Screen**

**Table 5-7: GCP General Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Name | 20 characters | GCP IF | Name used for the GCP interface in logs and reports. |
| ATCS Subnode | 0 to 99 | 16 | The ATCS subnode of the GCP, which is assume to have the same railroad, line, and group addresses as the WI. |
| Send Status on Change | Yes or No | Yes | If Yes, the GCP will send status changes on change of state. |
| Cfg Msg Period | 0 to 60 minutes | 0 minutes | Time period between configuration messages. If 0, the GCP will send configuration messages only on initiate of the link and on configuration data changes. |
| Status Msg Period | 0 to 300 seconds | 30 seconds | Period of status messages. If 0, the GCP will not send periodic status messages. |
| GCP Link Timeout | 10 to 600 seconds | 30 seconds | If the WI does not receive messages from the GCP for this length of time, it will declare the link as failed. |

The WI can receive I/O statuses and configuration data from a GCP over a network. The I/O statuses and the configuration data status are available to the MCF logic, which eliminates the need to wire physical inputs for many of the statuses.

The WI monitors the health of the link with the GCP. If the WI stops receiving status messages from the GCP, it will set the link to unhealthy. The Application Engineer can set the timeout for the GCP messages in the MCF. The link health is available to the MCF logic as an input logic state.

The WI receives the status of GCP I/O, such as XR, ISL, etc., which the executive makes available as input logic states to the MCF. Since the GCP is highly configurable, not all I/O status are relevant in all conditions. The GCP reports the I/O items used in its current configuration. The executive software also makes the “used” statuses available to the MCF logic as input logic states. See the Wayside Inspector Application Guideline Manual, SIG-00-16-05 for all the logic states available to the MCF.

The WI will also log changes in the I/O and configuration statuses, as reported from the GCP, into the Event Log using the configured function name for that status.

### 5.1.2.6 *WiMag Configuration*

#### *WiMag General*

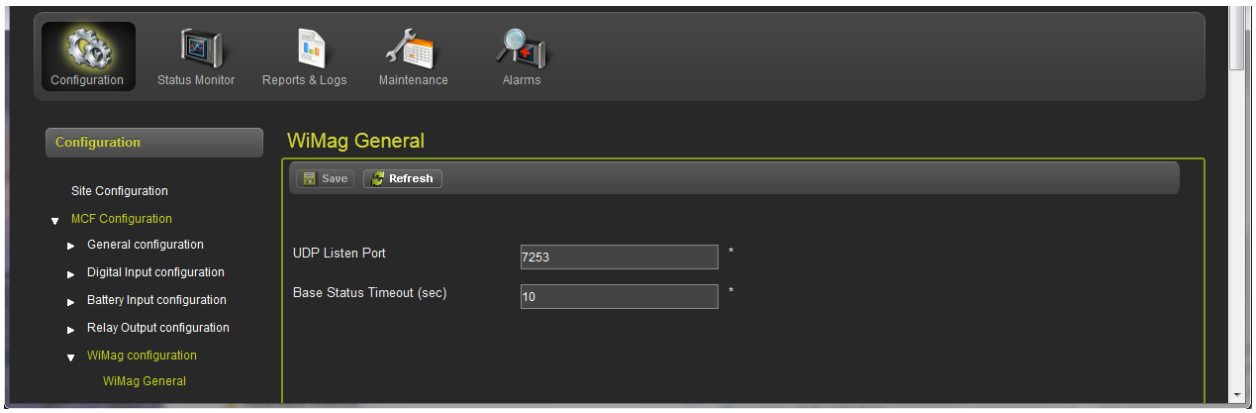



**Figure 5-8: The WiMag General Screen**

The user may set the UDP port number and a timeout value for the Access Point messages. The timeout is used to report the health of the link with the Access Point.

The Field Maintainer will enter the values as specified in the Agency/Railroad's approved site diagram. Alternatively, the MCF may have some or all of the fields locked, thereby preventing changes to the channel name and state names of that channel.

**Table 5-8:WiMag Base Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| UDP Listen Port | 1 to 65535 | 7253 | The UDP port the WI will listen on for WiMag sensor status messages. |
| Base Status Timeout | 0s to 255s | 10s | If the WI does not receive a status update from the WiMag base station in this amount of time, it will declare the link as failed. |

### *Sensor "N" (1-20)*

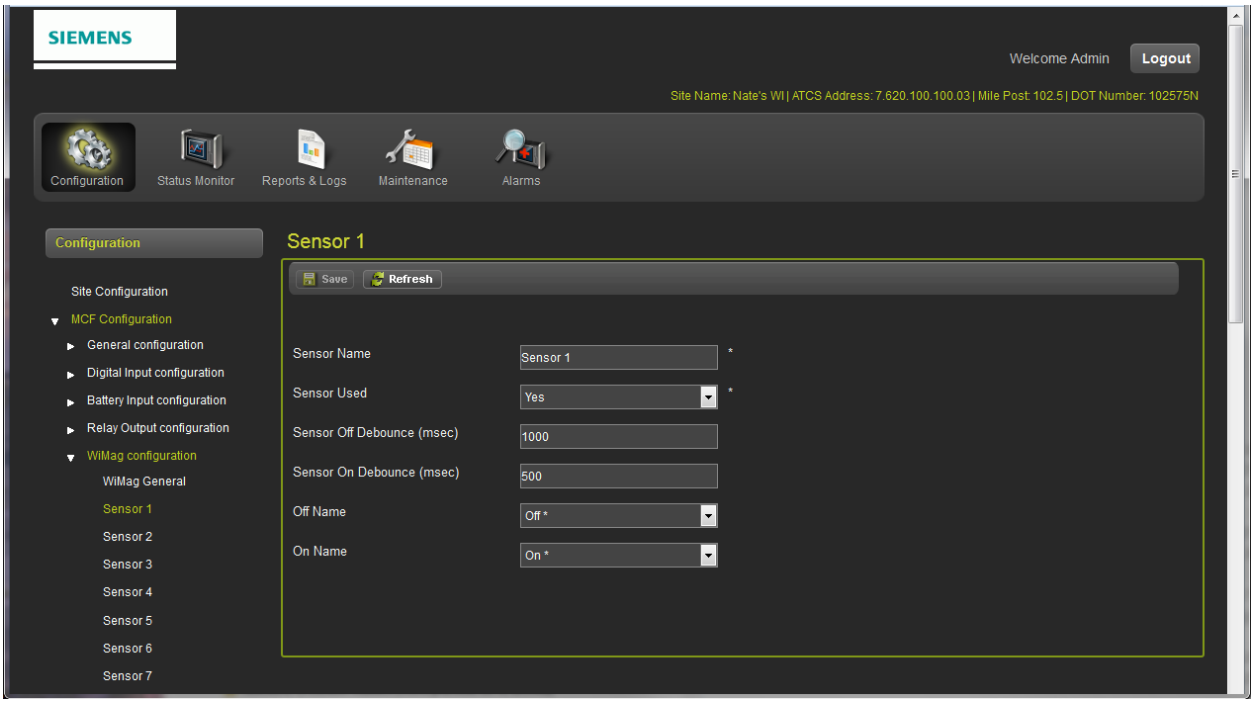



**Figure 5-9: The WiMag Sensor "N" Screen**

There are up to 20 separate WiMag Inputs. The Field Maintainer will enter the values as specified in the Agency/Railroad's approved site diagram.

The user can set a channel name, OFF name, and ON name for each sensor. The user can also set ON and OFF de-bounce values for each sensor (just like discrete digital inputs). These names are used when adding state change entries to the Event Log.

The WI can receive statuses from only 1 Access Point and at most 20 WiMag sensors.

The Application Engineer may use the "detected" and "error" statuses of each sensor and the "link OK" status of the Access Point in the MCF logic.

**Table 5-9: WiMag Sensors Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Senor Used | Yes or No | No | If set to Yes, the WI will expect status updates for this sensor. |
| Sensor Name | 20 characters | Sensor *x* | The name used when logging state changes to the event log and on reports. *Only visible if Sensor Used is Yes.* |
| Sensor Off Debounce | 0ms to 60,000ms | 100ms | The sensor must report off for this length of time, continuously, before the WI will declare the status as OFF. *Only visible if Sensor Used is Yes.* |
| Sensor On Debounce | 0ms to 60,000ms | 500ms | The sensor must report on for this length of time, continuously, before the WI will declare the status as ON. *Only visible if Sensor Used is Yes.* |
| Off Name | Off state name list | OFF | The name used for the OFF state when logging state changes to the event log. *Only visible if Sensor Used is Yes.* |
| On Name | On state name list | ON | The name used for the ON state when logging state changes to the event log. *Only visible if Sensor Used is Yes.* |

### 5.1.2.7 *Speed Measurement*

### *Speed Measurement 1-6*

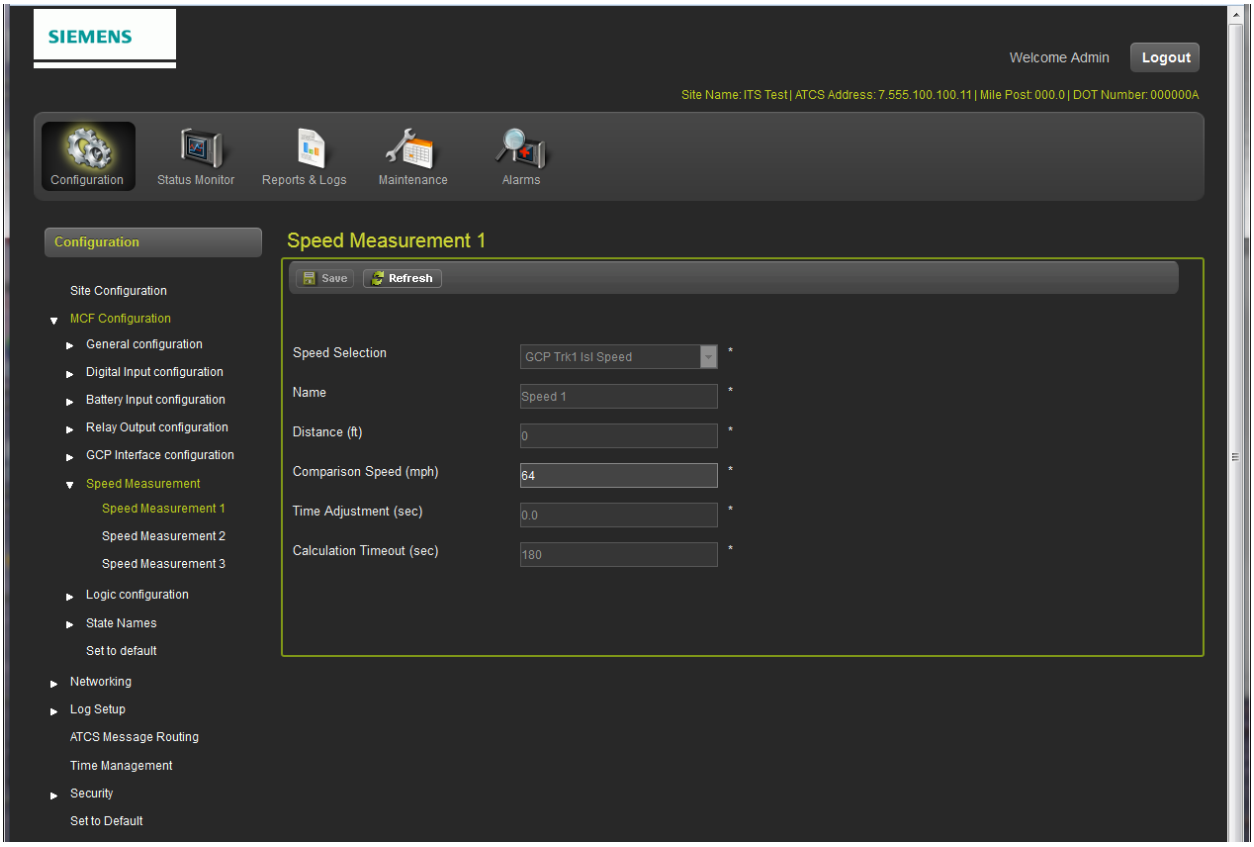



**Figure 5-10: The Speed Measurement "N" Screen**

To properly perform warning time tests, the WI must ensure the train was moving through the crossing at or near the maximum permissible speed for the route. The WI provides two methods to get train speed: calculate it or receive it from a GCP.

The executive software determines if the train speed is fast enough on behalf of the MCF. The MCF configuration data includes a “Speed Measurement Entry” for each speed the executive needs to check. The WI supports up to 64 entries.

At crossings using the Siemens GCP, the WI does not need to calculate the speed. The GCP can report the speed to the WI over a network. Again, the MCF and the executive software cooperate to determine if the reported speed is high enough for the warning time test. The Speed Measurement Entry will identify which island speed, reported from the GCP, to compare to the Comparison Speed. The executive will set the Speed Result logic state (and Result Ready) after the GCP reports the island speed (after the train has entered the island).

**Table 5-10: Speed Measurements Parameter Value**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Speed Selection | Calculate,<br>GCP Trk 1 Isl Speed,<br>GCP Trk 2 Isl Speed,<br>GCP Trk 3 Isl Speed,<br>GCP Trk 4 Isl Speed,<br>GCP Trk 5 Isl Speed,<br>GCP Trk 6 Isl Speed | Calculate Speed | Selects the method of determining speed. See section TBD for a description of the speed measurement method. |
| Name | 20 characters | Speed Measure-ment | The name used for the speed measurement entry in logs and reports. |
| Distance | 0 to 65535 ft. | 0 ft. | The distance to use in the speed calculation.<br>*Only relevant if Speed Selection is set to Calculate Speed.* |
| Comparison Speed | 0 to 255 mph | 0 mph | The calculated speed or reported speed from the GCP must be greater than or equal to this value to set the “Speed Result” logic state. |
| Time Adjustment | -12.8 to 12.7 seconds | 0 seconds | Time value used to adjust the speed calculation to account for de-bounce or other system delays.<br>*Only relevant if Speed Selection is set to Calculate Speed.* |
| Calculation Timeout | 0 to 65535 seconds | 180 seconds | Time limit on a complete speed calculation. If both speed measurement inputs do not change state within this length of time, the speed calculation will be abandoned.<br>*Only relevant if Speed Selection is set to Calculate Speed.* |

### 5.1.2.8 *Logic Configuration*

#### *Properties*

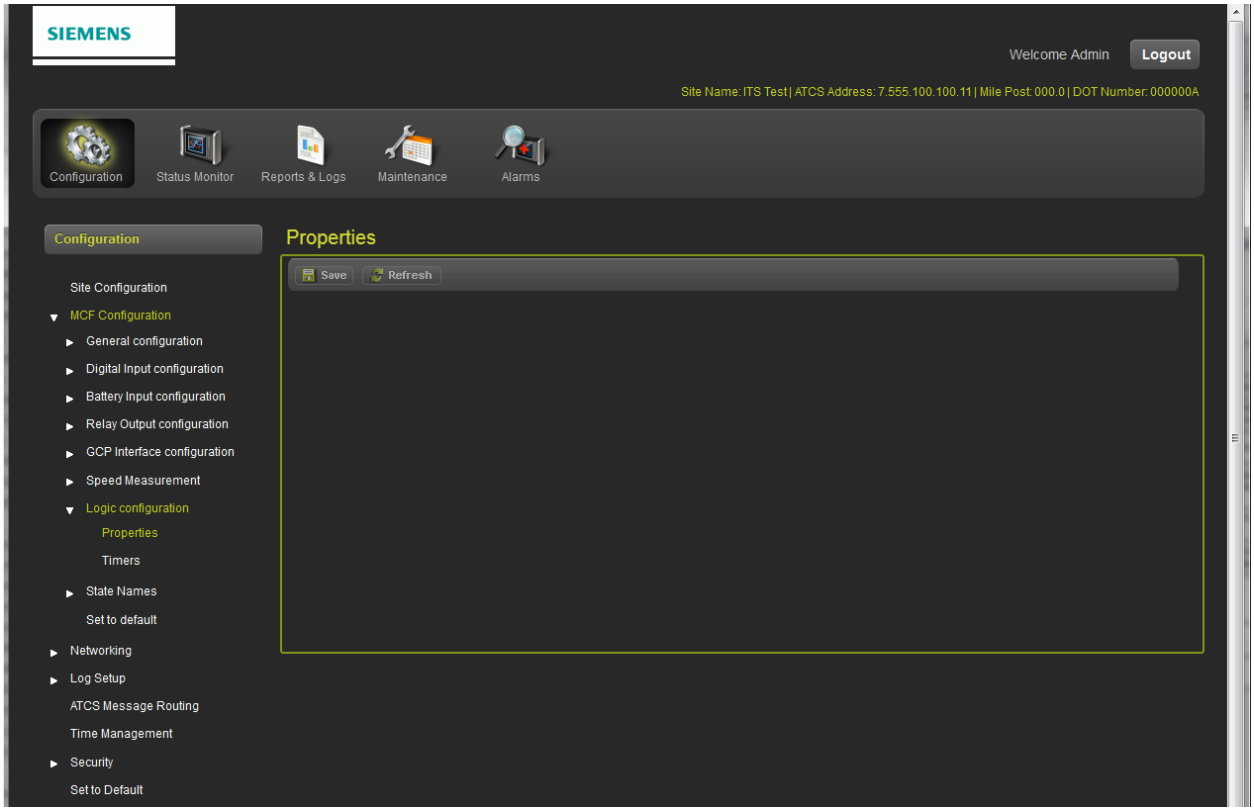



**Figure 5-11: The Properties Screes**

Properties are field programmable options within the MCF, created by the Application Engineer. The user can set or clear a property from a menu. Properties provide a logic state, which the Application Engineer may use in the relay logic. Properties allow the MCF to change behavior based on field personnel input on the UI.

**Table 5-11: Properties Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Some Description | No, Yes | No | See MCF paperwork for description |

### *Timers*

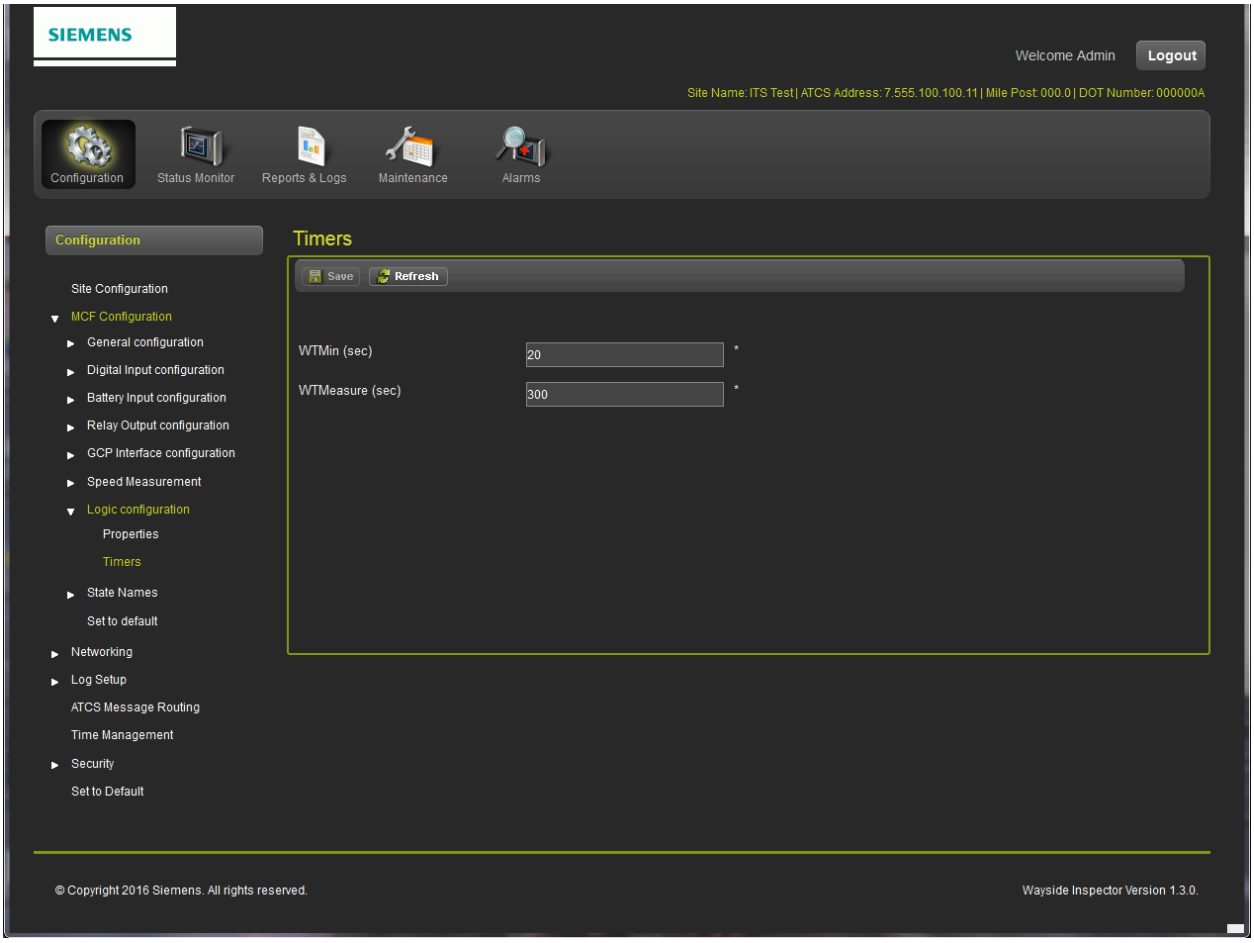



**Figure 5-12: The Logic Configuration Timers Screen**

The Wayside Inspector supports timers relay coils in the relay logic. Each timer has a single logic state to start/run the timer and a single logic state indicating if the timer has expired or not. The start logic state must remain set for the timer to run. The timer clears with the “start” logic state changes back to clear. The Application Engineer creates a timer within the MCT on the “Logic Data” page.

**Table 5-12: Logic Configuration Timers Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Some Description | No, Yes | No | See MCF paperwork for description |

### 5.1.2.9 *State Names*

There are 16 possible values for the channels of the states On and Off. There are eight possible Toggle Names and Battery Names. The Field Maintainer will enter the values as specified in the Agency/Railroad’s approved site diagram. Alternatively, the MCF may have some or all of the fields locked, thereby preventing changes to the channel name and state names of that channel.

