



APPLICATION GUIDELINES

WAYSIDE INSPECTOR, P/N A81000

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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 HAZARD-OUS 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/insertion 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 Insertion (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.

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CHAPTER 1 – INTRODUCTION

1.1 PURPOSE

This manual provides the information needed by Application Engineers to correctly create Module Configuration Files (MCFs) for and properly program the Wayside Inspector (WI) for use at crossings. This manual provides information to properly create MCFs for the WI, and how to program the WI for proper usage of 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 creating the MCF for and programming 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 wiring, but should not be used as a guide to the installation of the WI. For installation procedures and general installation instructions, see the Wayside Inspector Installation & Instruction Manual, SIG-00-16-03.

1.3 ABBREVIATIONS AND ACRONYMS

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

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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 Installation and Instruction Manual	SIG 00-16-03

CHAPTER 2 – OVERVIEW



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 WAYSIDE 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).

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 back office 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.

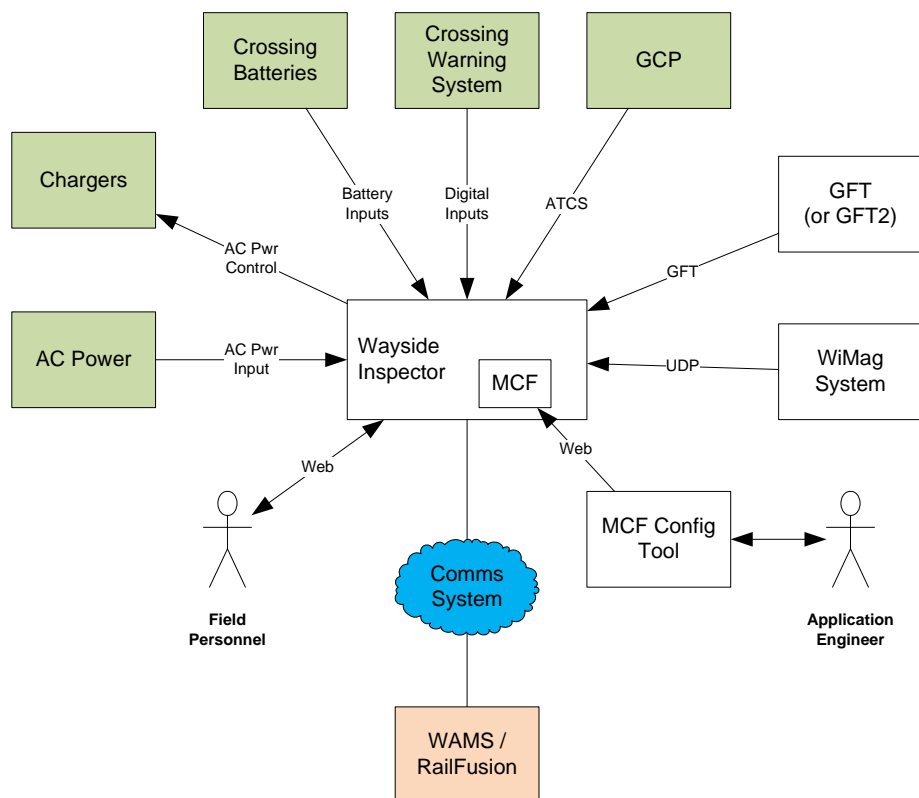


Figure 2-1: Context of Wayside Inspector Installed at Crossing

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 or 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 – WAYSIDE INSPECTOR FUNCTIONALITY

3.1 APPLICATION AND CONFIGURATION PROGRAMMING

An Application Engineer tailors the functionality of the WI by writing a Module Configuration File (MCF). The MCF includes configuration settings and the relay logic. The Application Engineer uses the MCF Configuration Tool (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.

This document provides guidance regarding MCF content. CHAPTER 4 provides a reference to the Application Engineer for all WI configuration settings and their purpose. CHAPTER 5 provides a reference to the Application Engineer for all WI logic states, which are available for the MCF logic.