## *On Names*

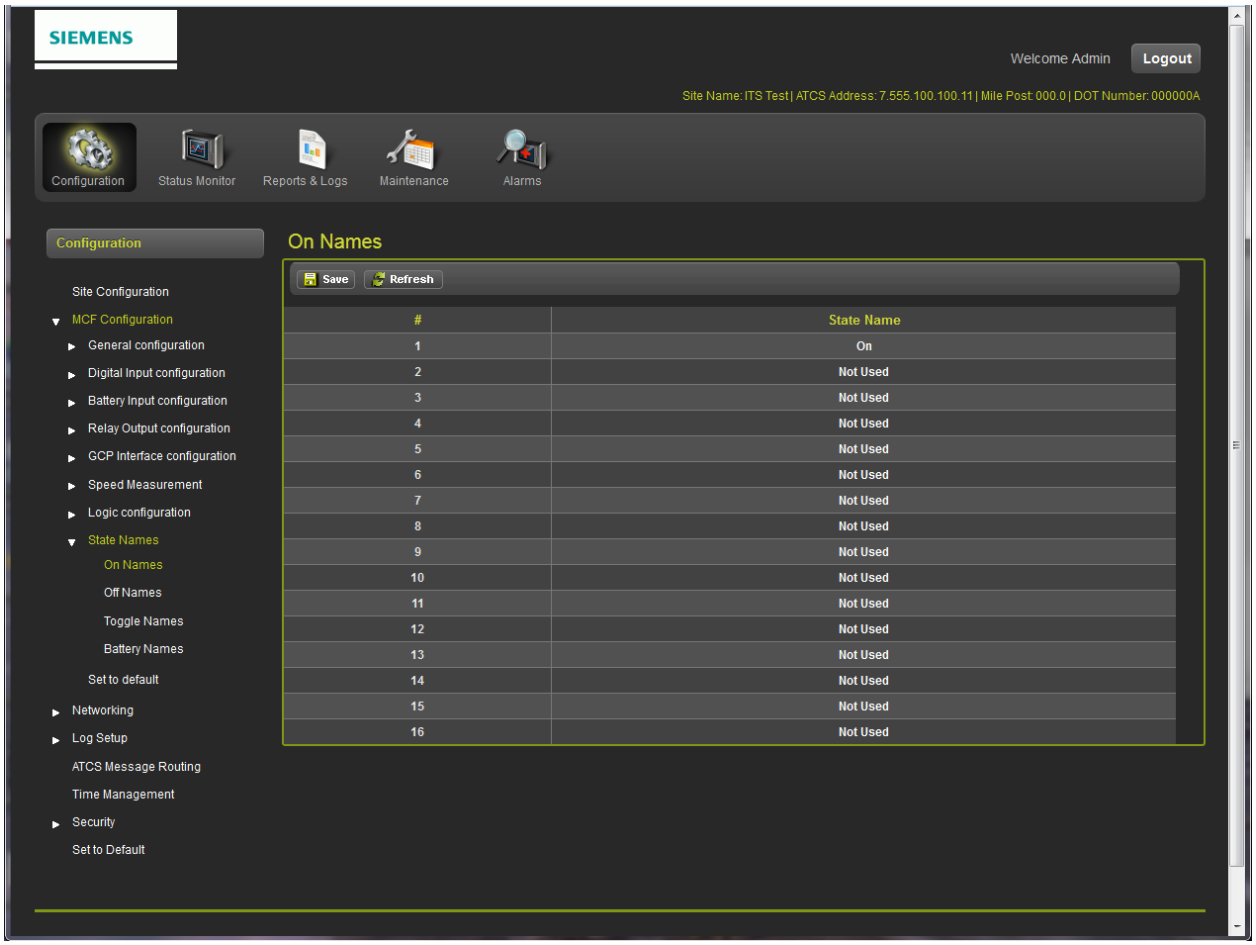



**Figure 5-13: The State “On” Names**

**Table 5-13: “On” State Names Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| On Names | 1 to 12 Characters | Not Used | List of names available to choose from when configuring the “On Names” for inputs and outputs that support discrete states. |

## *Off Names*

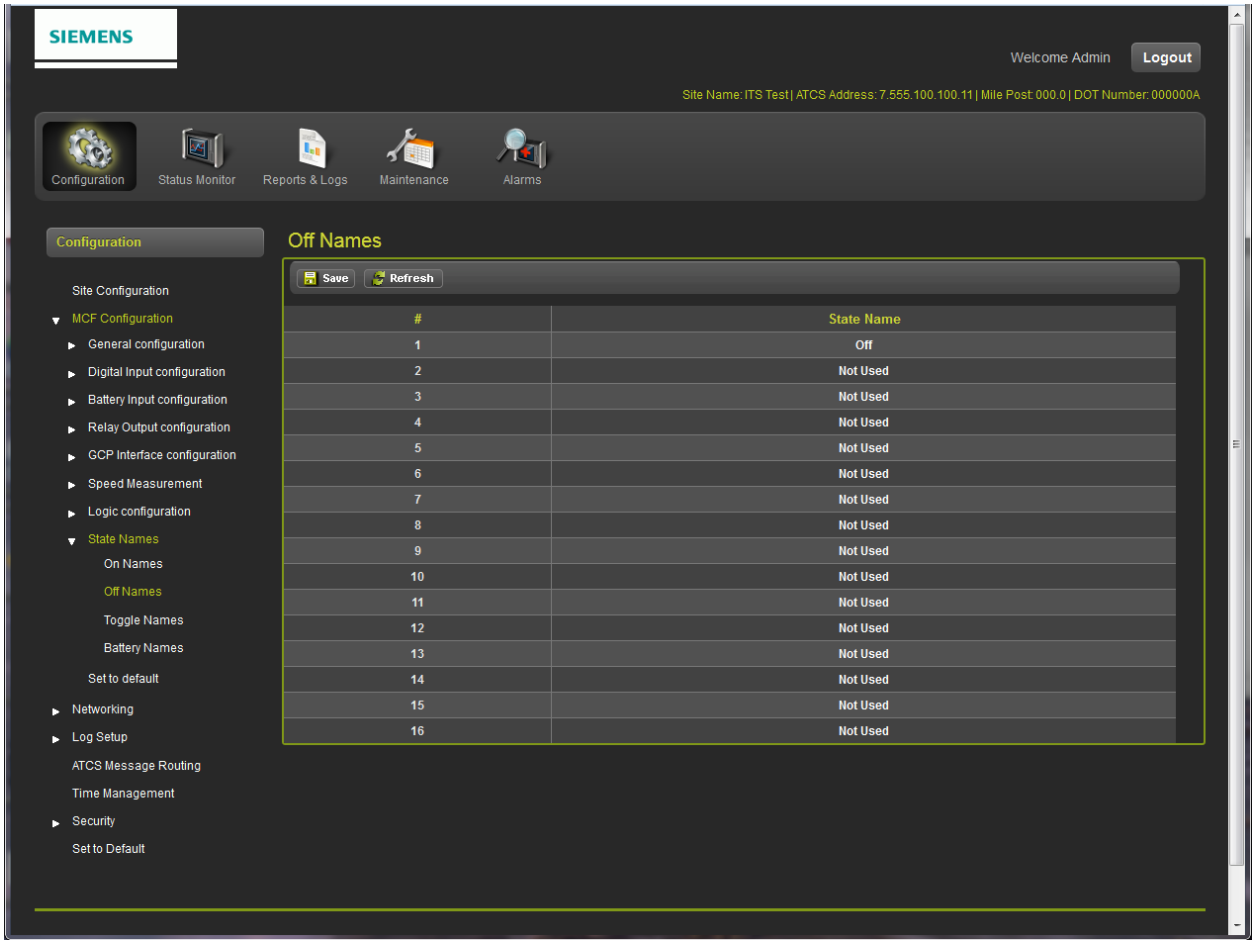



**Figure 5-14: The State "Off" Names**

**Table 5-14"Off" State Names**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Off Names | 1 to 12 Characters | Not Used | List of names available to choose from when configuring the "Off Names" for inputs and outputs that support discrete states. |

## *Toggle Names*

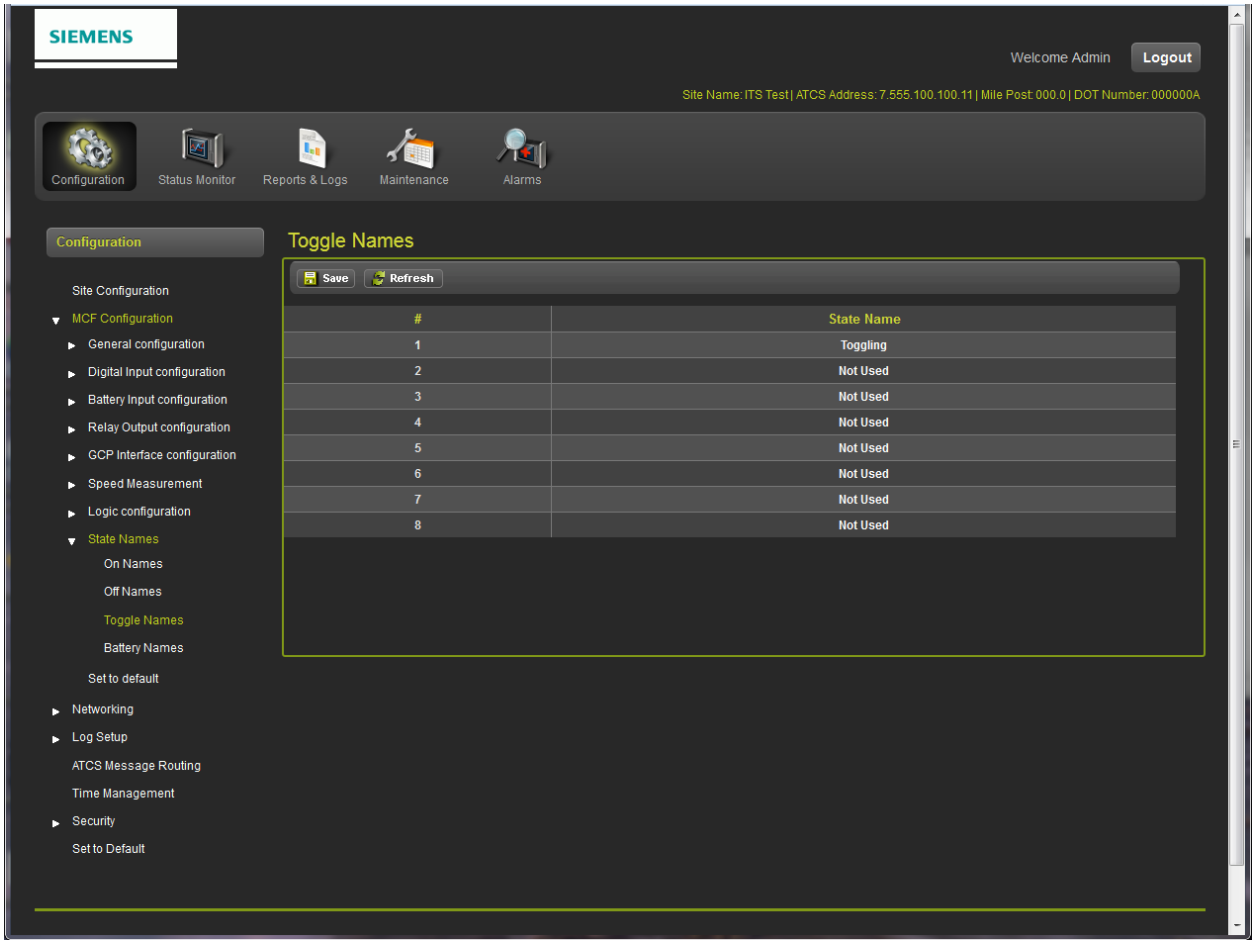



**Figure 5-15: The State Toggle Names**

**Table 5-15: "Toggle" State Names**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Toggle Names | 1 to 12 Characters | Not Used | List of names available to choose from when configuring the "Toggle Names" for inputs and outputs that support discrete states. |

## *Battery Names*

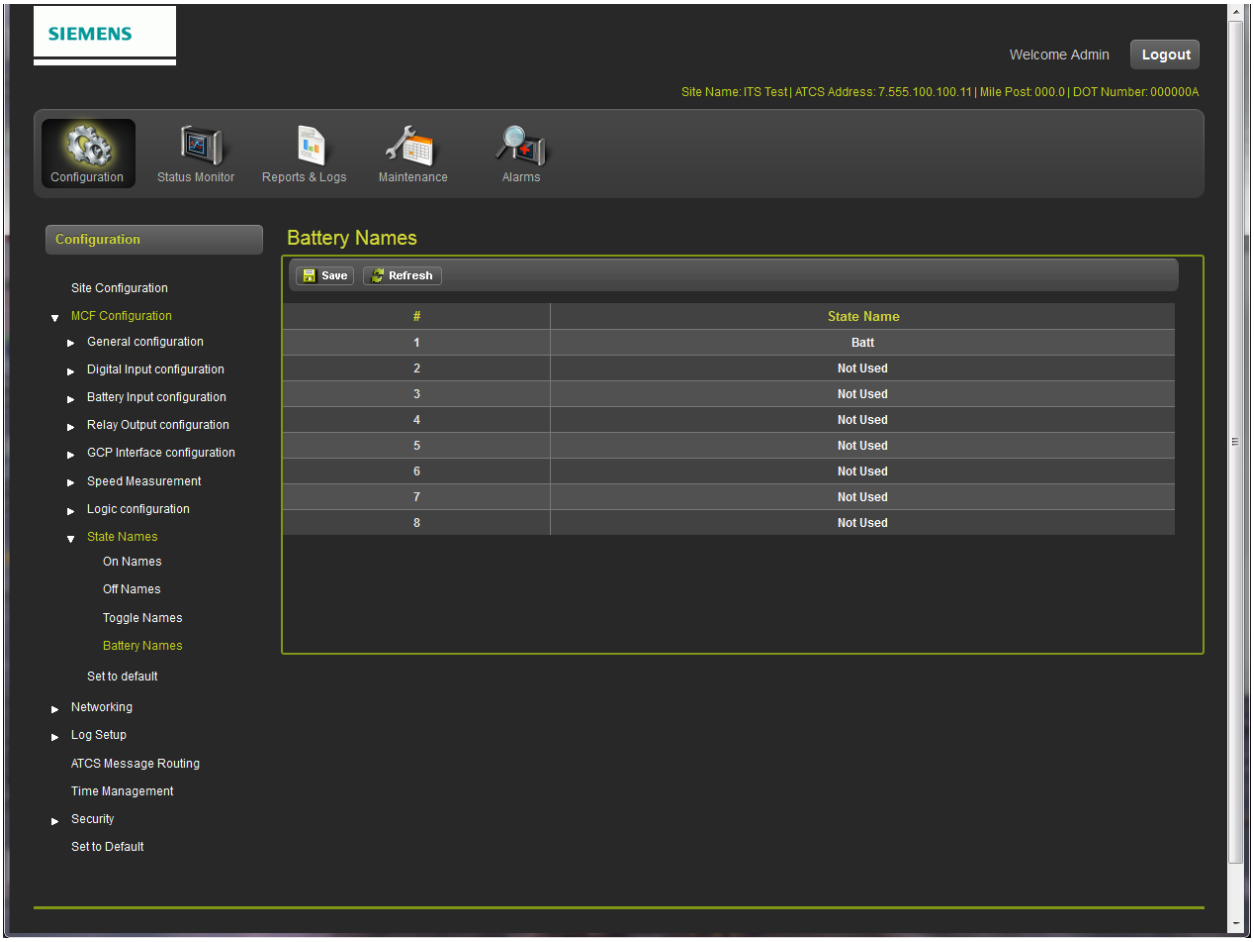



**Figure 5-16: The State Battery Names**

**Table 5-16: "Battery" Names**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Battery Names | 1 to 12 Characters | Not Used | List of names available to choose from when configuring the "Battery Names" for GFT input channels. |

### 5.1.2.10 *Set to Default*

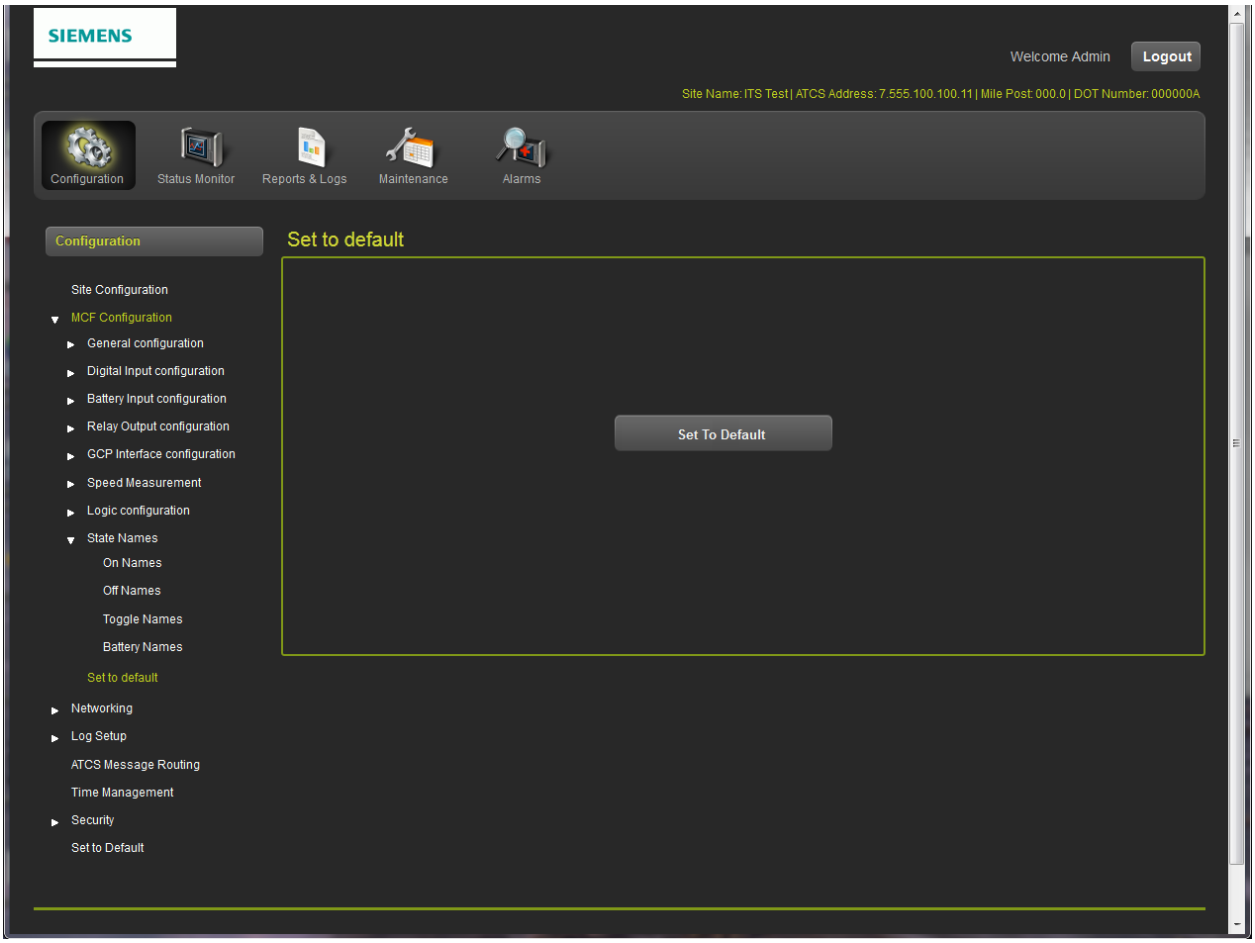



**Figure 5-17: The MCF Configuration Set to Default Screen**

Selecting the Set to Default button will return all entries in the MCF Configuration portion of the Configuration Tab menu back to the MCF Default. Selecting this button does not affect parameter values set in the Networking, Log Setup, ATCS Message Routing, Time Management portions of Configuration Tab menu.

**Table 5-17: Set to Default Screen**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Set to Default | Click | Not Used | Resets MCF Configuration parameters to the default condition. |

## 5.1.3 Networking

### 5.1.3.1 *Comms Interface*

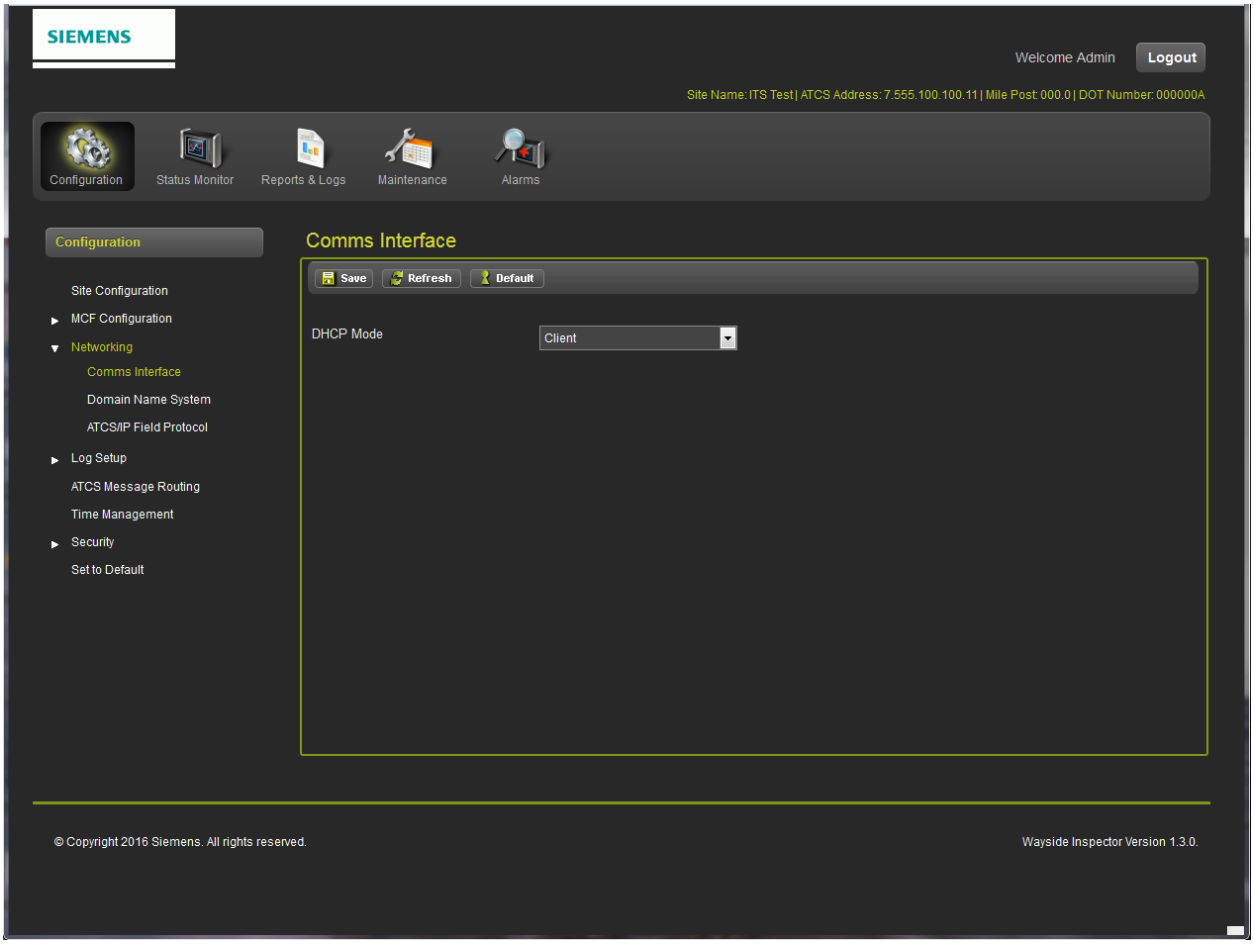



**Figure 5-18: The Comms Interface Screen**

**Table 4-18: Networking: Comms Interface Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| DHCP Mode | Disabled or Client | Disabled | If set to Client the WI will request the network settings using the DHCP protocol. If set to Disabled, the interface uses static settings. |
| IP Address | IPv4 Address | 192.168.2 .100 | The IPv4 address of the Network Ethernet interface. *Only visible if DHCP Mode is Disabled.* |
| Network Mask | IPv4 Address | 255.255.2 55.0 | The network mask of the Network Ethernet interface. *Only visible if DHCP Mode is Disabled.* |
| Default Gateway | IPv4 Address or Blank | Blank | The default gateway of the Network Ethernet interface. Leaving the field blank means no default gateway used. *Only visible if DHCP Mode is Disabled.* |

### 5.1.3.2 *Domain Name System*

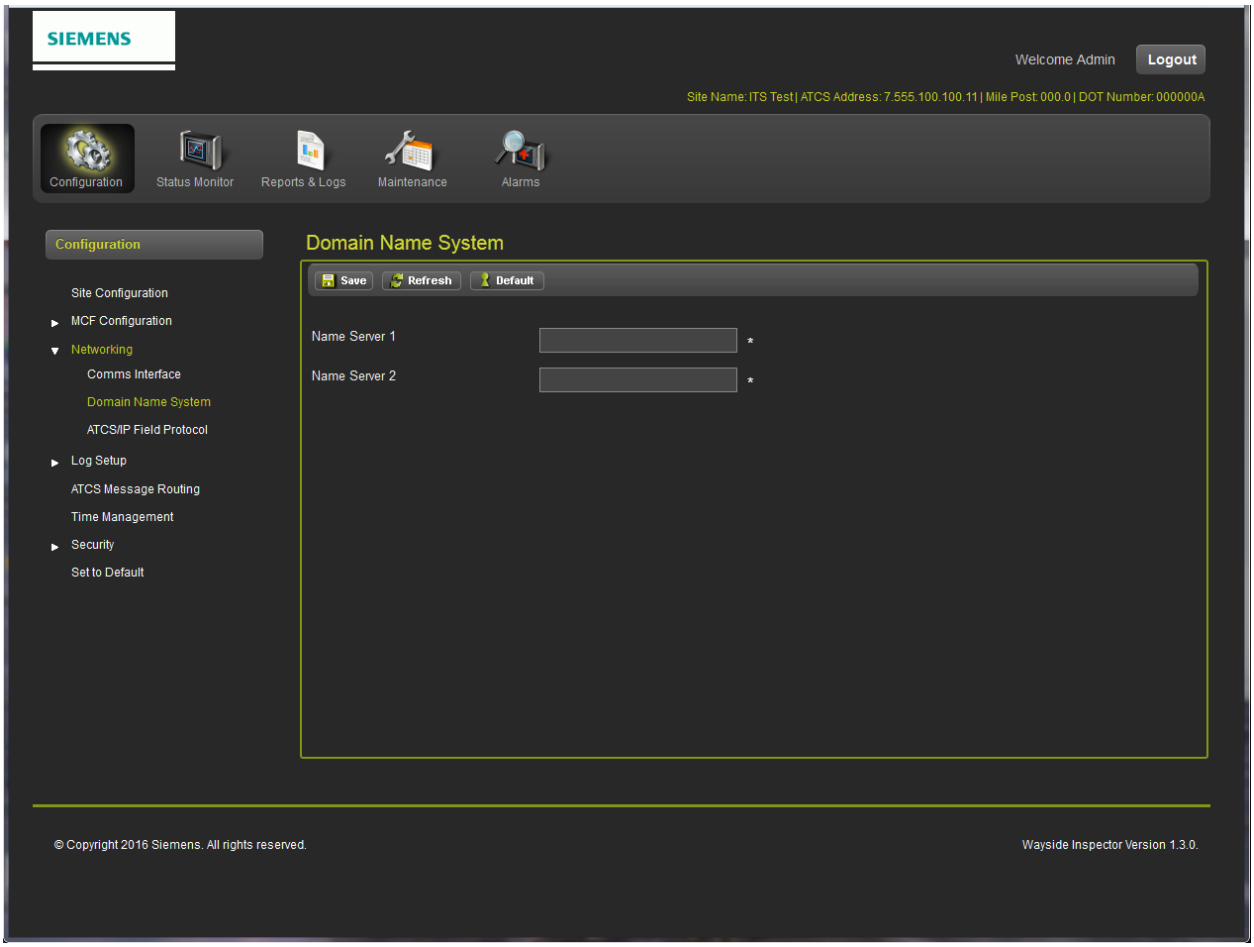



**Figure 5-19: The Domain Name System Screen**

**Table 4-19: Networking: Domain Name System Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Name Server 1 | IPv4 Address or Blank | Blank | IP address of the primary name server for use with name resolution. |
| Name Server 2 | IPv4 Address or Blank | Blank | IP address of the secondary name server for use with name resolution. |