3.2 EVENT LOGGING AND DIAGNOSTIC LOGGING

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.

3.2.1 Event Log Entries

Each entry in the event log has the following fields of information:

Table 3-1: Event Log Entry Fields

Example Text	Field	Description
095D	CRC	When downloading an event report, each line of the report includes a CRC. The CRC is generated using the data for this entry and seeded using data from previous entries. The user can verify a malicious person has not changed the report text or re-order the entries by using a verification tool on a PC.
11-Apr-2016 13:26:15.30	Time stamp	The date and time the entry was added to the log, to the hundredth of a second.
AI	Entry Type	The entry type mnemonic shown the type of event entry. AI is for analog input (a.k.a. Battery Input). See Table 3-4 for entry type mnemonics.
Power In 12.0 V	Entry Text	The text of the entry detailing the event. This example shows the Power In input changed to 12.0V.

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

3.2.2 Diagnostic Log Entries

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

Each entry in the diagnostic log has the following fields of information:

Table 3-2: Diagnostic Log Entry Fields

Example Text	Field	Description
DA75	CRC	When downloading an event report, each line of the report includes a CRC. The CRC is generated using the data for this entry and seeded using data from previous entries. The user can verify a malicious person has not changed the report text or re-order the entries by using a verification tool on a PC.
24-Mar-2016 13:59:27.33	Time stamp	The date and time the entry was added to the log, to the hundredth of a second.
INFO	Verbosity Level	The verbosity level of this entry, which is “Information”. See Table 3-3 for a description of each verbosity level.
TMON	Entry Type	The entry type mnemonic shown the type of event entry. AI is for analog input (a.k.a. Battery Input). See Table 3-4 for entry type mnemonics.
Thread Registered: wimag id:10	Entry Text	The text of the entry detailing the event.

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.

Table 3-3 lists the verbosity levels and their meanings.

Table 3-3: Diagnostic Log Verbosity Levels

Verbosity Level	Meaning
Basic	Basic level entries are always included in the diagnostic log and contain standard information about the operation of the system.
Error	Critical system errors such as hardware failures the system cannot heal or recover from.
Warning	Unexpected events, which could indicate a problem but the system can continue operating under this condition.
Info	Potentially useful information. These entries do not represent a failure or fault in the system.
Debug	Information that may be needed to understand the internal operation for a software or hardware engineer. This information is not normally useful for anyone else.

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.

3.2.3 Entry Type Mnemonics

Tab lists the entry type mnemonics and their meanings.

Table 3-4: Log Entry Type Mnemonics

Mnemonic	Meaning
AC	Entries relating to the AC power input and AC power control relay.
AI	Entries for battery inputs (a.k.a. analog inputs).
APPL	Messages added by the MCF as defined in the application logic.
CFG	Entries concerning configuration data changes.
COMM	Communications-related log entries
DEBUG	Debugging entries
DI	Digital inputs
ETH	Ethernet port
EXEC	General events logged by the executive software
GFT	Ground fault test entries
INIT	Entries relating to system initialization.
INSP	Inspection entries

Mnemonic	Meaning
MCFE	MCF logic engine entries
MOSM	Maintainer on Site mode
PBTN	On-site personnel button
PMGR	Port manager
RLY	Relay outputs
SER	Serial port
SYS	General system entries
TIME	Date/time changes and time related entries
TMON	Internal task monitor entries

3.2.4 Log Duration

When the log is full, the WI overwrites the oldest entry with the new entry. By default, the WI uses the full storage capacity of the log. The Application Engineer may choose to only keep a specific duration of log data instead of the full storage capacity (for example, keep only the last 90 days of log entries). If the Application Engineer sets a Log Duration, the WI will delete entries older than the Log Duration value, each day at midnight.

The Application Engineer sets the Log Duration when writing the MCF. Field personnel may not change the Log Duration setting and it is not visible on the web-browser user interface.