### 5.1.3.3 *ATCS/IP Field Protocol*

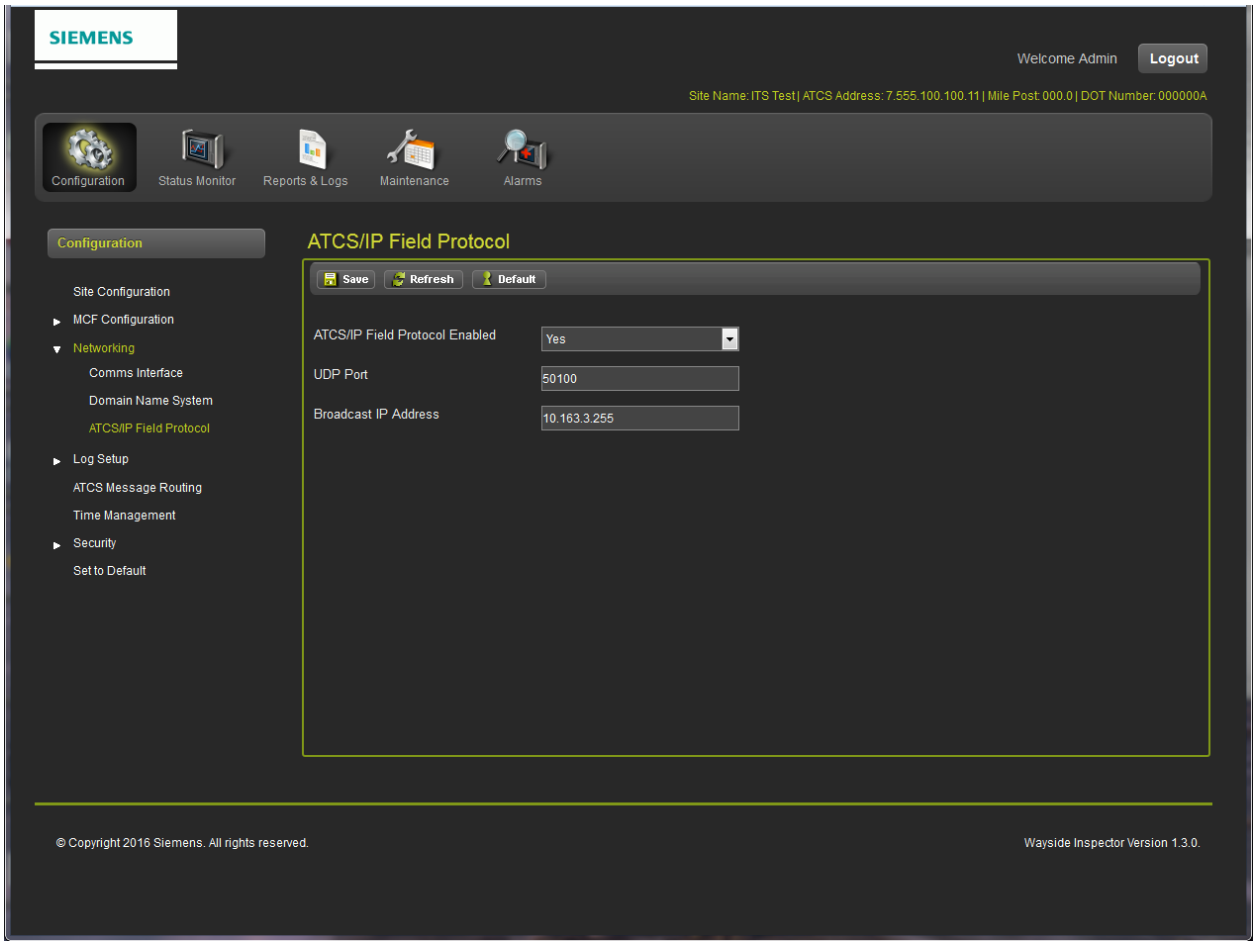



**Figure 5-20:The ATCS/IP Field Protocol**

**Table 4-20: Networking: ATCS/IP Field Protocol Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| ATCS/IP Field Protocol Enabled | Yes or No | No | If set to Yes, enables the ATCS/IP Field Protocol, which is used for communication to other ATCS systems installed on a network, such as the Siemens GCP. |
| UDP Port | 1024 to 65535 | 5000 | The UDP port to use for the ATCS messages. |
| Broadcast IP Address | IPv4 Address | 255.255.255.255 | The WI will send ATCS packets to this address if it has not yet discovered the IP address associated with the ATCS destination address. |

## 5.1.4 Log Setup

### 5.1.4.1 *Diagnostic Logging*

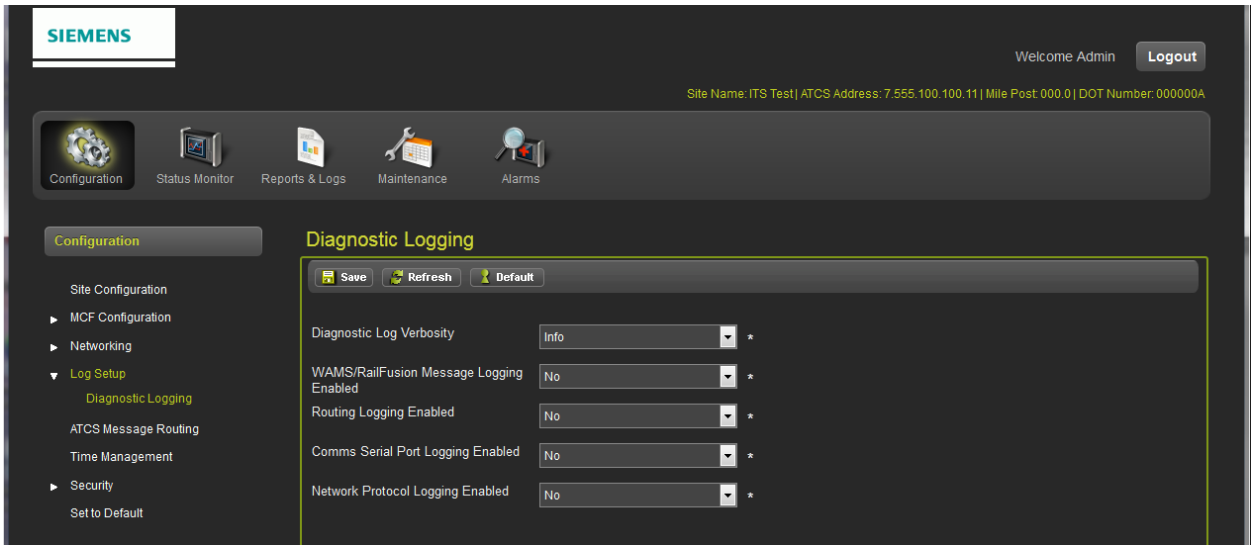



**Figure 5-21: The Diagnostic Logging Screen**

**Table 4-21: Log Setup: Diagnostic Logging Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Diagnostic Log Verbosity | Error,<br>Warning,<br>Info,<br>Debug | Info | Sets the level of diagnostic entries to include in the diagnostic log. The selected level includes all entries at that level and lower (e.g. Info includes all Error, Warning, and Info entries in the diagnostic log). |
| WAMS/RailFusion Message Logging Enabled | Yes or No | No | ***Future Feature***. |
| Routing Logging Enabled | Yes or No | No | Enables logging of the internal ATCS message router functionality, which shows ATCS messages and their contents (starting with ATCS layer 3 header) in the diagnostic log. |
| Comms Serial Logging Enabled | Yes or No | No | ***Future Feature***. |
| Network Protocol Logging Enabled | Yes or No | No | Enables logging of any enabled network protocol, such as ATCS/IP Field. The diagnostic log will include entries showing the sent and received message data, including the network protocol specific headers. |

## 5.1.5 ATCS Message Routing

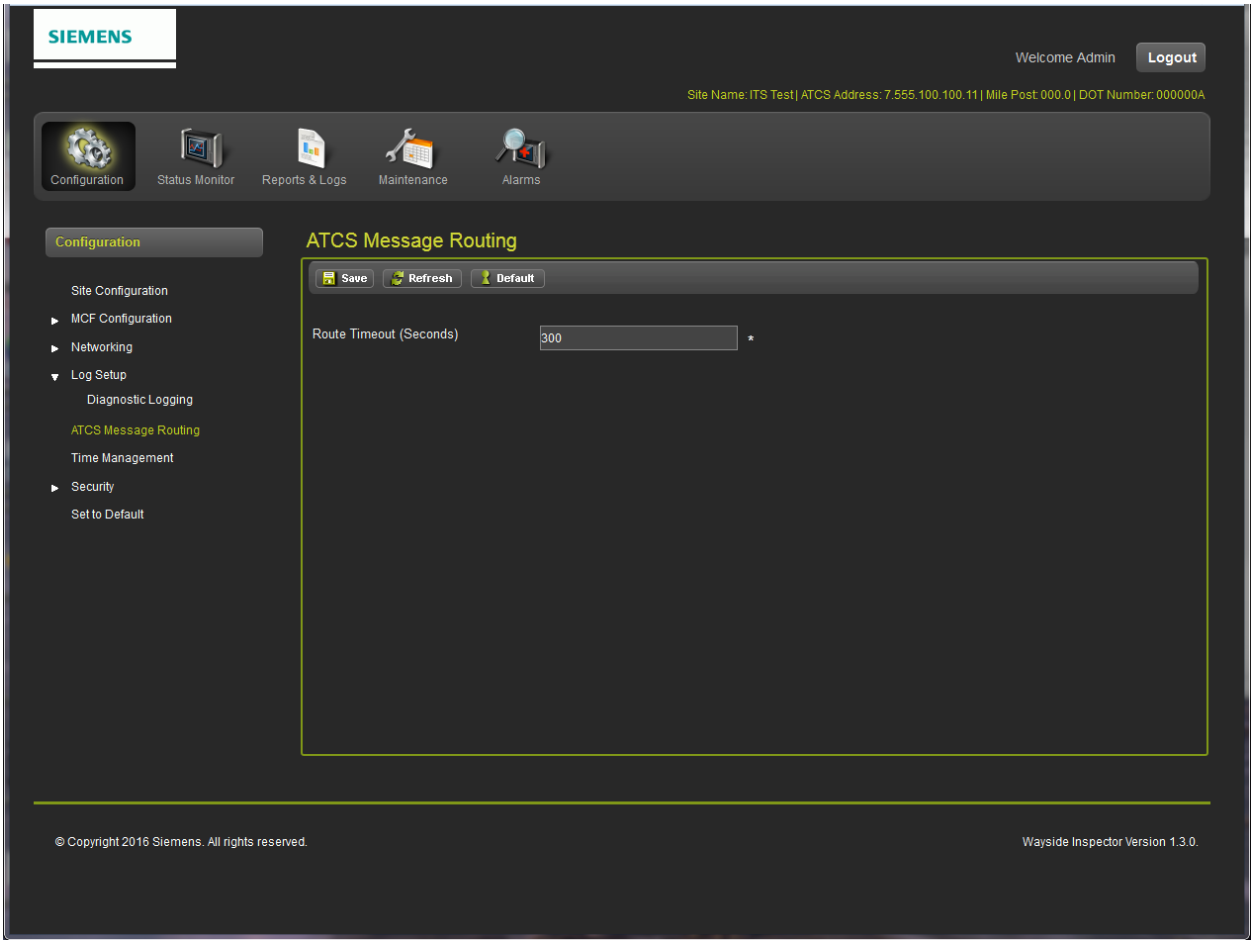



**Figure 5-22: The ATCS Message Routing Screen**

**Table 4-22: ATCS Message Routing Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Route Timeout | 0 to 172,800 seconds | 300 seconds | The length of time, in seconds, the WI will hold the ATCS route information for a discovered device before discarding it. A value of 0 means entries will never time out. |

### 5.1.6 Time Management

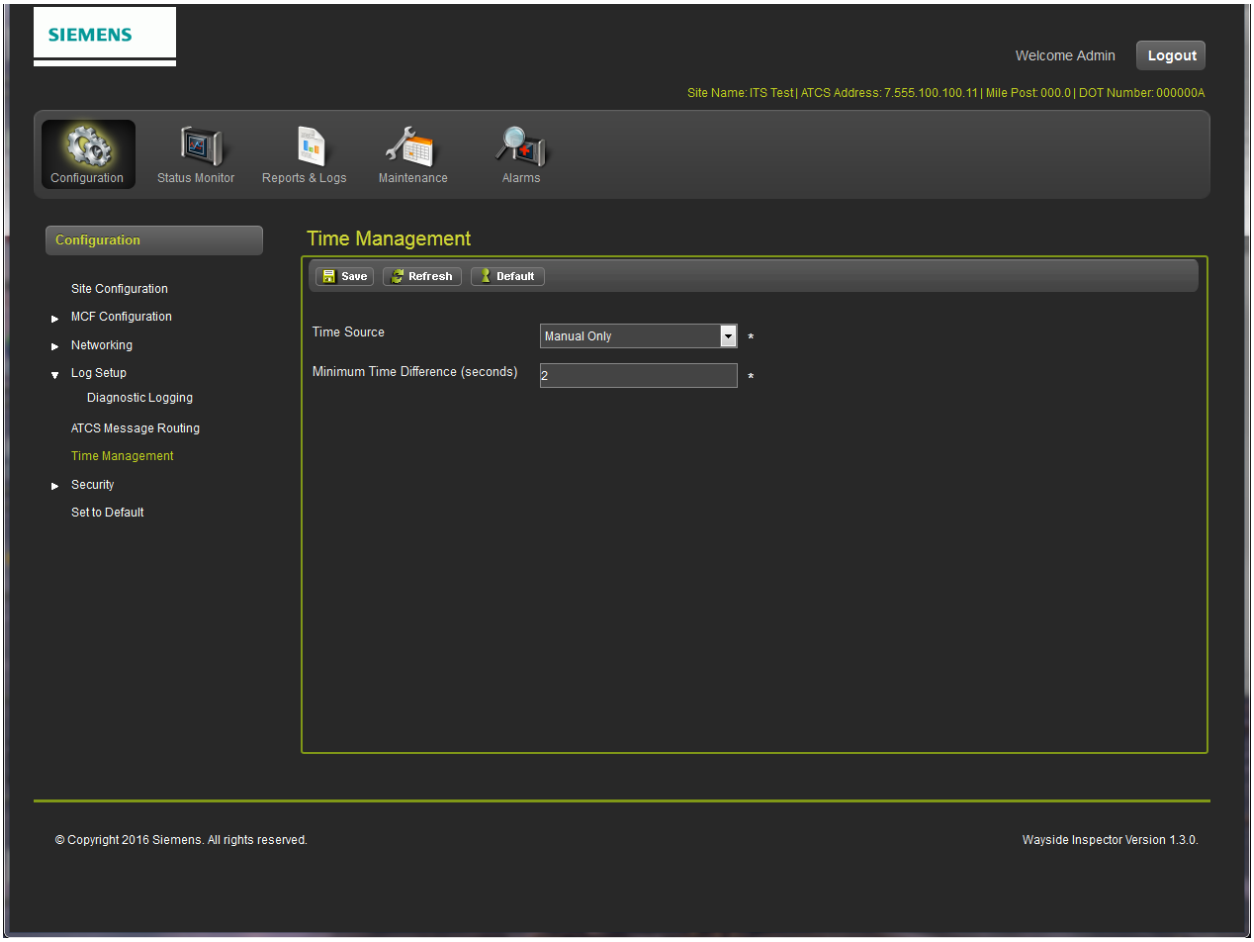



**Figure 5-23: The Time Management Screen**

**Table 4-23: Time Management Screendd**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Tiem Source | Manual Only, | Manual Only | Types of activites that may be accessee for a time source. |
| Name Server 2 | 0 – 60 sec | 2 | Minimum amount of time difference between reference time and machine time before an alert is sent. |

## 5.1.7 Security

The Security Tab has two sub-menus: Password and WebUI Configuration.

### 5.1.7.1 *Password*

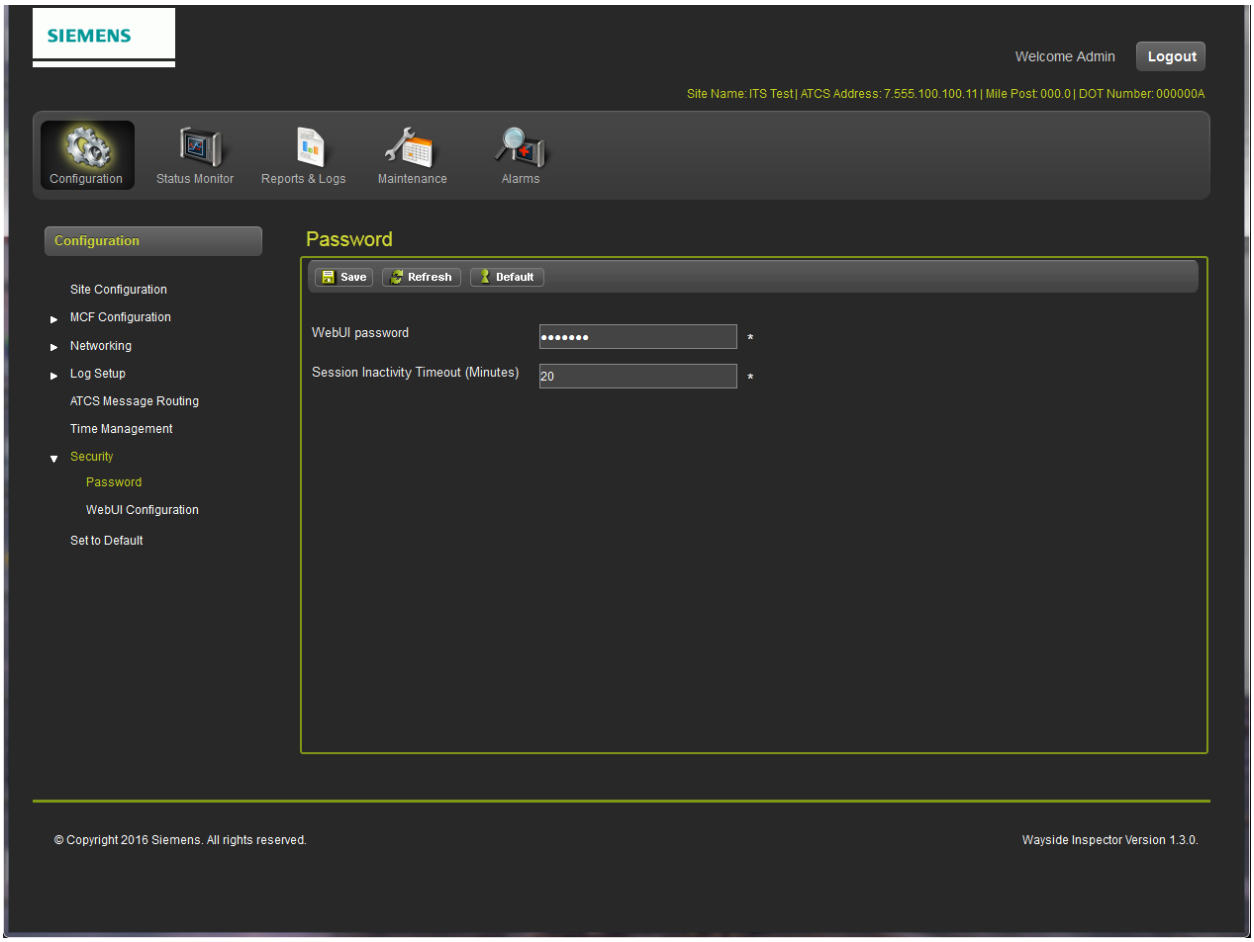



**Figure 5-24: The Password Screen**

**Table 4-24: Security: Password Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| WebUI password | 20 characters | Siemens | Sets the password the user must enter to access the web browser UI. |
| Session Inactivity Timeout | 5 to 60 Minutes | 20 minutes | The number of minutes of inactivity before the WI will automatically log out a connected user from the web browser UI. |

### 5.1.7.2 *WebUI Configuration*

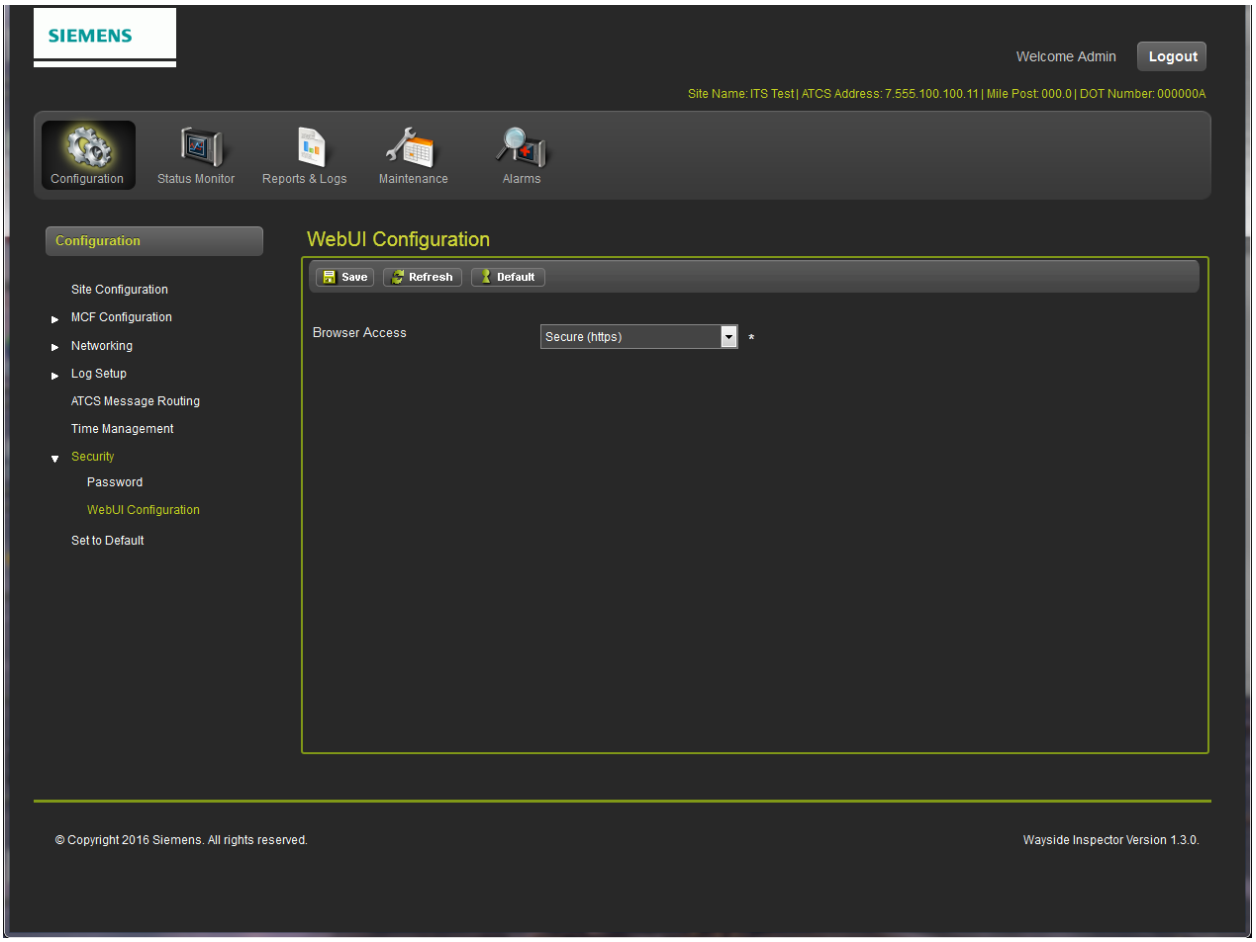



**Figure 5-25: The WebUI Configuration Screen**

**Table 4-25: Security: Web UI Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Browser Access | Secure (https) or Non-Secure (http) | Secure (https) | Whether or not the web browser is accessed using http or https. |

### 5.1.8 Set to Default

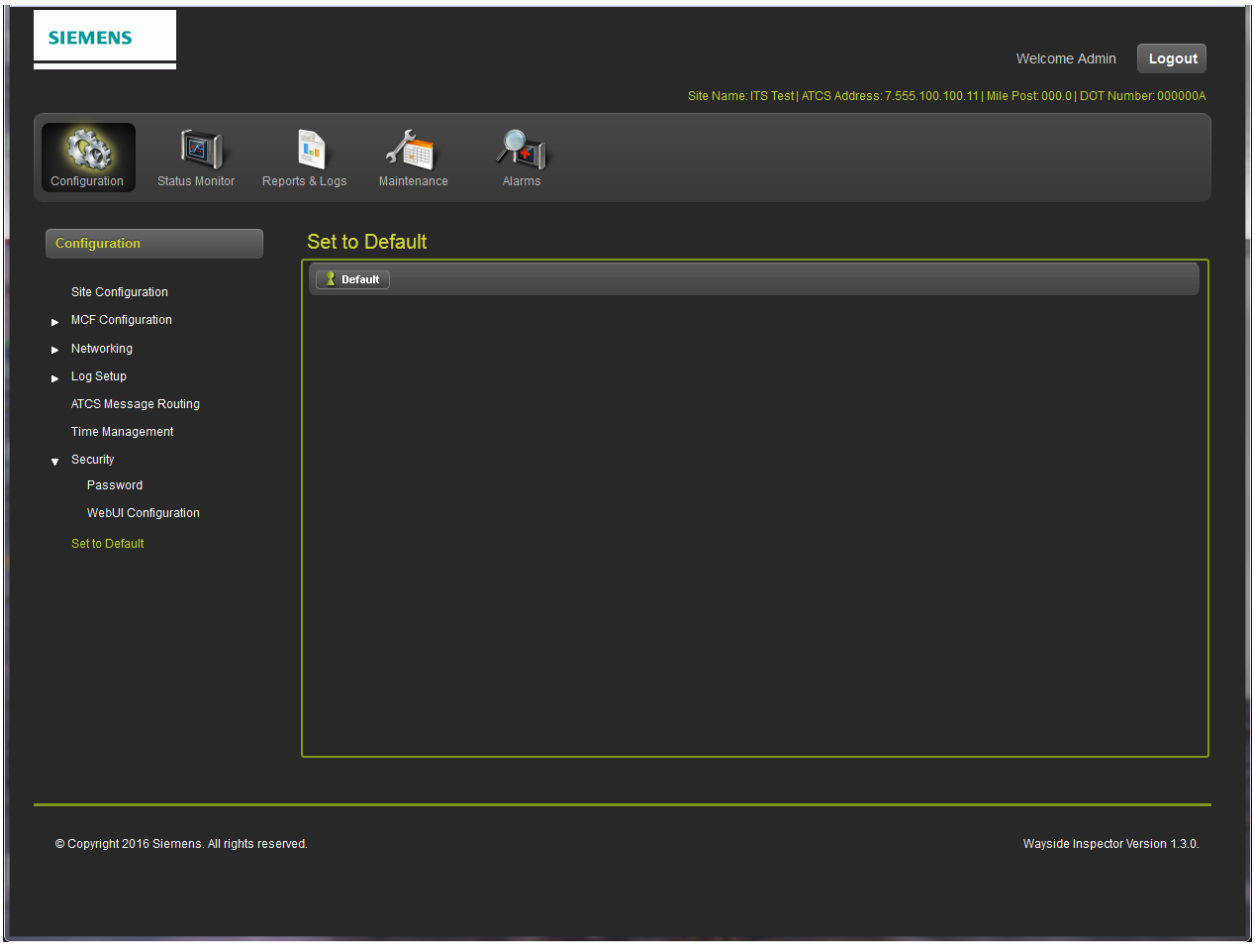



**Figure 5-26: The Set to Default Screen**

This Set to Default screen resets all values entered within the Configuration Tab.