3.3 CONFIGURATION SETTINGS

The WI stores all system settings on the ECD. The activity LED on the ECD will blink when the WI accesses the ECD. Field personnel may replace a WI with a new unit, without going through all the settings again.

The WI uses two types of configuration settings: MCF settings and per-unit settings.

3.3.1 MCF Settings

The MCF includes the values of all MCF settings. The Application Engineer defines the values of these settings when writing the MCF. After field personnel load the MCF into the WI, they can change many of the MCF settings using the web browser UI. Not all MCF settings are field programmable. Paragraph 3-4 describes all system settings, including the MCF settings, and identifies those settings that are changeable on the UI.

3.3.2 Per-unit Settings

The per-unit settings are specific to each installation. The values are not included in the MCF; field personnel must set the value of these settings while on-site using the web browser UI. Examples of per-unit settings include the Site Name, Mile Post, DOT Number, networking settings, and protocol options.

The functional descriptions throughout this document provide additional details on MCF and per-unit settings.

3.4 DIGITAL INPUTS

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

3.4.1 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.

3.4.2 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), and 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.

3.4.3 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.

3.5 ANALOG INPUTS (BATTERY INPUTS)

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.

3.6 RELAY OUTPUTS

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.

3.7 AC POWER MONITOR AND CONTROL

The AC Power Input works the same as a standard discrete digital input except the default de-bounces and toggle period are set for AC power. Internally, the hardware half-wave rectifies the AC signal, which means only half the energy is visible to the software sampling. To improve AC detection, the default ON de-bounce is 0ms. The software will declare the AC power as ON if any AC energy is present. The default OFF de-bounce is 1000ms. The software will not declare the AC power as OFF until it has been off for a full second. There is no need to detect "TOGGING" for AC power; therefore toggle detection is not enabled. The Application Engineer may change the default de-bounce settings when writing the MCF and field personnel may change them using the web browser user interface.

The AC Power Control relay works the same as the general-purpose relay outputs except the back contact is not available for wiring. Also, there is no need to toggle the AC power so automatic toggling of the AC power control relay is not available.

3.8 APPLICATION LEDS

The MCF controls the 8 general purpose Application LEDs using application logic. The Application Engineer may use the LEDs for any site-specific or application specific indication. LED state changes are not logged. However, the LEDs are named for convenient reference when viewing status on the web browser user interface. The MCF may command the LEDs to OFF, ON, or TOGGLE. In the TOGGLE state, the executive software will automatically toggle the LED without needing timer logic in the MCF. The flash rate is fixed at a 2 second period and 50% duty cycle (LED is on for 1 second, off for 1 second).

3.9 APPLICATION MESSAGES AND ALARMS

The Application Engineer may create messages, which can be added to the Event Log by MCF logic. The software may optionally send the message to the office as an alarm, as a traditional WAMS alarm (future), an SNMP trap (future), or a RailFusion alarm (future).

The executive software considers each application message as either "set" or "clear". The "set" or "clear" state is commanded by the MCF logic.

When the MCF logic sets the application message status, the executive software adds the "Set Text" into the Event Log using the "APPL" event type. The Set Text may include a data value (for example, a battery voltage). If an alarm transmission method is enabled, the executive will also send the alarm message to the office, including the configured "Set Code" (future).

When the MCF logic clears the application message status, the executive software adds the "Clear Text" into the Event Log using the "APPL" event type. The Clear Text may include a data value. If an alarm transmission method is enabled, the executive will also send the clear message to the office, including the configured "Clear Code" (future).

Some alarms do not have a corresponding clear. In that case, the MCF may leave the "Clear Text" blank and the executive software will ignore the application message when the MCF clears the status. The "set" state can also be ignored, if the Set Text is left blank.

3.10 INSPECTIONS

The intended application of the WI is to automatically perform crossing inspections. The MCF drives the inspections and determines when the inspections pass.