**Table 5-26: Set to Default Screen**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Set to Default | Click | Not Used | Resets all parameters other than MCF Configuration parameters to the default condition. |

## 5.2 STATUS MONITOR

The Status Monitor Tab provides the status of the various portions of the WI.

### 5.2.1 Digital Inputs

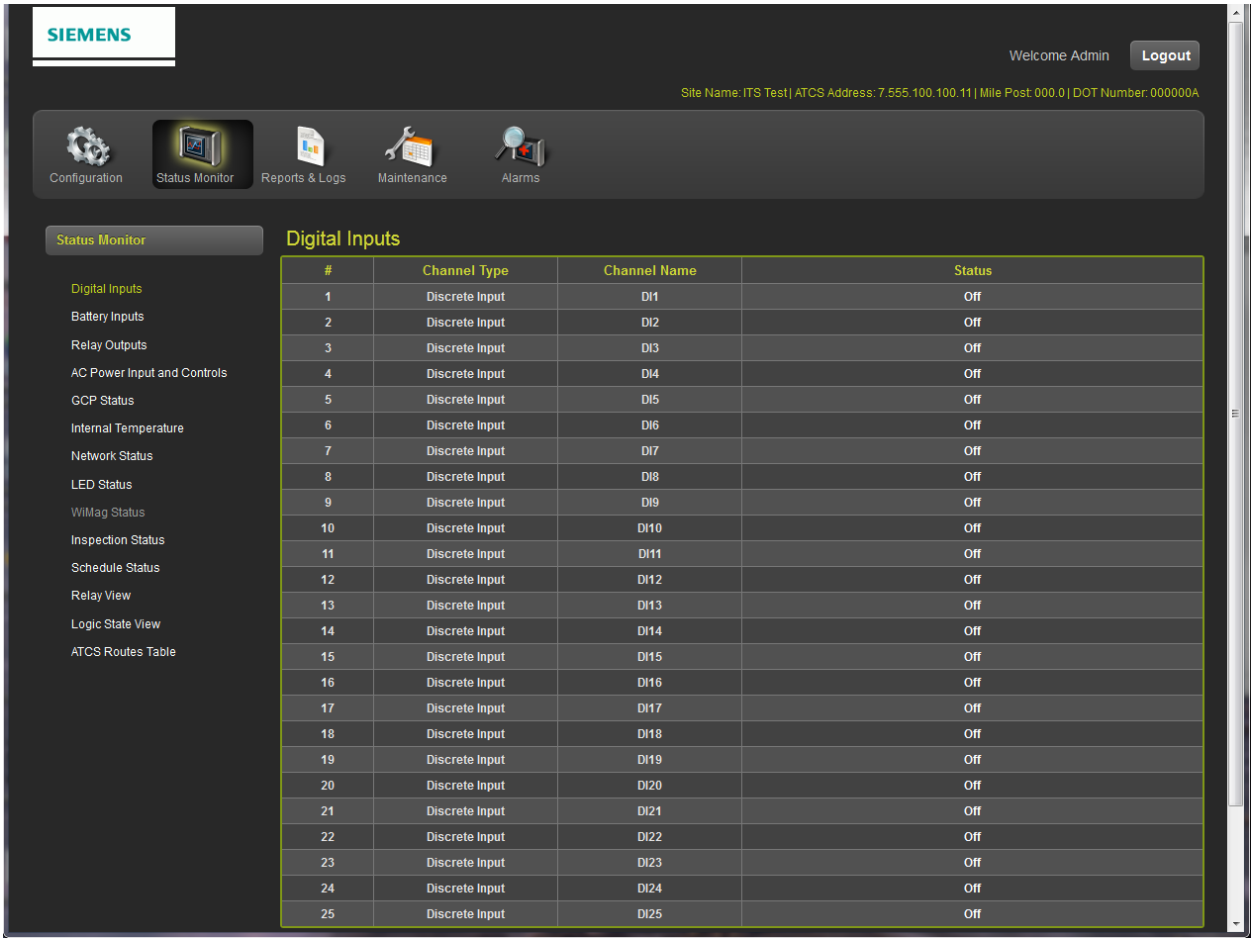



**Figure 5-27: The Digital Input Screen**

The Digital Input Screen provides the status of the Type Channel, the Channel name, and its Status.

## 5.2.2 Battery Inputs

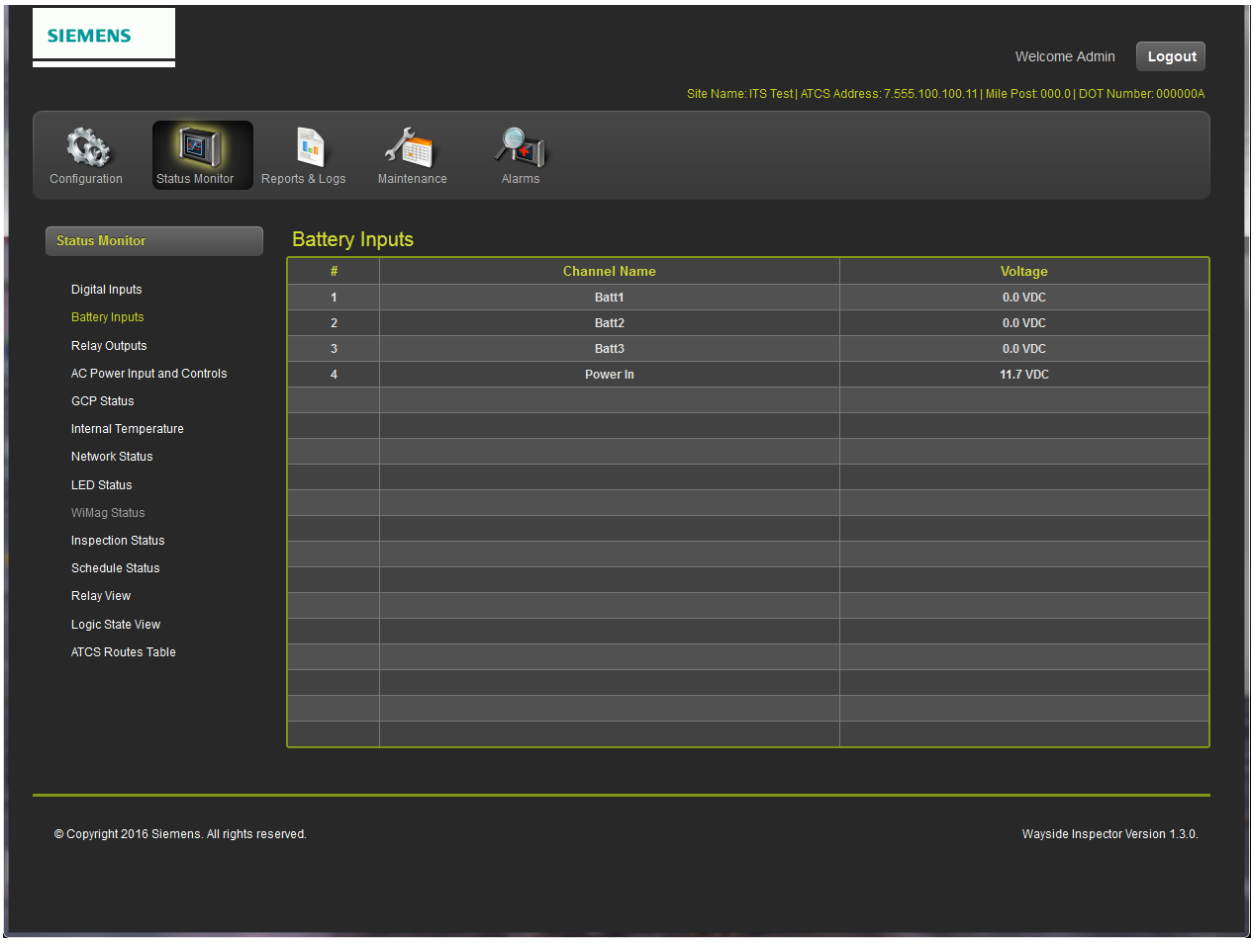



**Figure 5-28: The Battery Inputs Screen**

The Battery Inputs Screen provides the status of up to four batteries with their respective Channel Names and their voltages.

### 5.2.3 Relay Outputs

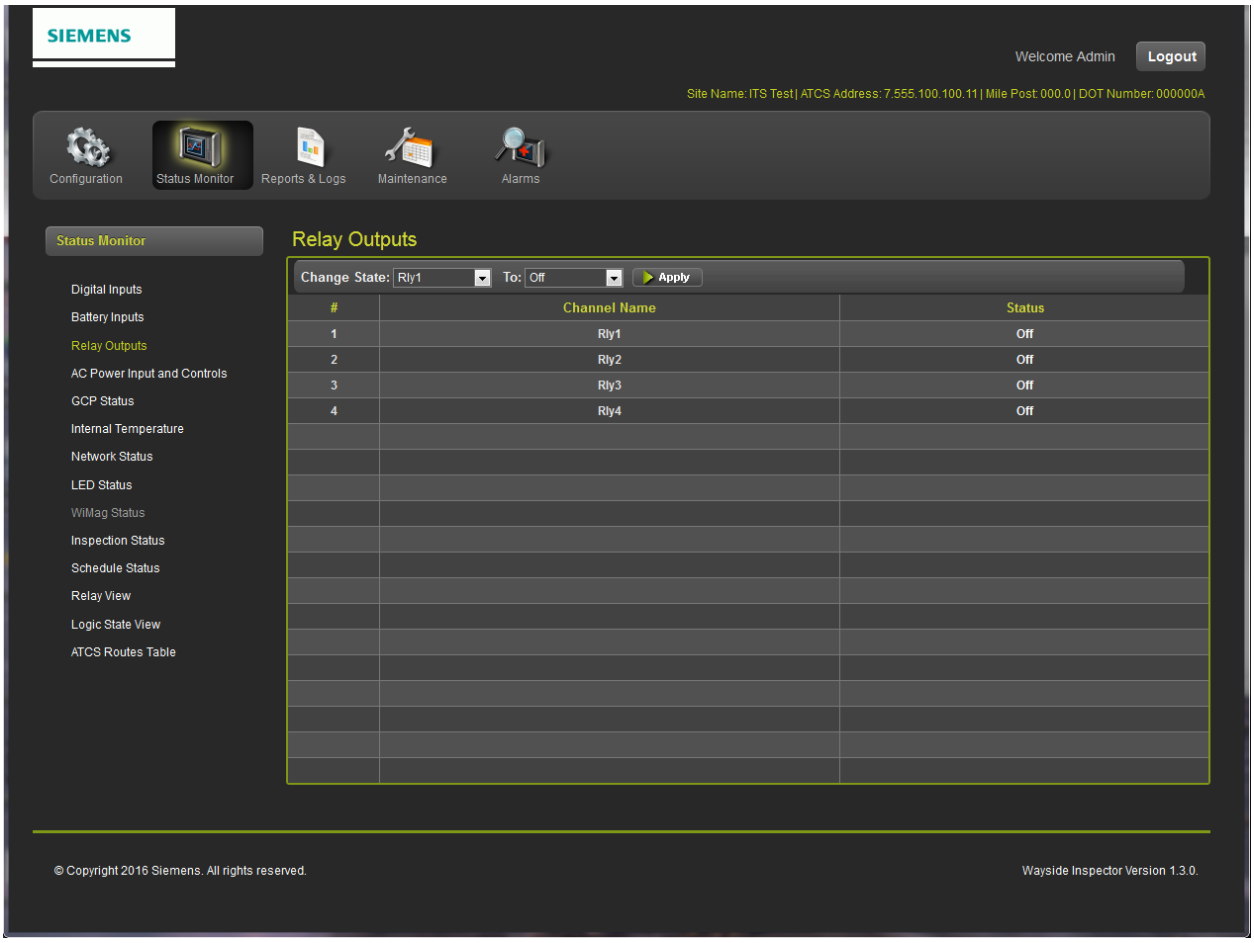



**Figure 5-29: The Relay Outputs Screen**

The Relay Outputs Screen provides the status of each Relay Output and depicts the Channel Name and Relay Status. From this screen, the user can command the relay off, on, or to toggle.

## 5.2.4 AC Power Input and Controls

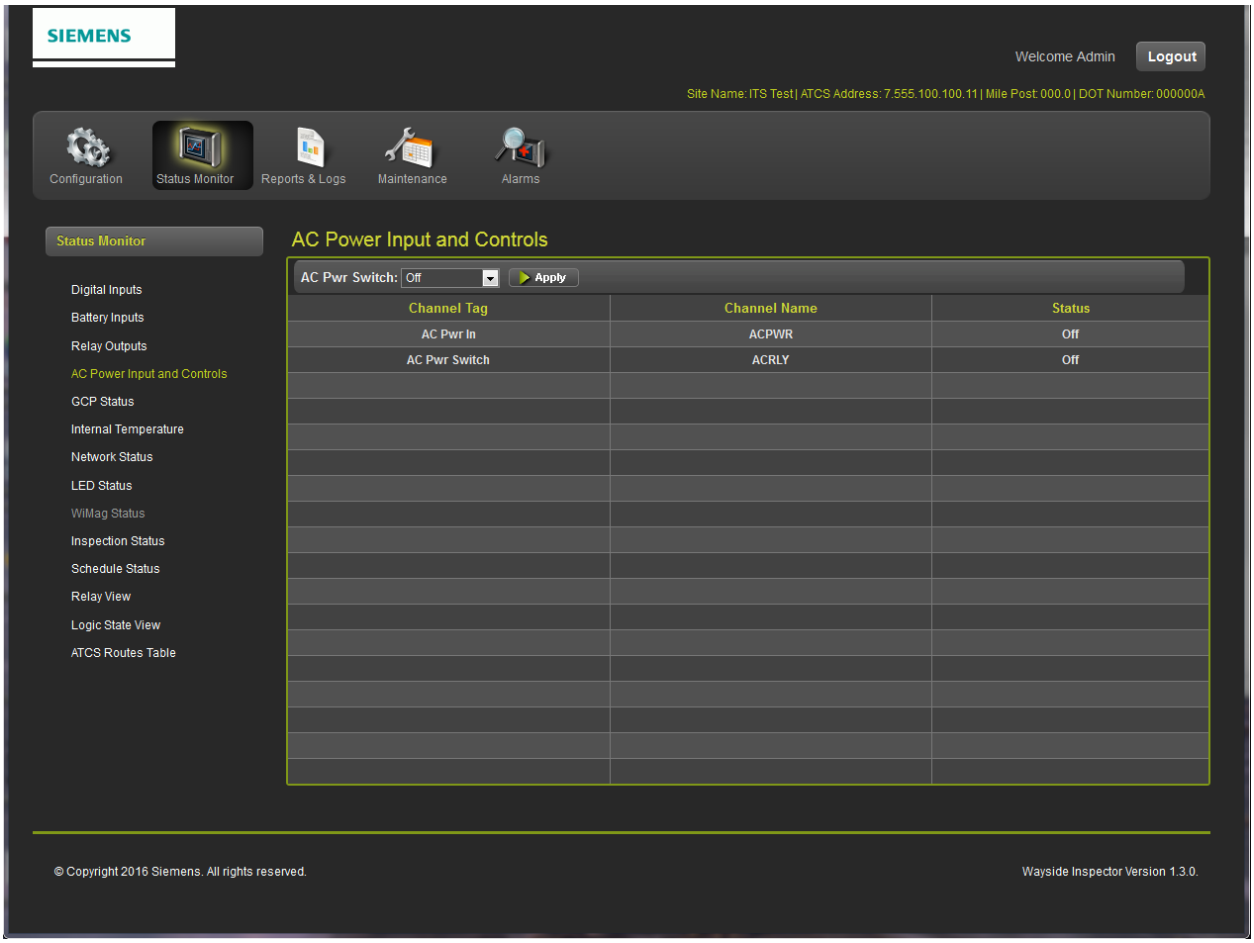



**Figure 5-30: The AC Power Input and Controls Screen**

The AC Power Input and Controls Screen provides the Channel Name and Status of AC Power In and the AC Power Switch. The AC Control Relay is commanded off and on from this screen.

## 5.2.5 GCP Status

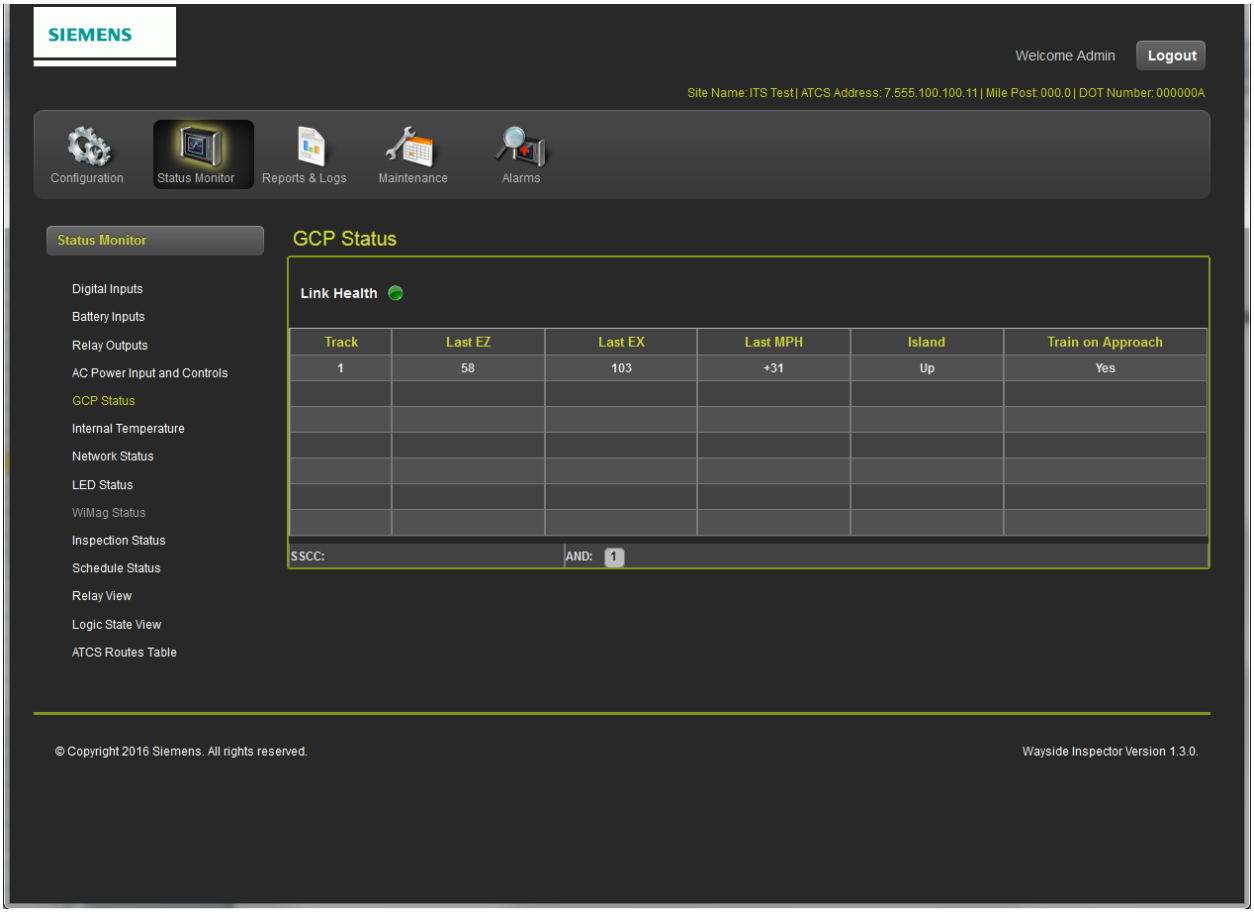



**Figure 5-31: The GCP Status Screen**

The GCP Status Screen provide data for up to six tracks, providing Last EZ, Last EX, Last MPH, Island, and Train on Approach for each track as well as SSCC & AND status.

## 5.2.6 Internal Temperature

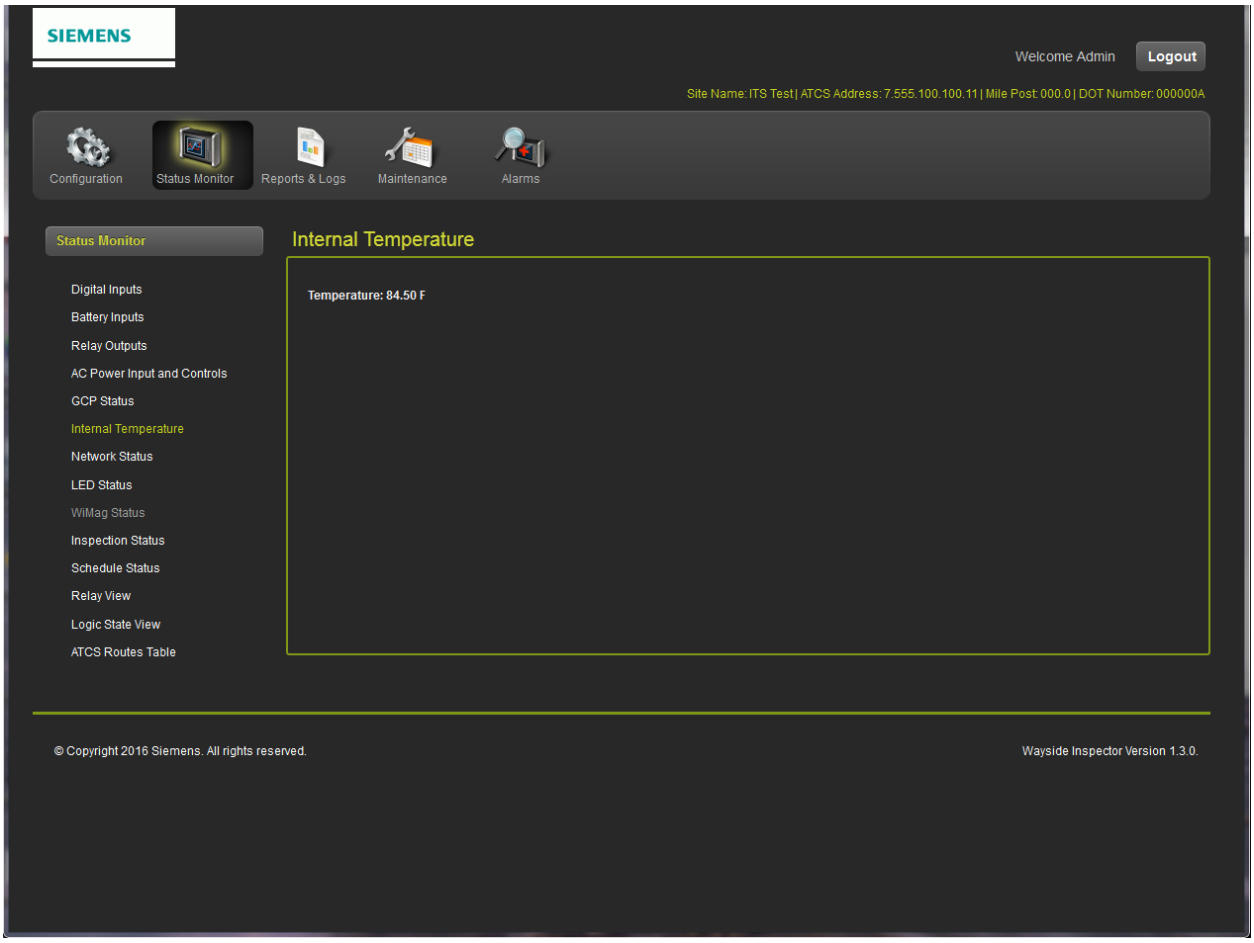



**Figure 5-32: The Internal Temperature Screen**

The Internal Temperature Screen provides the current internal temperature of the WI.

## 5.2.7 Network Status

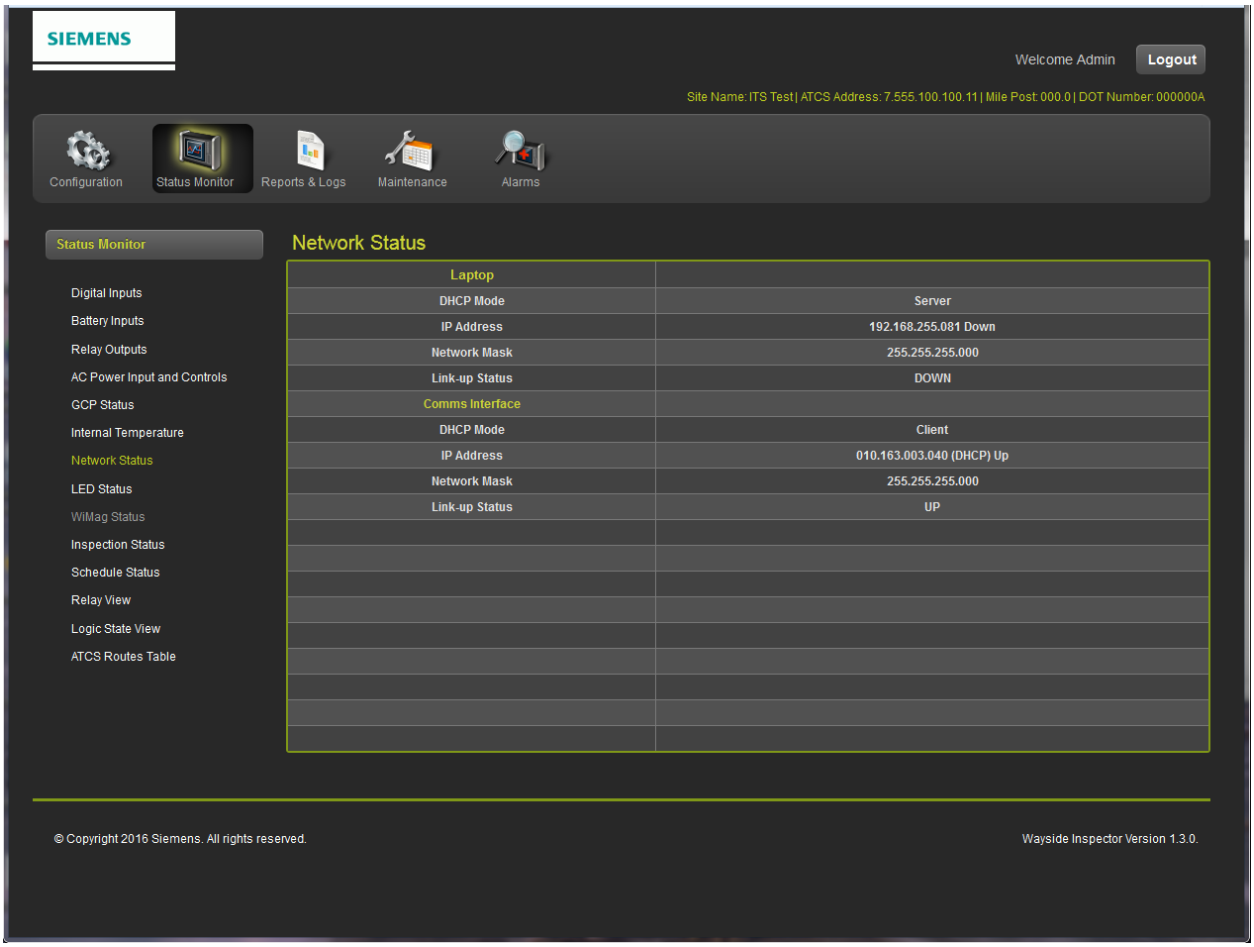



**Figure 5-33: The Network Status Screen**

The Network Status Screen provides network data for the Laptop and Comms Interface connectors.

## 5.2.8 LED Status

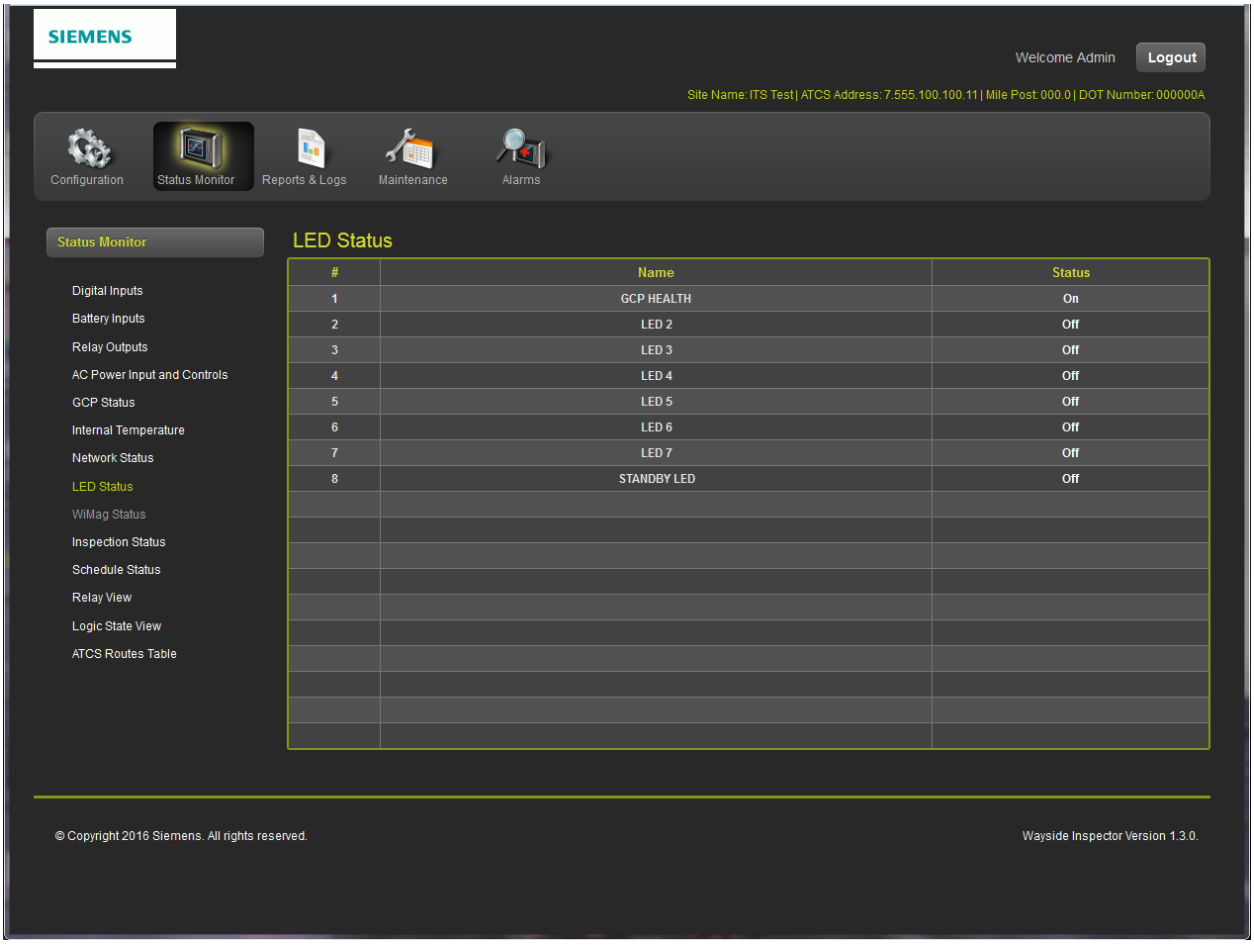



**Figure 5-34: The LED Status Screen**

The LED Status Screen provides the Name and Status of each of the eight Application LEDs.

### 5.2.9 WiMag Status


**Figure 5-35: The WiMag Status Screen**

The WiMag Status Screen provides the Sensor Name and State of all sensors currently in use.

## 5.2.10 Inspection Status

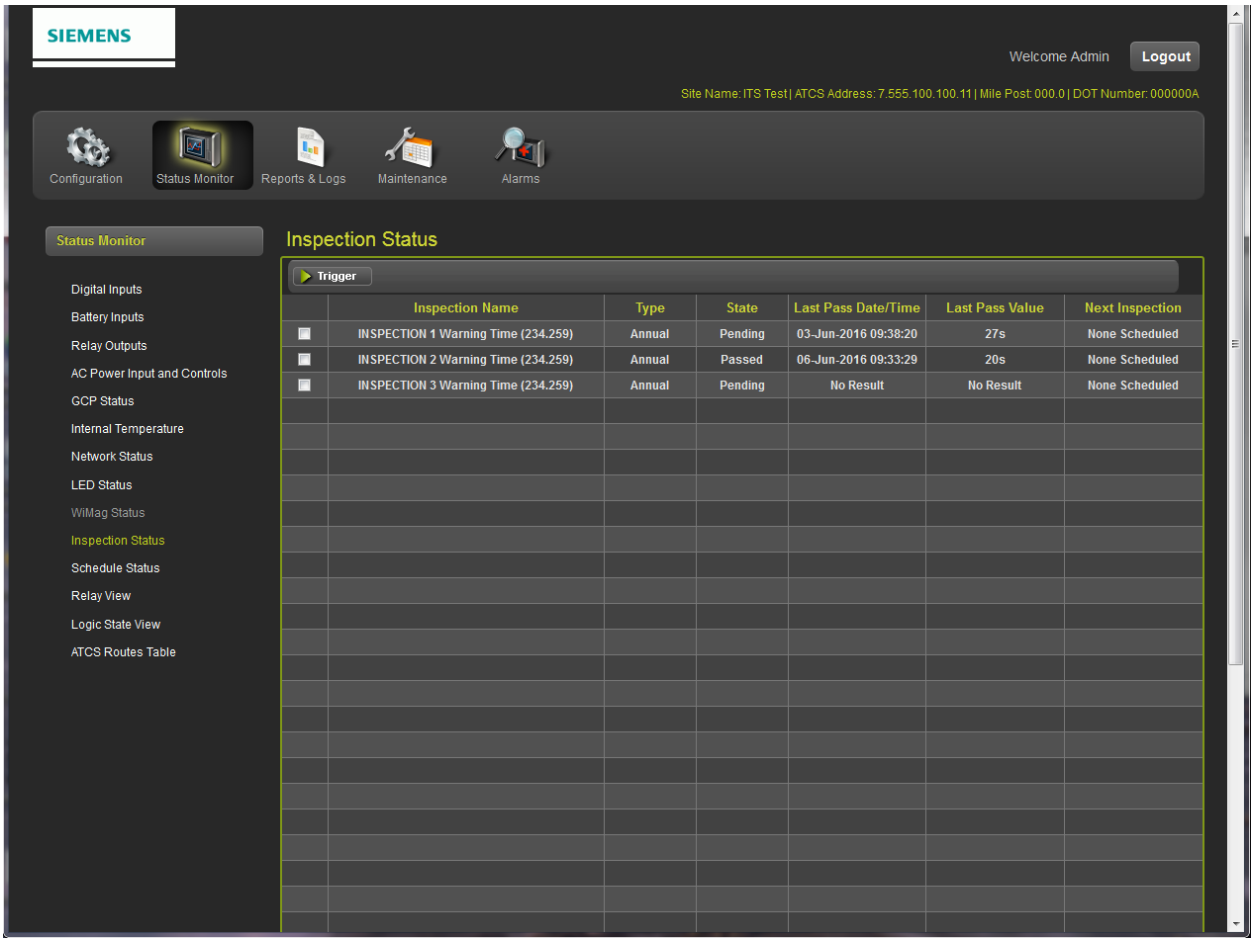



**Figure 5-36: The Inspection Status Screen**

The Inspection Status Screen shows the status of currently programmed tests.

## 5.2.11 Schedule Status


**Figure 5-37: The Schedule Status Screen**

The Schedule Status Screen provides the status of scheduled inspections.

## 5.2.12 Relay View

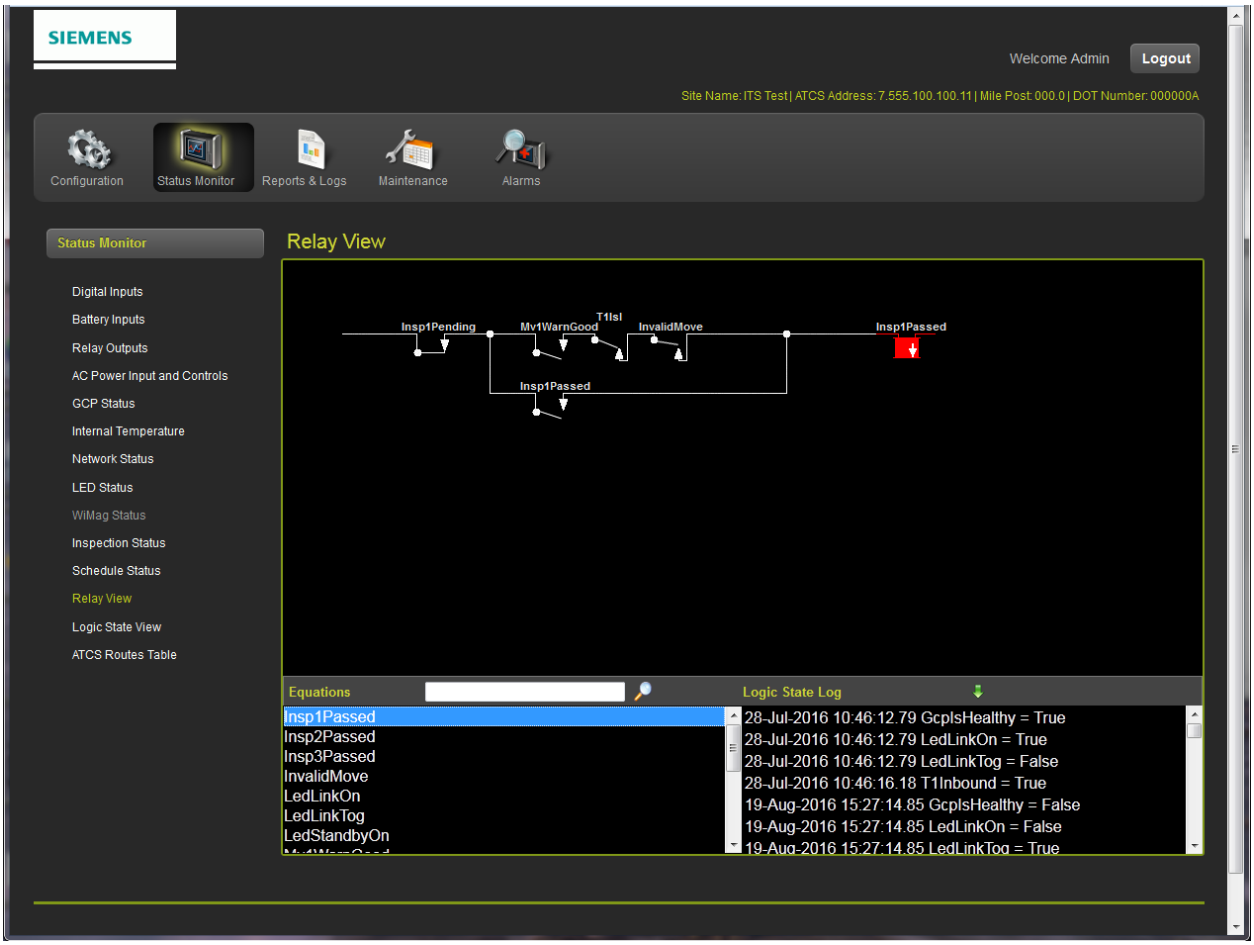



**Figure 5-38: The Relay View Screen**

The Relay View Screen lists the conditions for each test using relay logic.

## 5.2.13 Logic State View

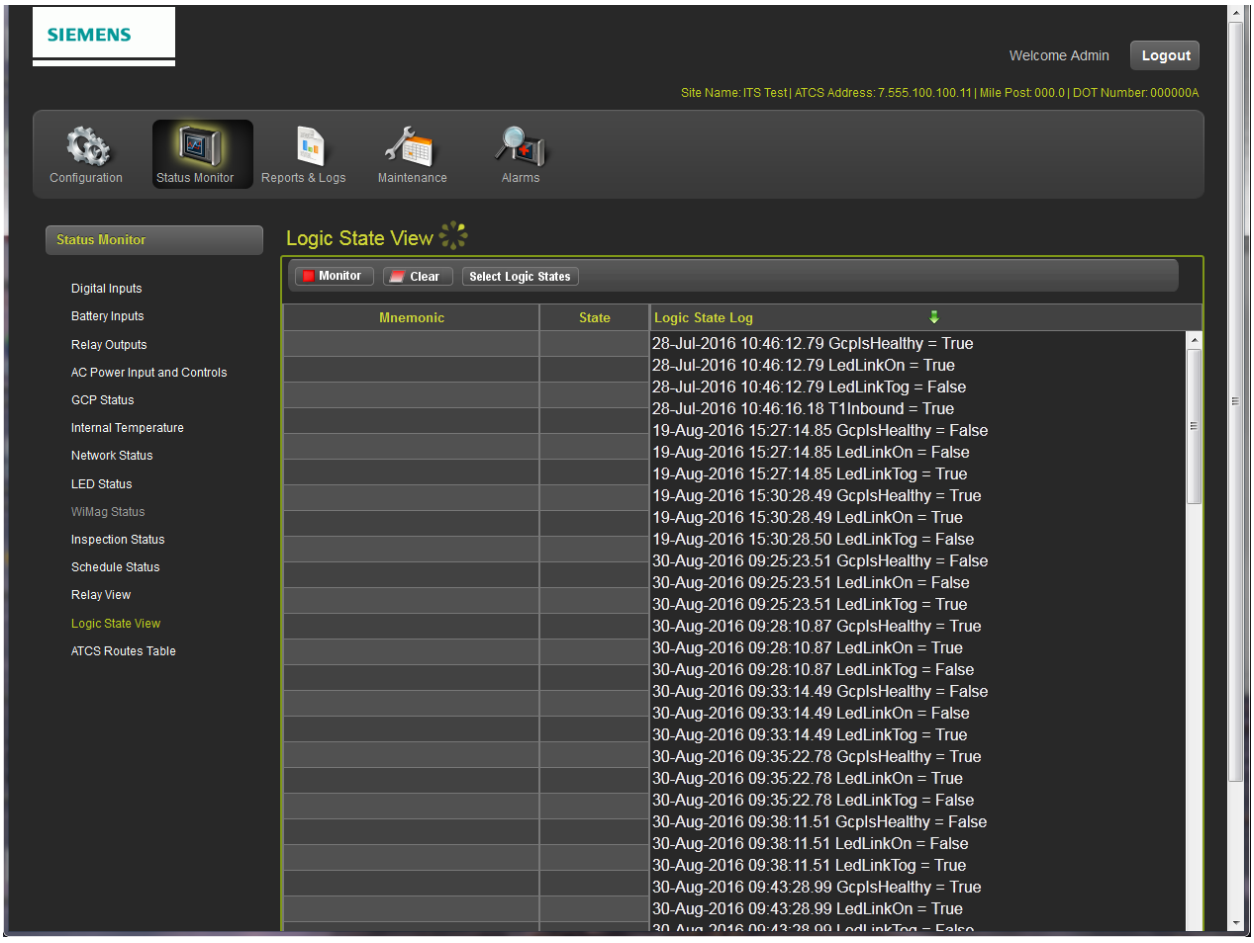
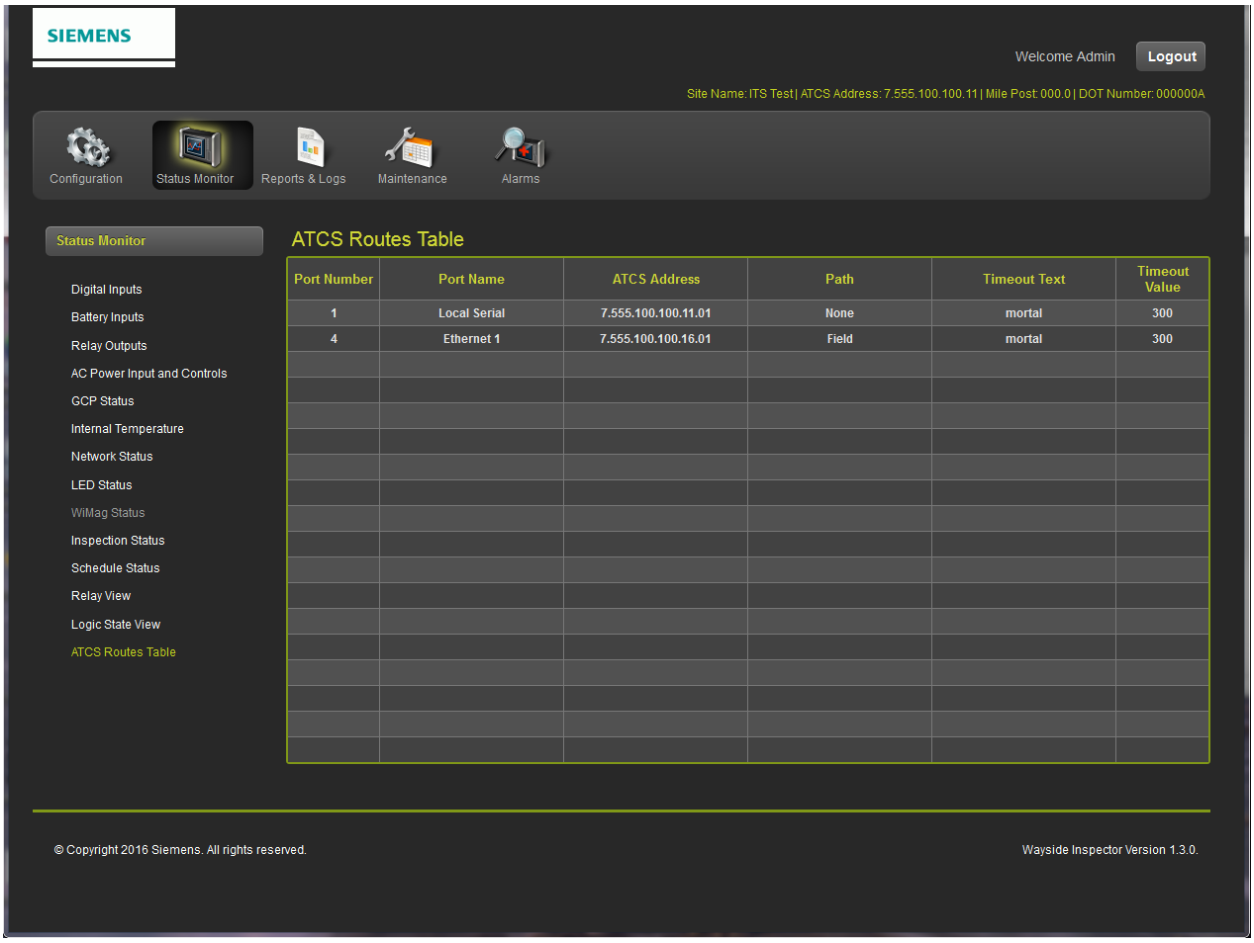



**Figure 5-39: The Logic State Screen**

The Logic State Screen provides the Mnemonic and State of each programmed Logic Statement.

### 5.2.14 ATCS Routes Table




The ATCS Routes Table provides the list of Routes used in the WI.

## 5.3 REPORTS & LOGS

The WI keeps two logs: the Event Log and the Diagnostic Log.

The Event Log contains entries showing external crossing events detected by the WI. The Event Log is useful to investigate crossing operation.

The Diagnostic Log contains entries showing internal WI operations and data. The Diagnostic Log is useful to troubleshoot the WI itself.

The WI always logs entries in chronological order. The time stamp may change forward or backward as the user changes the time; however, events are always added to the log in the order they occurred.

### 5.3.1 Event Log

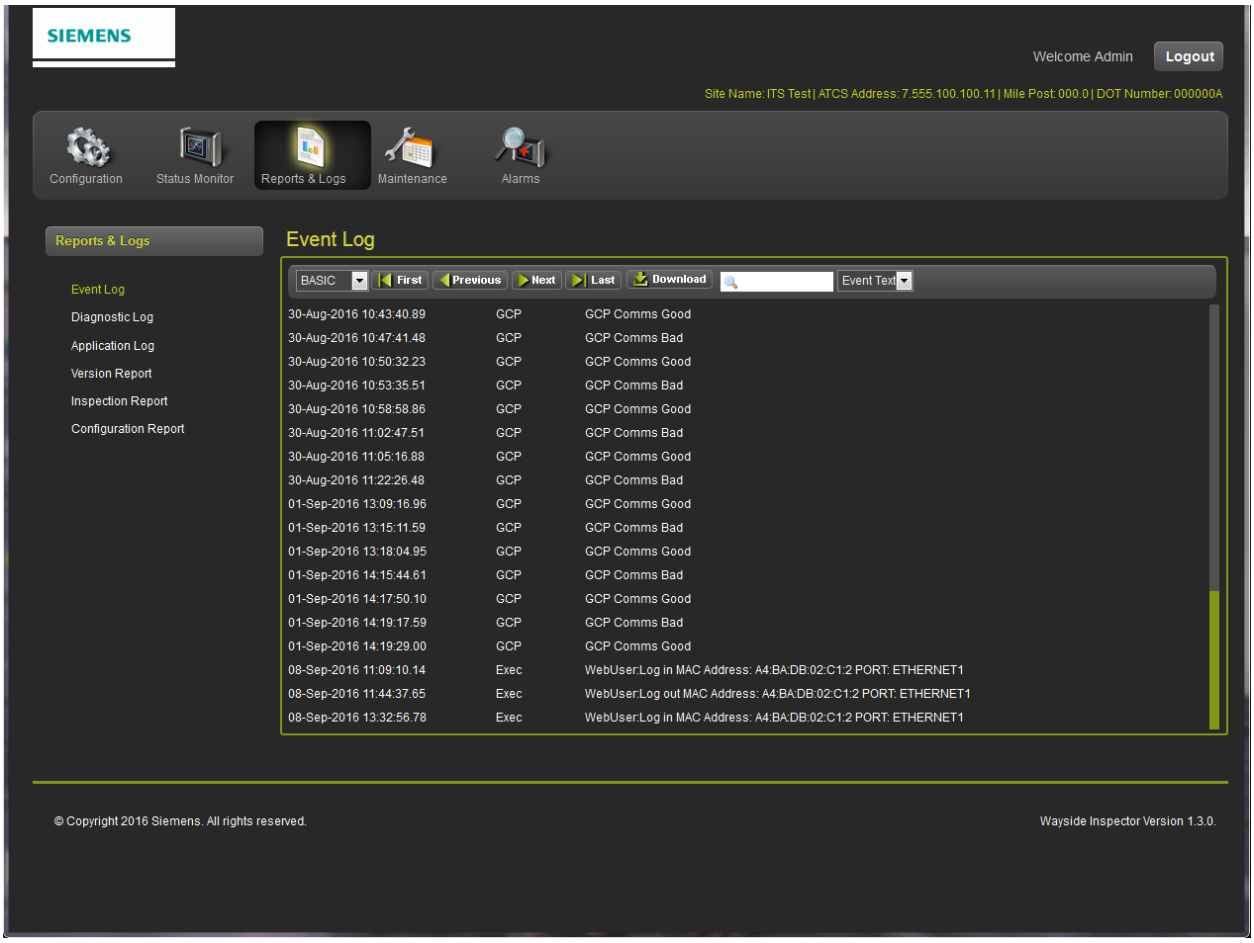



**Figure 5-40: The Event Log Screen**

The event log will hold up to 172,800 entries. The following is an example event log entry:

```
095D  11-Apr-2016 13:26:15.30  AI      Power In 12.0 V
```

## 5.3.2 Diagnostic Log

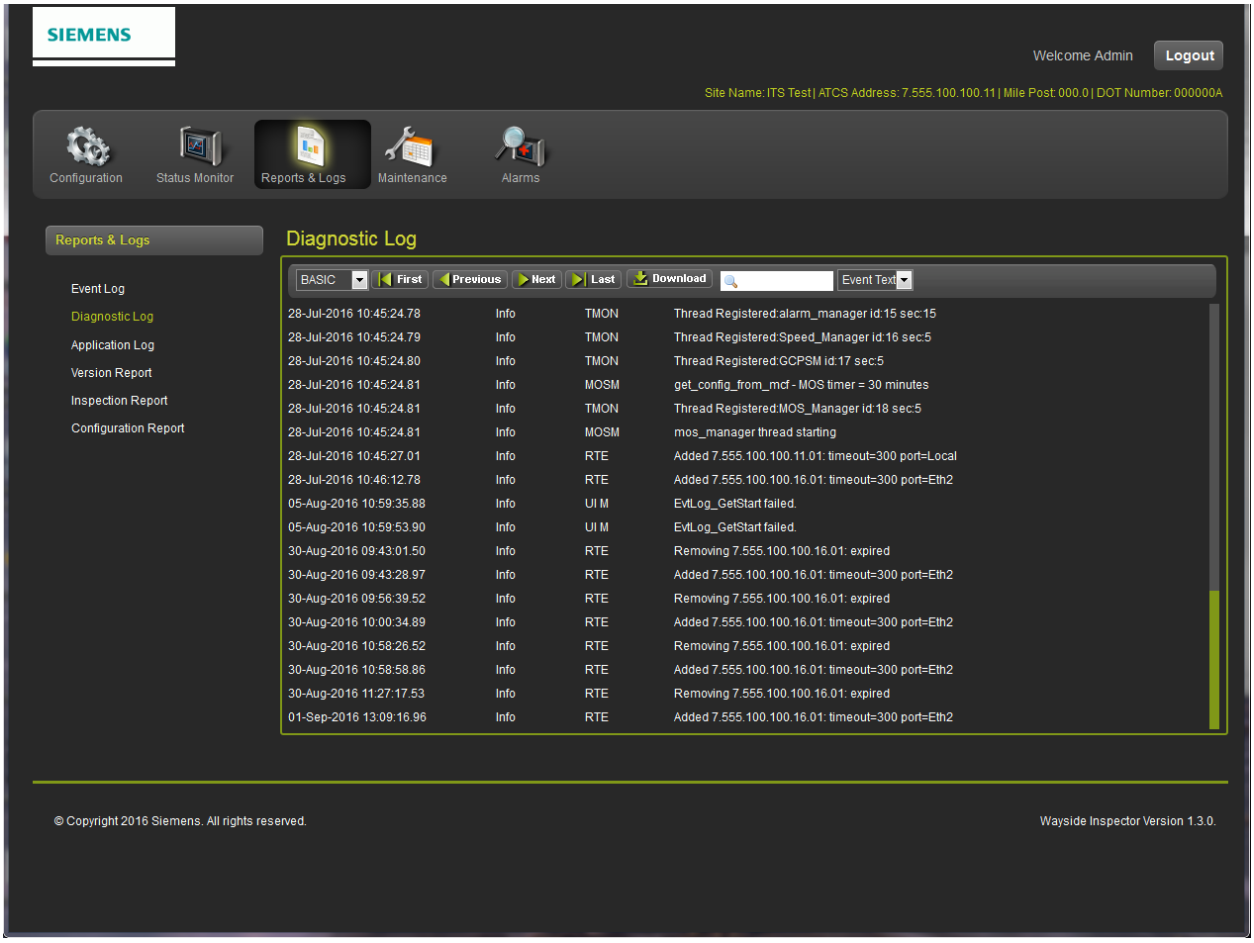



**Figure 5-41: The Diagnostic Log**

Field personnel can change the diagnostic log verbosity level using the web browser user interface. The verbosity level defaults to “Info”, which means the diagnostic log contains entries at verbosity level Basic, Error, Warning and Info. It will not include Debug level entries.

Each entry has a verbosity level associated with it. The diagnostic log also has a logging verbosity level. The WI will only add entries with the same verbosity level or lower to the diagnostic log. The user may turn the verbosity up or down to control how much information is in the diagnostic log. If turned all the way up, the diagnostic log may include a lot of information in a short amount of time, limiting the duration of time the log covers. If turned all the way down, the diagnostic log may cover a long duration of time but not include much detail.

The diagnostic log will hold up to 172,800 entries. The diagnostic log entries contain the same data as the event log entries with the addition of the “Verbosity” field. The following is an example of a Diagnostic Log entry.

```
DA75  24-Mar-2016 13:59:27.33  INFO  TMON   Thread Registered:wimag id:10
```

### 5.3.3 Application Log

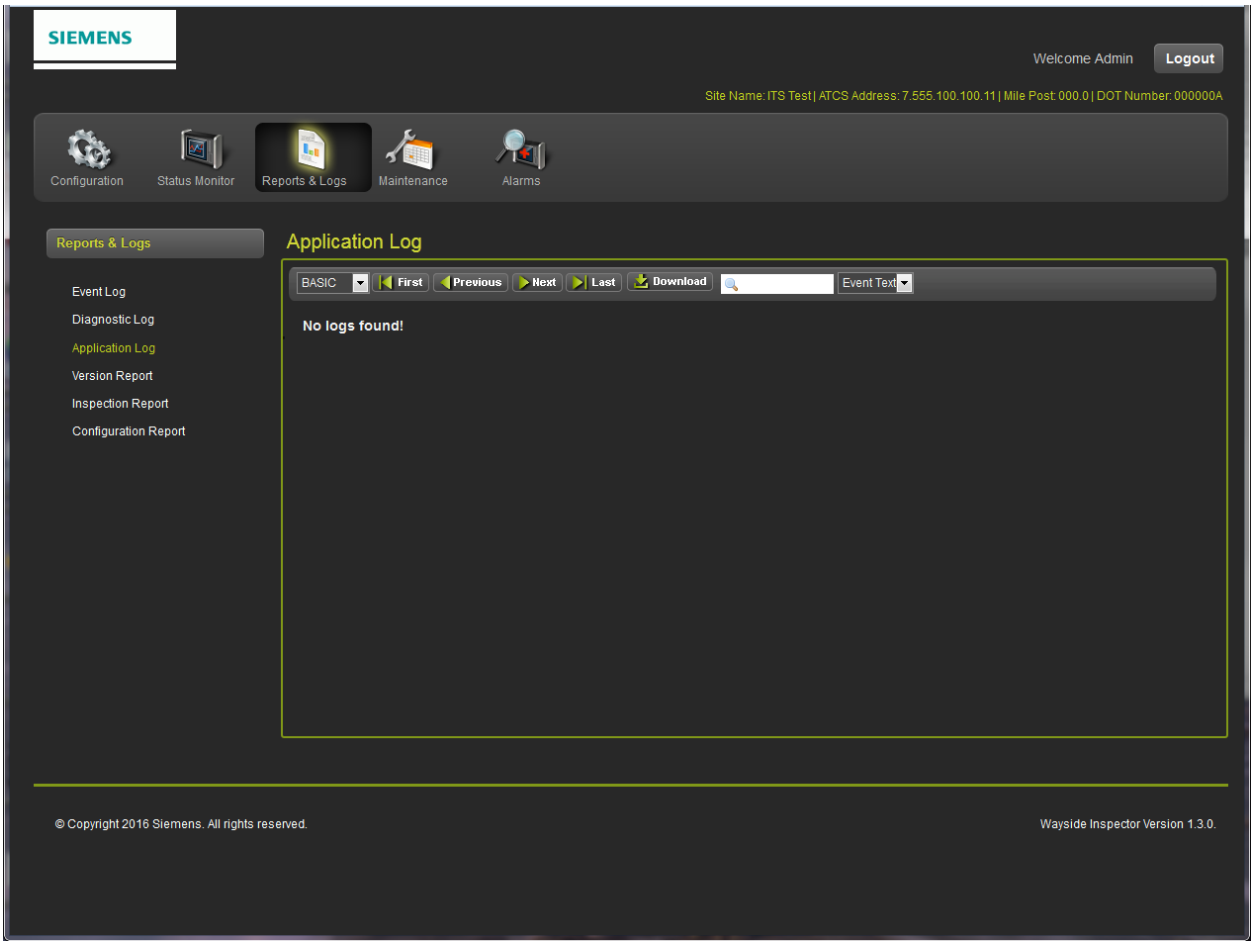



**Figure 5-42: The Application Log**

The Application Log is a filtered version of the Event Log that shows only the entries added to the Event Log by the MCF logic.

## 5.3.4 Version Report


**Figure 5-43: The Version Report**

## 5.3.5 Inspection Report

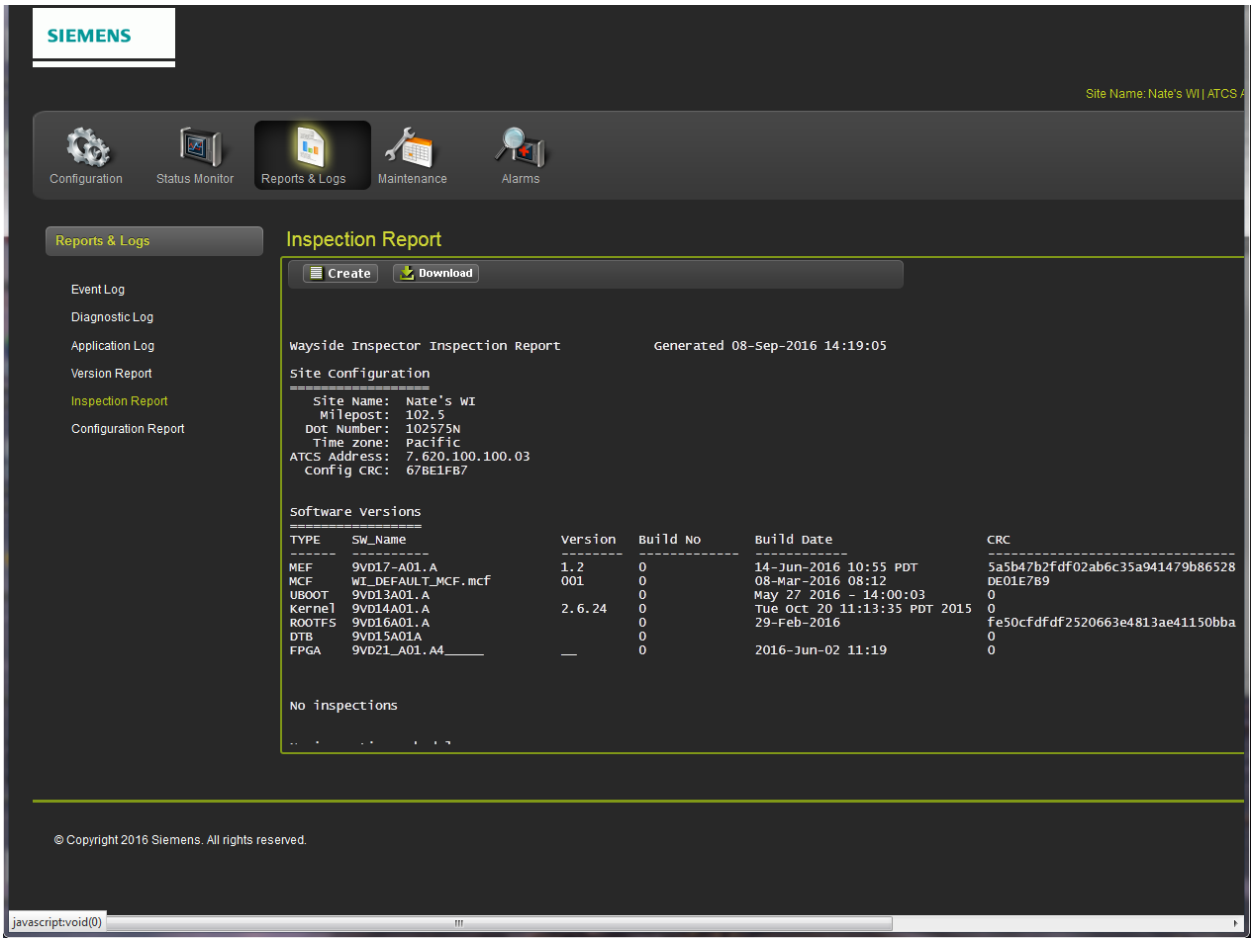



**Figure 5-44: The Inspection Report**

## 5.3.6 Configuration Report

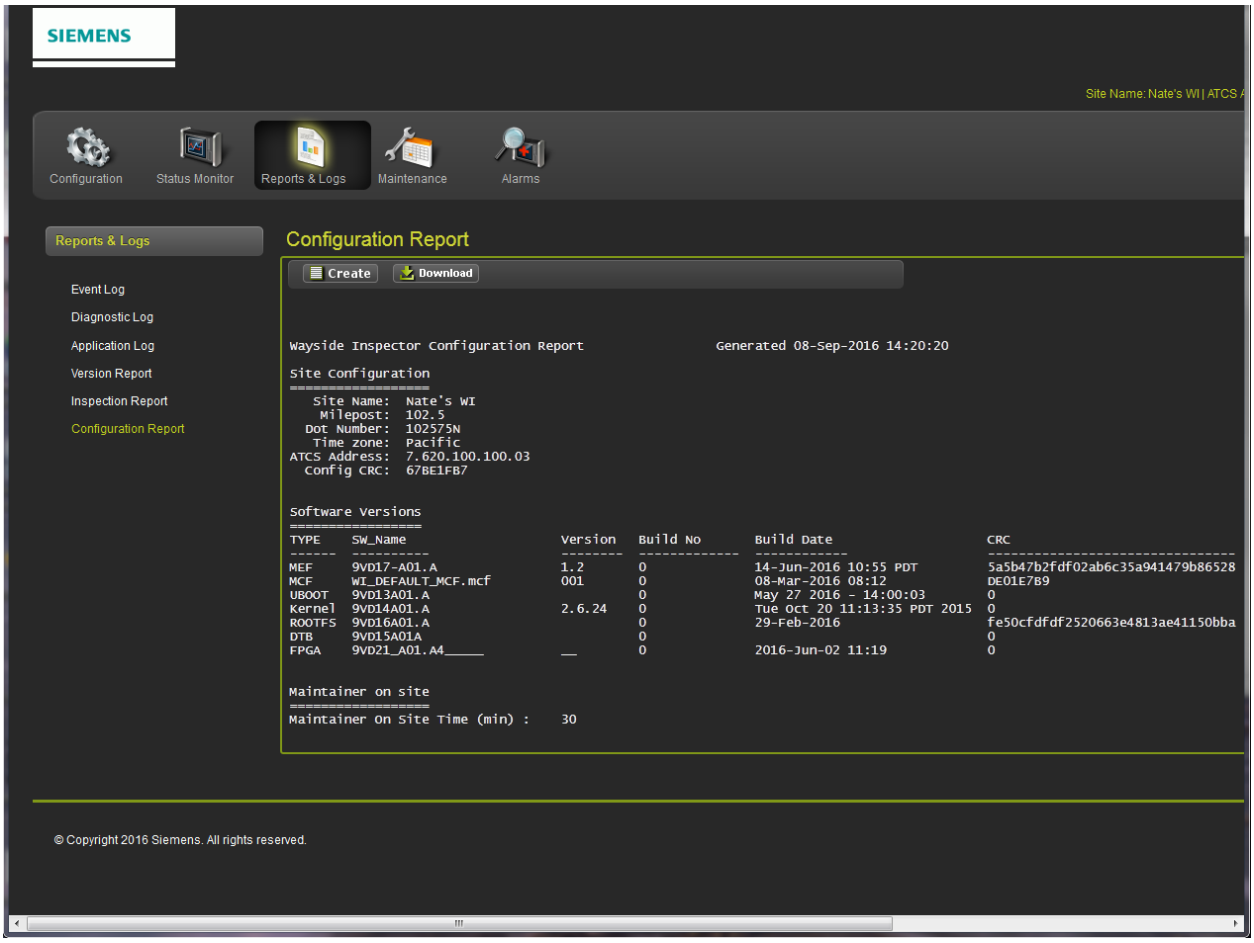



**Figure 5-45: The Configuration Report**

## 5.4 MAINTENANCE

### 5.4.1 Date/Time

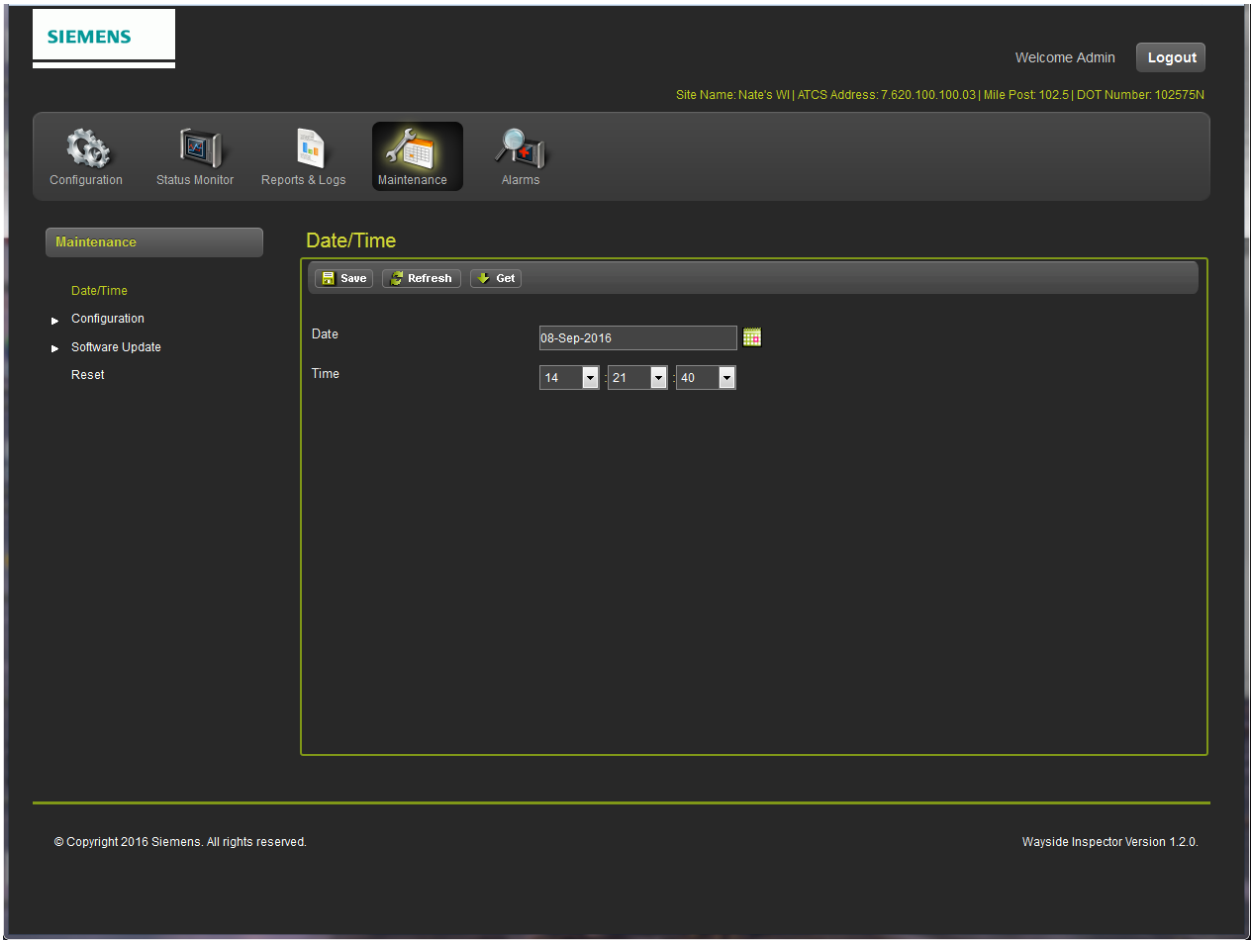



**Figure 5-46: The Date/Time Screen**

The Field Maintainer may set the time by either manually entering it on the screen or using the GET button to obtain it from other equipment.

## 5.4.2 Configuration

### 5.4.2.1 *Download*

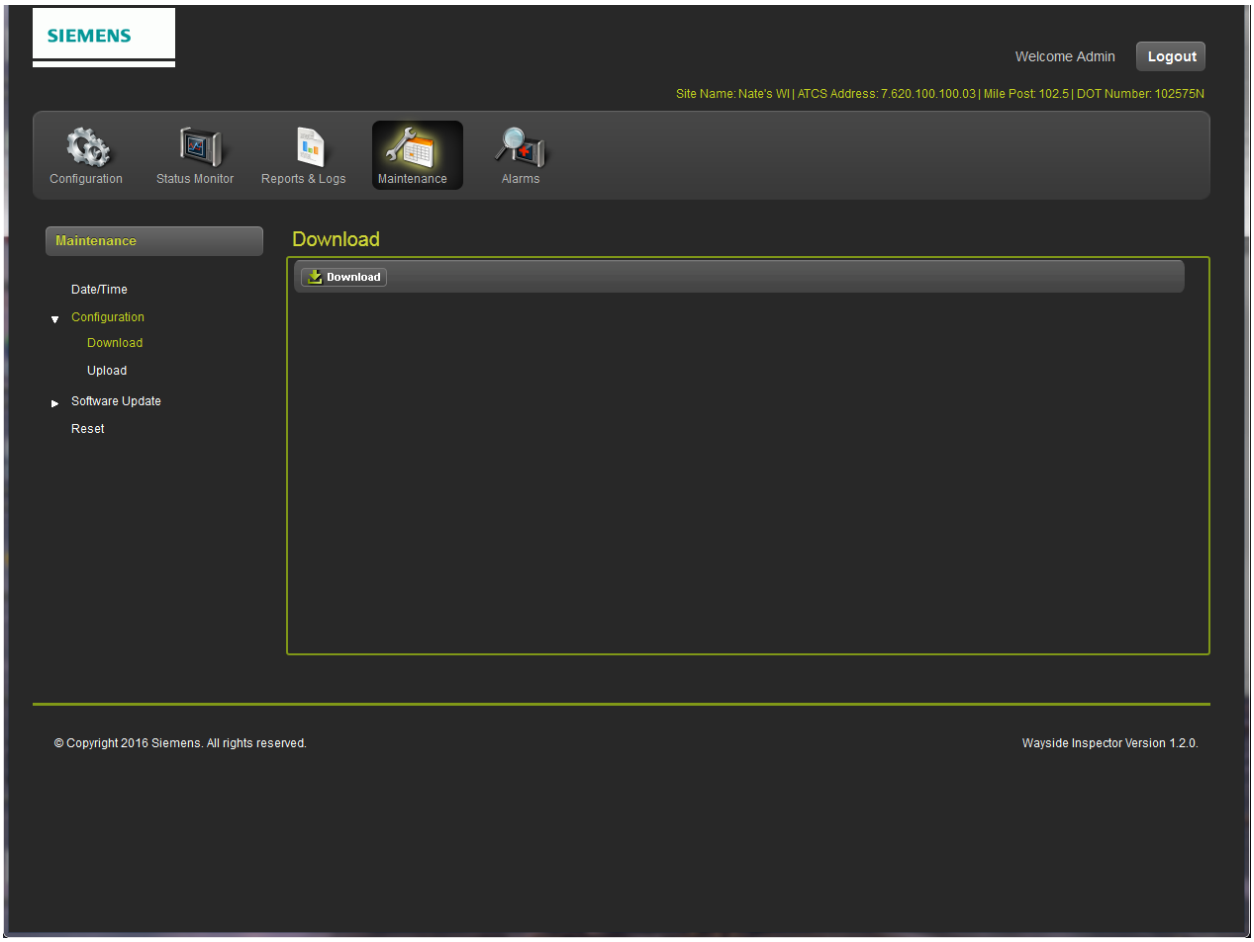



**Figure 5-47: The Download Configuration Screen**

### 5.4.2.2 *Upload*

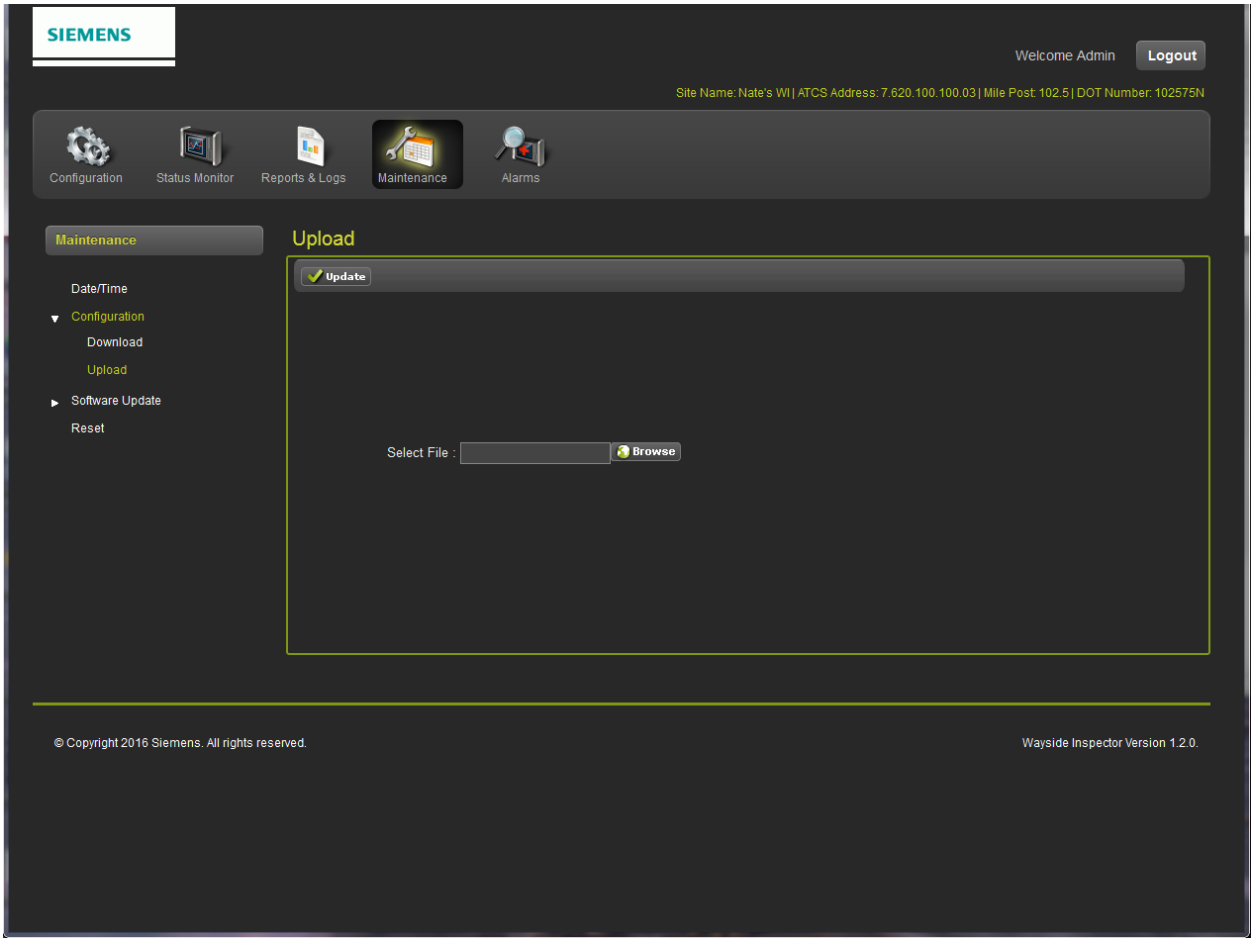



**Figure 5-48: The Upload Configuration Screen**

### 5.4.3 Software Update

Within the Software Update tab, the following screens may be updated: Executive, MCF, Inspection Schedule, Delete MCF, Erase ECD

#### 5.4.3.1 *Executive*

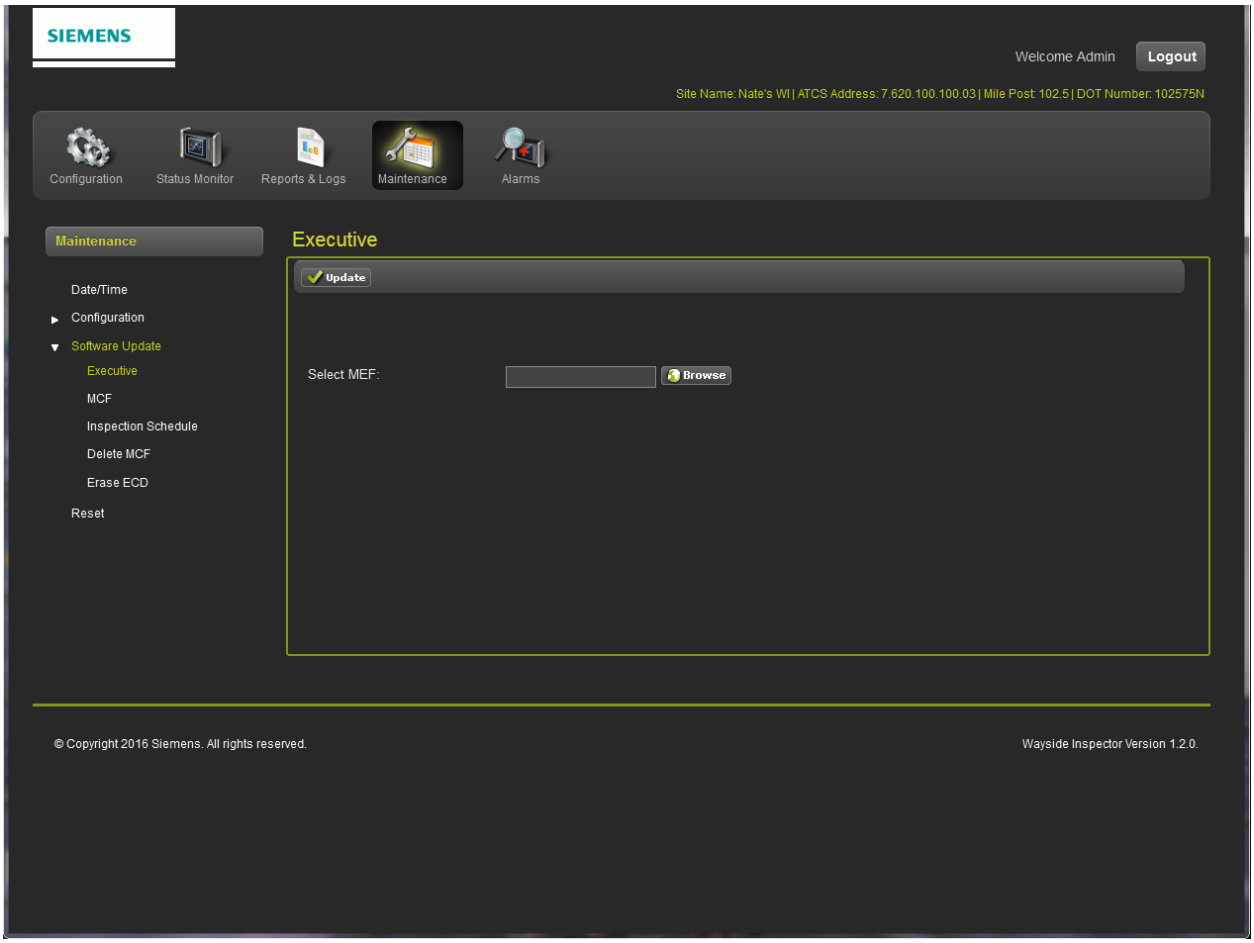



**Figure 5-49: The Update Executive Software Screen**

From the Update Executive Software screen, select the MEF from the available files.

### 5.4.3.2 *MCF*

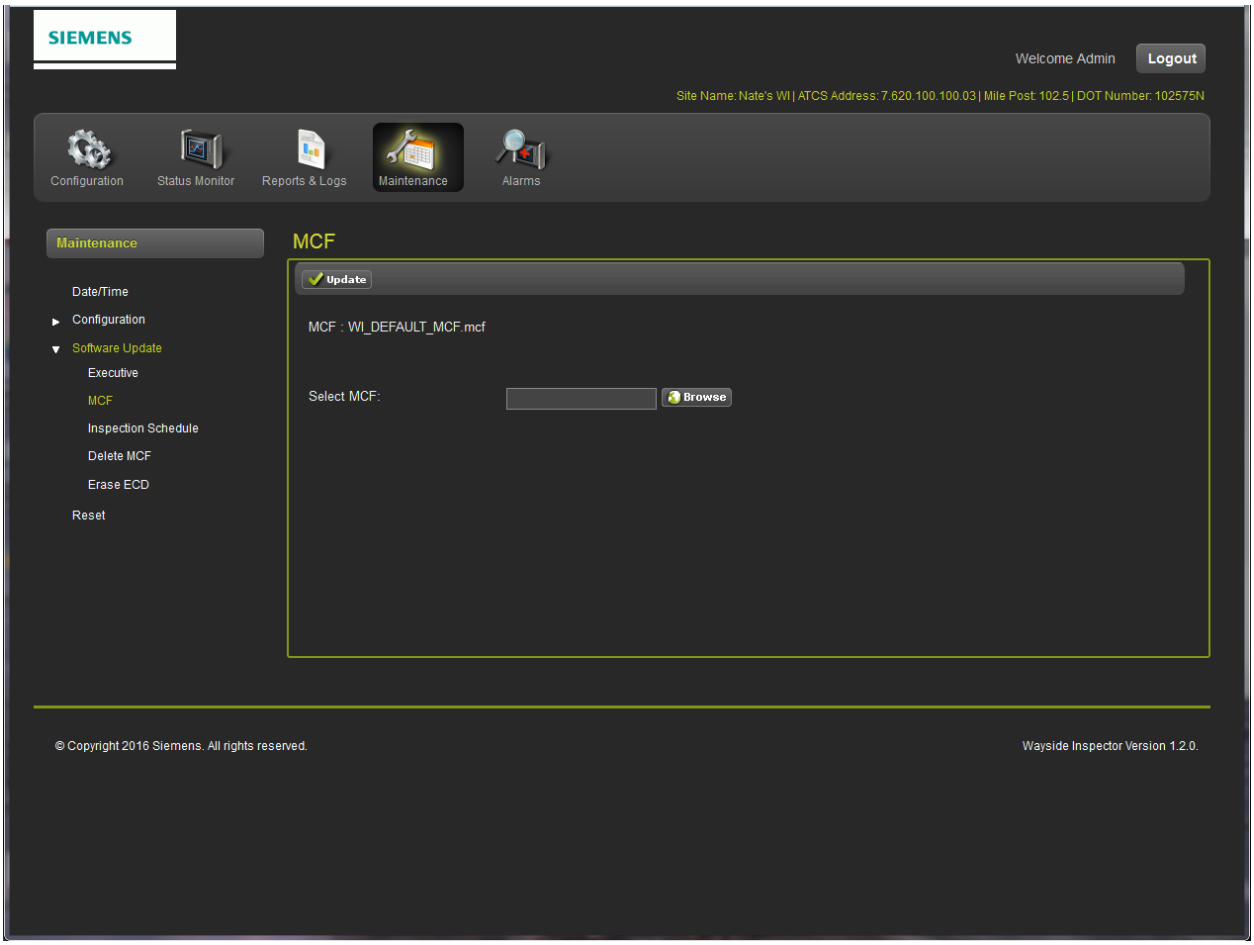



**Figure 5-50: The Update MCF Software Screen**

From the Update MCF Software screen, select the MCF from the available files.

### 5.4.3.3 *Inspection Schedule*

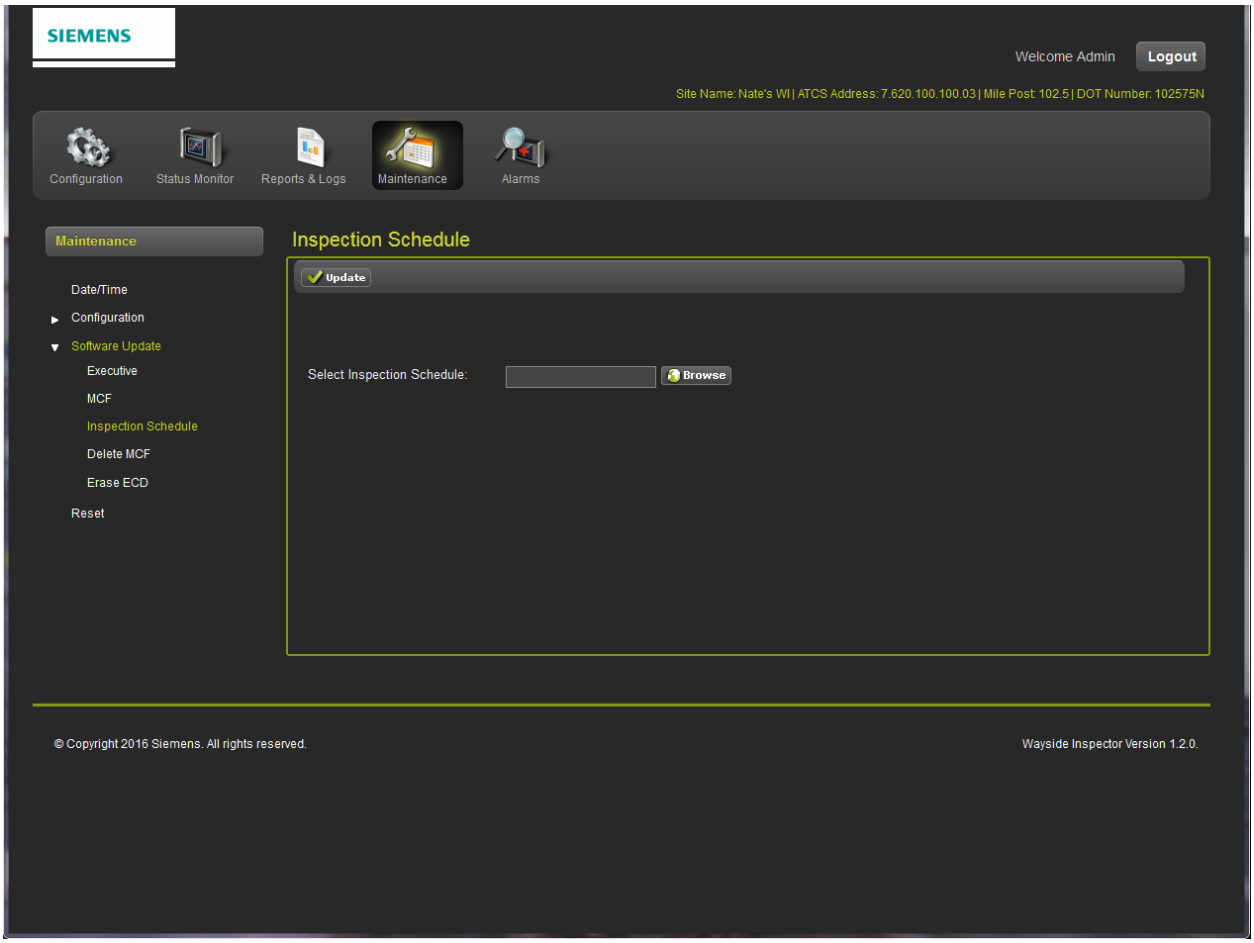



**Figure 5-51: The Update Inspection Schedule Screen**

From this screen, a new Inspection Schedule may be updated. Locate the applicable .txt file from the pull down list, make the updates, save the file, and click the Update button on the screen.

### 5.4.3.4 *Delete MCF*

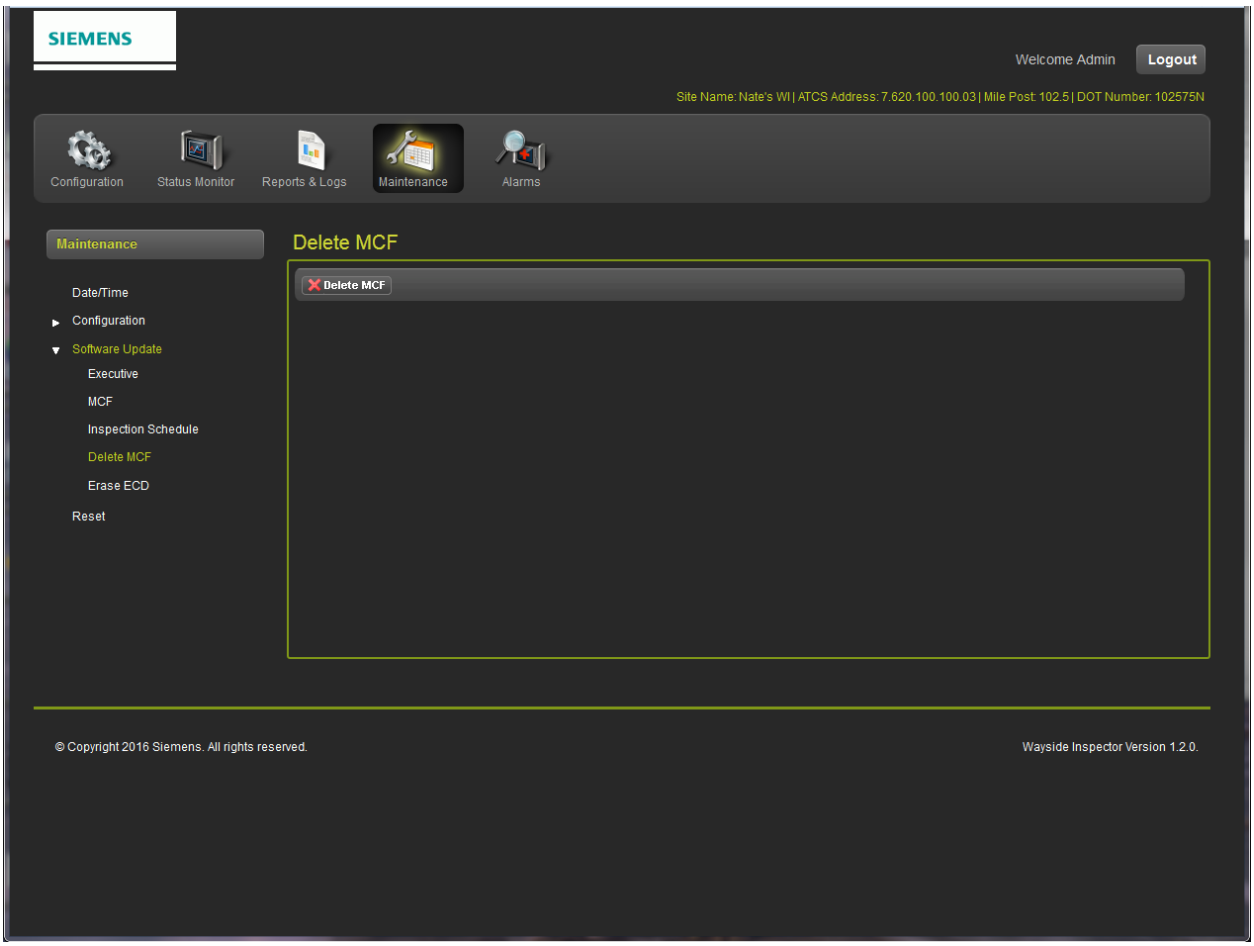



**Figure 5-52: The Delete MCF Screen**

From this screen, the currently loaded MCF may be deleted.

### 5.4.3.5 *Erase ECD*

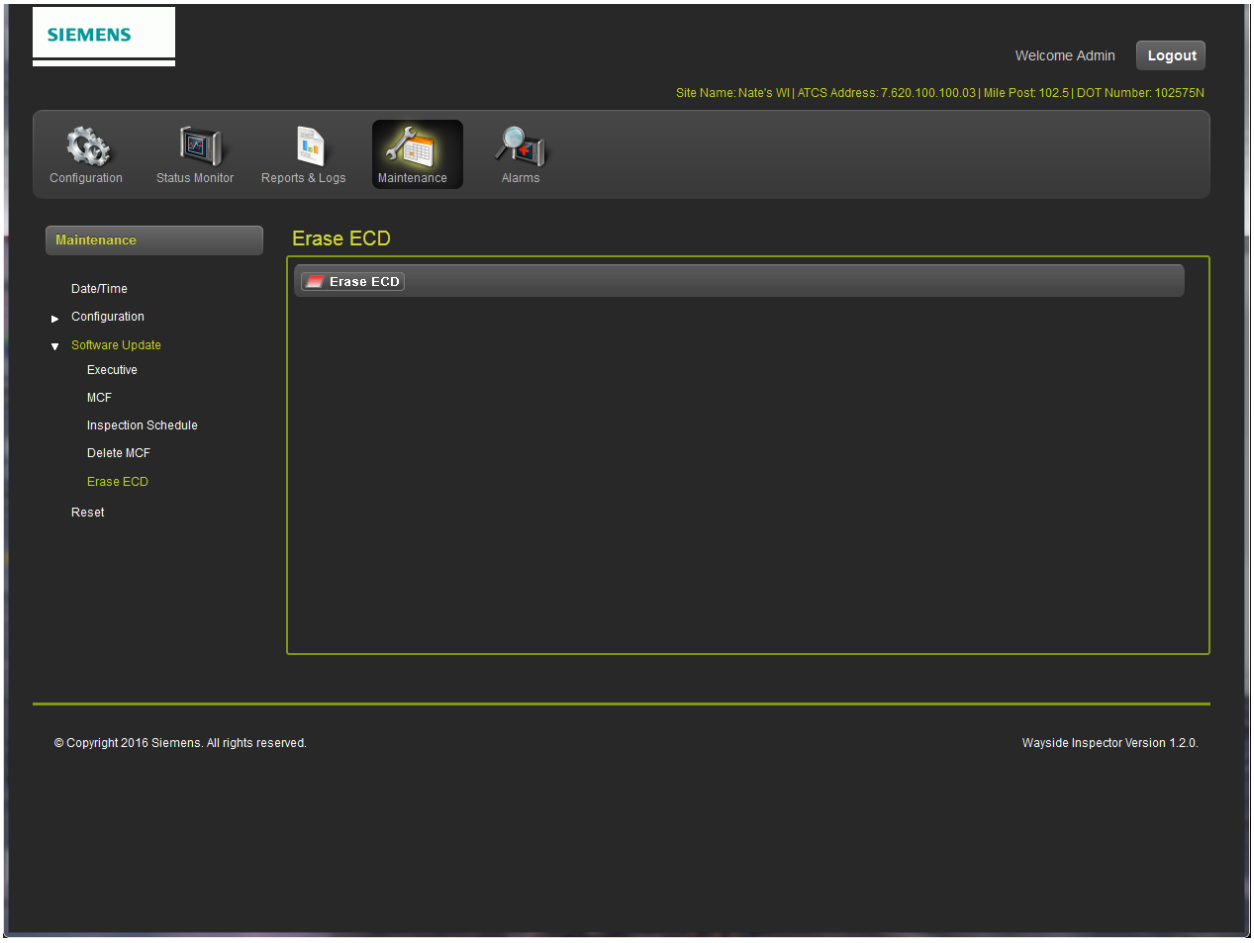



**Figure 5-53: The Erase ECD Screen**

From this screen, the ECD may be erased.

### 5.4.4 Reset

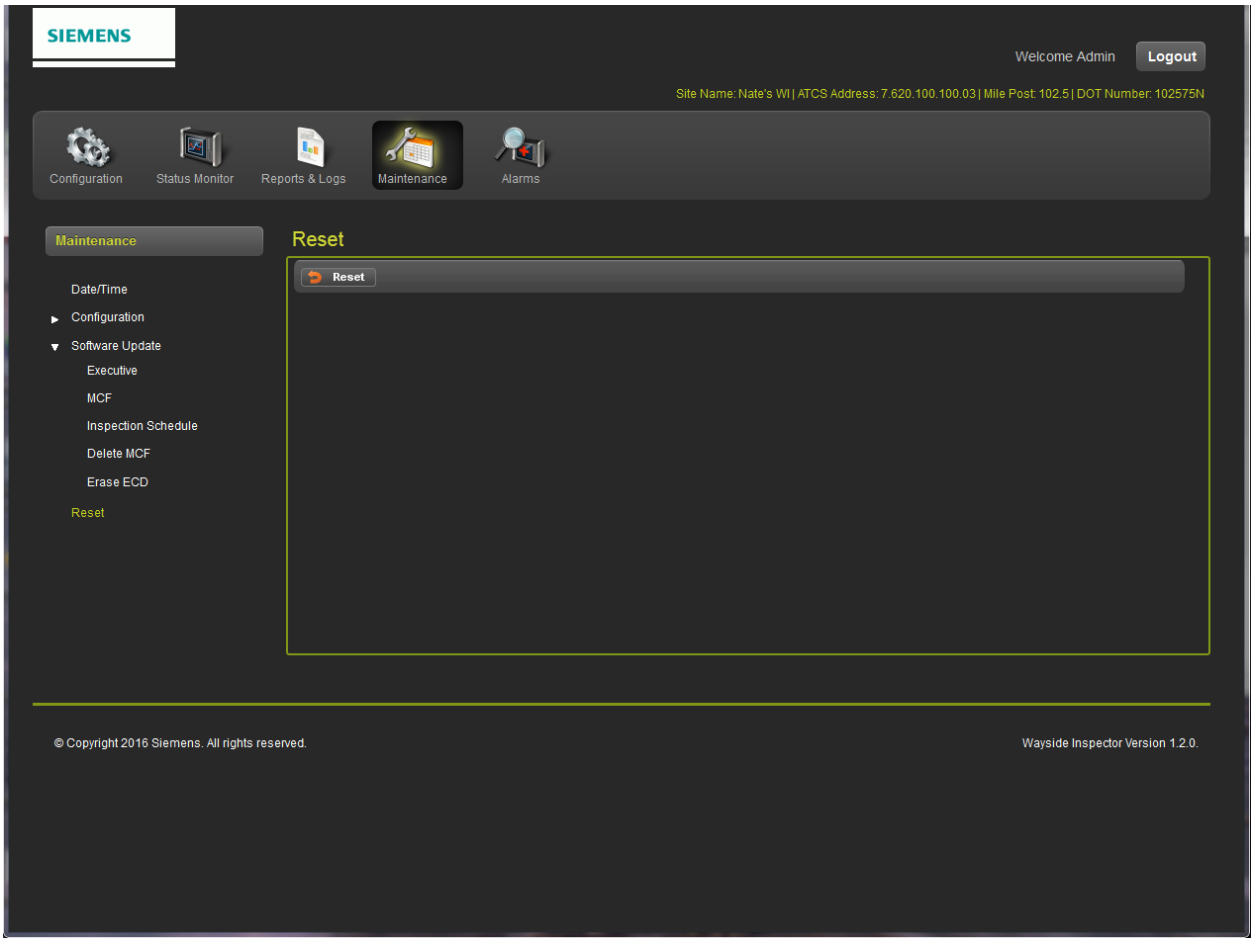



**Figure 5-54: The Reset Screen**

Using the Reset function returns all parameters in the Status Monitor, Reports & Logs, and Maintenance sections to the default established in the MCF.

## 5.5 ALARMS

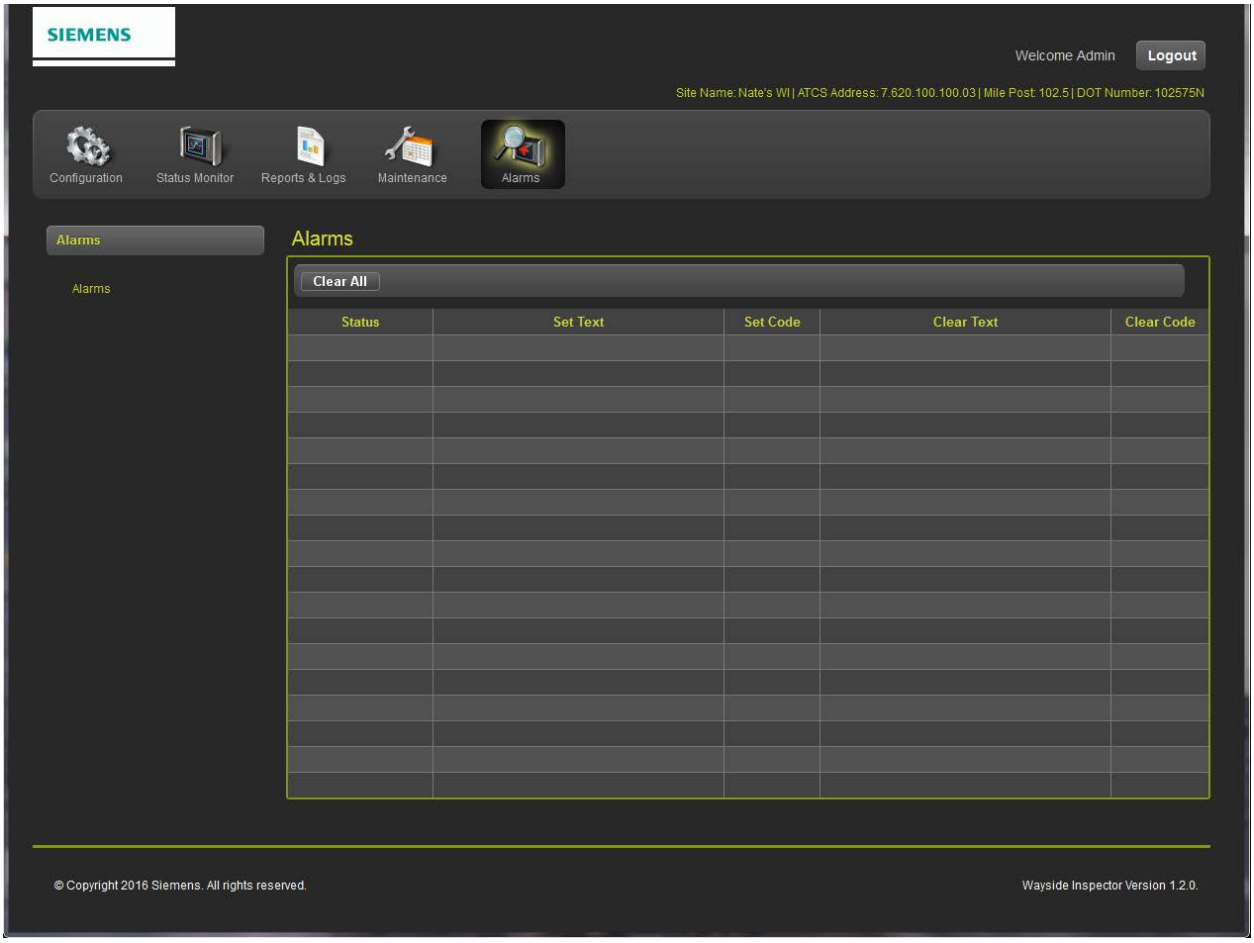



**Figure 5-55: The Alarms Screen**

The Alarms Screen provides a listing of all programmed alarms.

**Table 4-27: Alarms Parameter Values**

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Log | Yes or No | Yes | If yes, when the application logic sets the alarm's logic state and if the Set Text is not blank, the executive will log the Set Text into the event log. When the application logic clears the alarm's logic state and if the Clear Text is not blank, the executive will log the Clear Text into the event log. |
| Set Text | 64 characters | <blank> | Text to include in log entries and alarm messages when the alarm is set. |
| Set Code | 0 to 255 | 0 | The code to use for this alarm in alarm messages when the alarm status is set. |

| Parameter Name | Range | Default | Description |
|---|---|---|---|
| Set Value Type | None, Battery Input Voltage, Timer, Digital Input, Relay Output, Logic Bit | None | The value to include in the log entry or alarm message, when the alarm is set. |
| Set Value Channel | 0 to 4000 | 0 | The channel that determines where the executive will ready the Set Value from according to the Set Value Type. |
| Clear Text | 64 characters | <blank> | Text to include in log entries and alarm messages when the alarm is cleared. |
| Clear Code | 0 to 255 | 0 | The code to use for this alarm in alarm messages when the alarm status is cleared. |
| Clear Value Type | None,<br>Battery Input Voltage,<br>Timer,<br>Digital Input,<br>Relay Output,<br>Logic Bit | None | The value to include in the log entry or alarm message, when the alarm is cleared. |
| Clear Value Channel | 0 to 4000 | 0 | The channel that determines where the executive will ready the Clear Value from according to the Clear Value Type |

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# CHAPTER 6 – INSTALLATION AND WIRING

## 6.1 WAYSIDE INSPECTOR INSTALLATION AND WIRING

The Wayside Inspector is wall, shelf, or rack mountable. It will be installed in accordance with the Railroad/Agency's approved site drawing. In Figure 6-1, the WI is wired to perform the Standby Power Inspection (CFR, Title 49, §234.251).

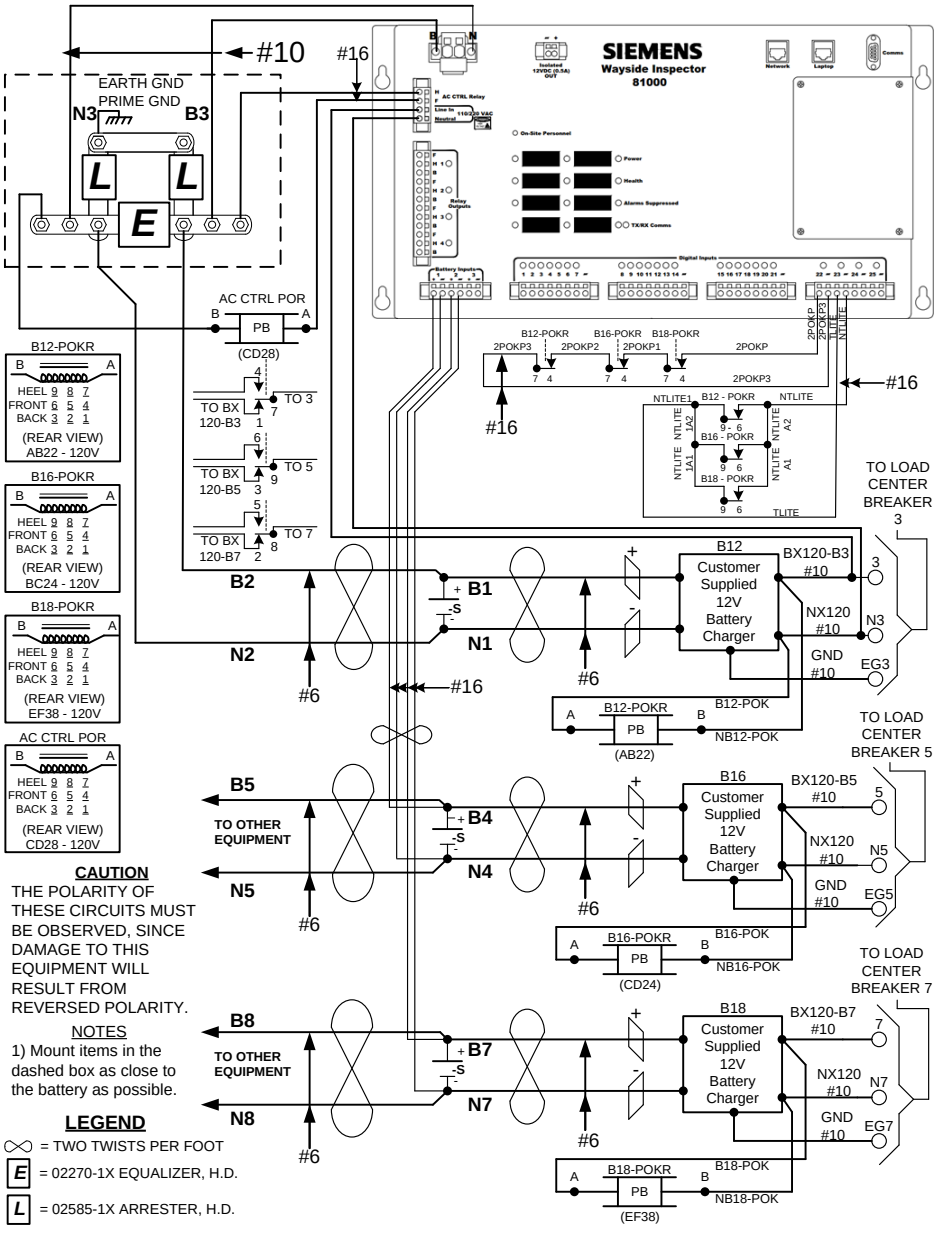


**Figure 6-1: Recommended Battery Surge Protection Wiring for WI, with WI Configured for Stand-By Power Inspection**

## 6.2 ANCILLARY EQUIPMENT INSTALLATION AND MOUNTING

All ancillary equipment used with the Wayside Inspector is wall or rack mountable. The following ancillary equipment is installed and wired as shown:

1. WI Connected to the Ground Fault Tester 2 (GFT2) and Configured for Grounds Inspection
2. WI Connected to the Model 5000 Grade Crossing Predictor (GCP) and Configured for Warning Time Inspection
3. WI Connected to the Model 4000 Grade Crossing Predictor (GCP) via the Wayside Access Gateway (WAG) and Configured for Warning Time Inspection

### 6.2.1 WI Connected to the Ground Fault Tester 2 (GFT2) and Configured for Grounds Inspection

The GFT2 is wall, shelf, or rack mountable. The Data Out wire may be connected to any unused Digital Input. In Figure 6-2, the WI is configured to perform the Grounds (CFR, Title 49, §234.249) Inspection. The GFT2 will be installed in accordance with the Railroad/Agency's approved site drawing.

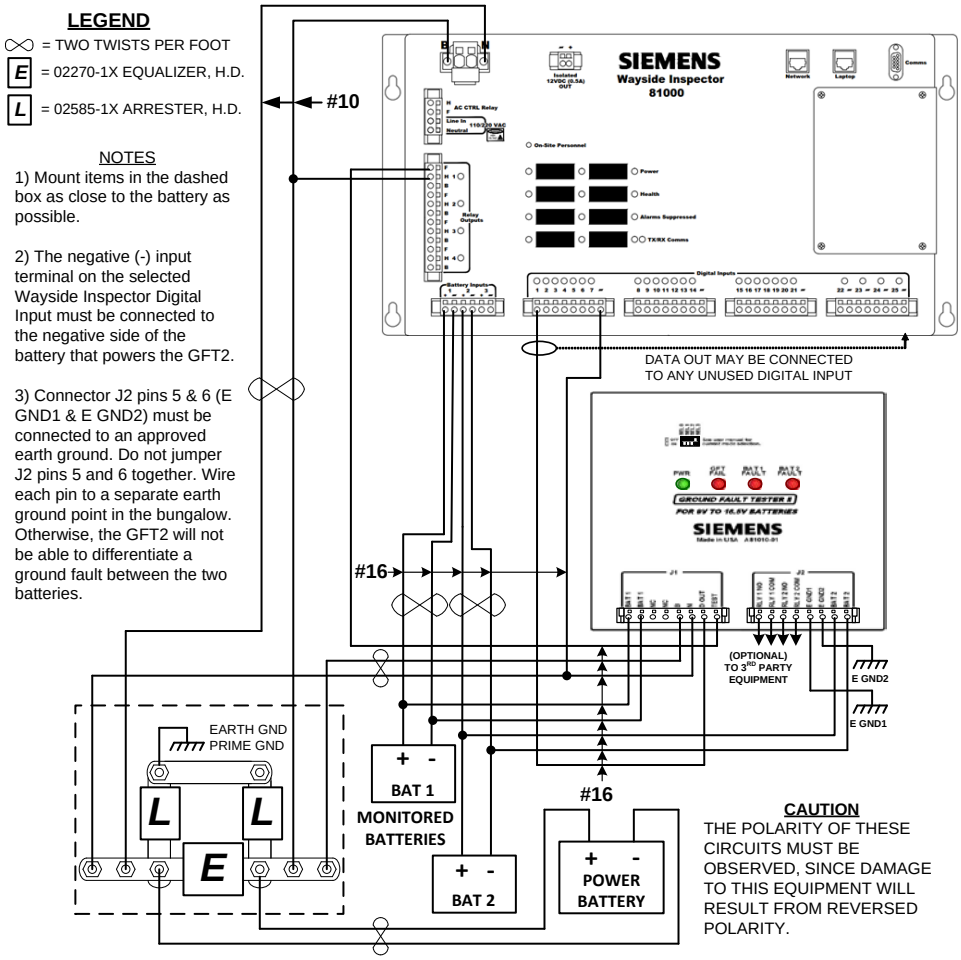


**Figure 6-2: Recommended Wiring for WI Connected to Ground Fault Tester 2 (GFT2) with WI Configured for Grounds Inspection**

### 6.2.2 WI Connected to the Model 5000 Grade Crossing Predictor (GCP) with WI Configured for Warning Time Inspection

**NOTE**

**NOTE**

Customer supplied ethernet hubs may be used to ensure connectivity between all eithernet capable equipment in the shelter.

The Model 5000 GCP is wall, shelf, or rack mountable. The GCP automatically provides the WI with Warning Time ((CFR, Title 49, §234.259) Inspection data. The Model 5000 is network capable, and is connected via Cat 5 cable to the WI in either the ETH1 or ETH2 connector in accordance with the Railroad/Agency's approved site drawing.

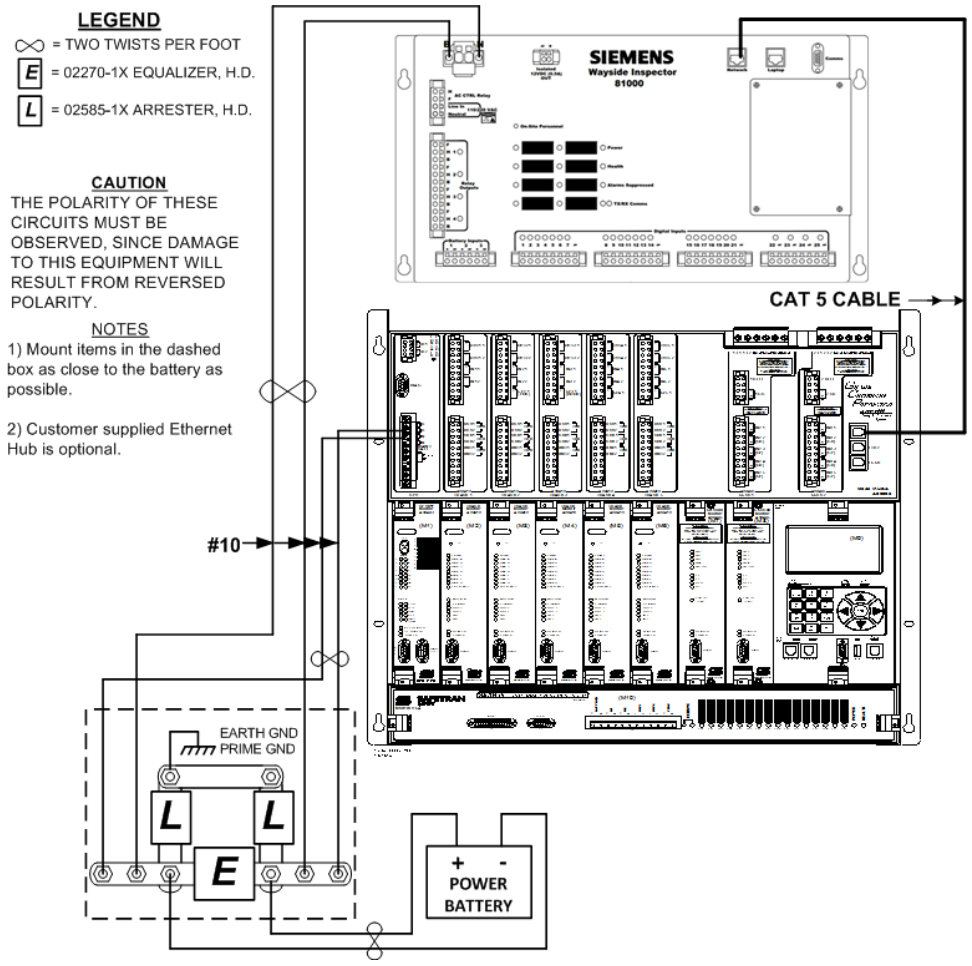


**Figure 6-3: Wayside Inspector Connected to the Model 5000 Grade Crossing Predictor (GCP) with WI Configured for Warning Time Inspection**

### 6.2.3 WI Connected to the Model 4000 Grade Crossing Predictor (GCP) via the Wayside Access Gateway (WAG) with WI Configured for Warning Time Inspection

**NOTE**

**NOTE**

Customer supplied ethernet hubs may be used to ensure connectivity between all eithernet capable equipment in the shelter.

The Model 4000 GCP is wall, shelf, or rack mountable. The GCP automatically provides the WI with Warning Time ((CFR, Title 49, §234.259) Inspection data. The Model 4000 GCP cannot be directly connected to the WI. The Model 4000 GCP is connected via the Echelon connector to the WAG, and the WAG is connected to the Wayside Inspector in accordance with the Railroad/Agency's approved site drawing.

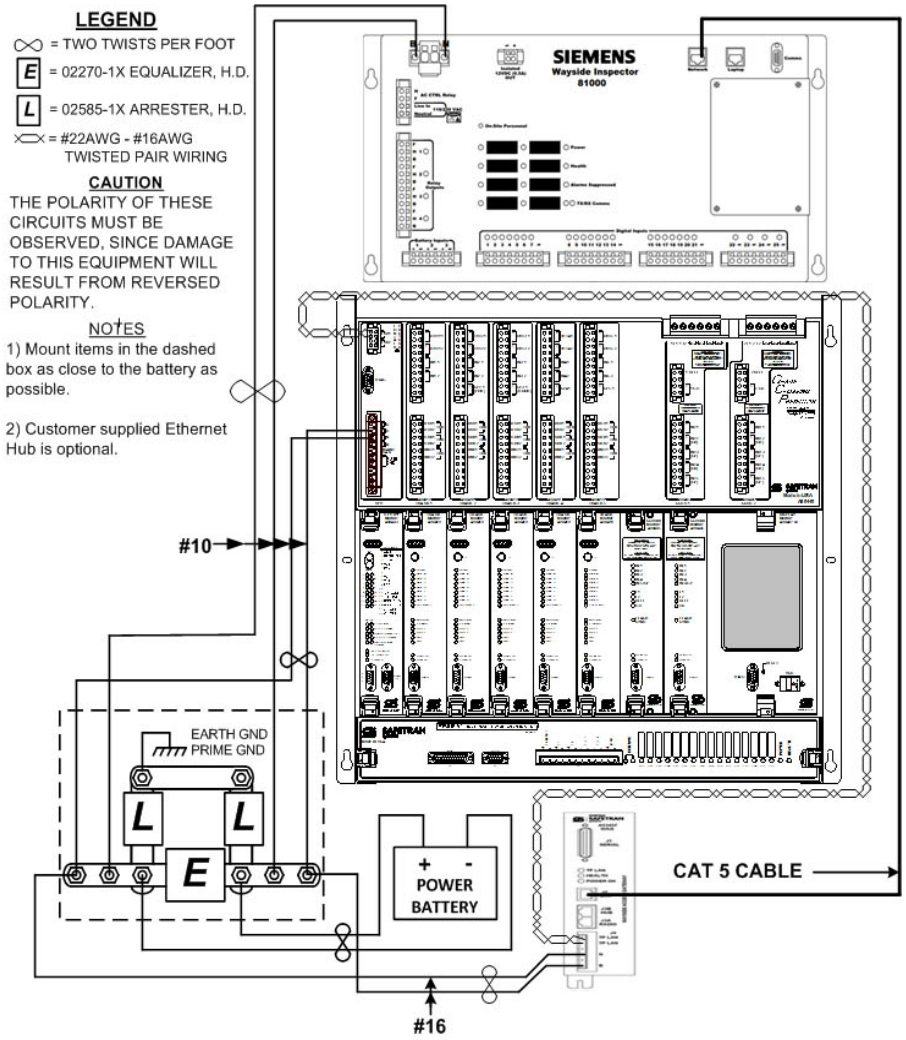


**Figure 6-4: WI Connected to the Model 4000 Grade Crossing Predictor (GCP) via the Wayside Access Gateway (WAG) with WI Configured for Warning Time Inspection**