3.10.1 Inspection Types

The WI supports 3 types of inspections: Annual, Quarterly, and Monthly. Annual inspections are intended to be run once per year. Quarterly inspections are intended to run once every 3 months and Monthly inspections are intended to run once per month. However, the frequency of running each inspection is determined by the Inspection Triggers (see section 3.10.3 below). The MCF defines each inspection record and its type.

3.10.2 Inspection States

The WI considers each inspection in one of the following states:

- **No Results:** The inspection has not been triggered to run yet or it was triggered and then abandoned before it passed.
- **Pending:** The inspection has been triggered. The next time the conditions are appropriate for the inspection (e.g. next train move), the WI will perform the inspection. If the inspection does not pass, it remains pending and the WI will attempt to pass the inspection the next time the conditions are appropriate. Inspections remain pending until they pass or until a user abandons the inspection.
- **Passed:** The inspection passed and there are passed results saved. The inspection has not been triggered to run again. When the inspection is triggered to run again, it will change to Pending.

The WI never declares an inspection “failed”. There are a number of real-world reasons the automated inspection might not pass, even when the crossing warning system is performing correctly. This approach allows field personnel to fix an issue and then manually trigger the inspection again to get a pass. Or, field personnel may abandon the inspection and perform it the traditional (not automated) way.

3.10.3 Inspection Triggers

The system may trigger inspections to run (change state to Pending, see 3.10.2) using three methods: Inspection Schedule, User Interface, Back-office Command (future).

The user may load an Inspection Schedule into the WI, which defines the date and time to run each type of inspection. The inspection schedule is just a text file. The user may type an inspection schedule by hand, provided the file syntax is followed (see CHAPTER 7).

The user may manually trigger inspections using the web browser user interface (on the Inspection Status screen).

3.10.4 Inspection Trigger Logging

The WI adds an entry to the Event Log when inspections are triggered. The following is an example log entry:

```
E1A1 23-Mar-2016 09:26:27.38 INSP EB 1-1 Warning Time (234.259) triggered
by user, Annual test
```

NOTE

NOTE

Each event entry is a single line in the report. The entry is shown on two lines here due to space constraints.

The event text includes the inspection name as programmed in the MCF. For the example entry above, the inspection name is “EB 1-1 Warning Time (234.259)”. The entry also includes how the inspection was trigger and the type of inspection.

3.10.5 Inspection Pass Logging

The WI adds an entry to the Event Log when an inspection passes. The following is an example log entry:

DDE6 24-Mar-2016 12:53:40.43 INSP

EB 1-1 Warning Time (234.259) Passed, Value: 21s, Annual Test

NOTE	NOTE
	<i>Each event entry is a single line in the report. The entry is shown on two lines here due to space constraints.</i>

The entry includes the time stamp of when the inspection passed, the inspection name as programmed in the MCF, the value associated with the inspection when it passed, and the type of inspection. For the above example, the inspection name is “EB 1-1 Warning Timer (234.259)”, the measured warning time was 21 seconds, and this is an annual test.

3.11 LAPTOP ETHERNET INTERFACE

The Laptop Ethernet interface is dedicated for on-site personnel access to the web browser user interface. The user cannot change the interface settings, which are the following:

Table 3-5: Laptop Ethernet Interface Settings

Parameter	Value
IP Address	192.168.255.81
Subnet Mask	255.255.255.0
Default Gateway	None

The WI runs a DHCP server on the Laptop interface. The server assigns IP addresses to connected clients starting at 192.168.255.82.

NOTE	NOTE
	The Wayside Inspector does not support IP version 6.

3.12 NETWORK ETHERNET INTERFACE

The Network Ethernet interface is for general purpose networking and communication. The user can change the Network interface settings. The user can also set the Network interface as a DHCP client, if connected to a network with a server. The following are the default settings for the Network Ethernet Interface:

Table 3-6: Default Network Ethernet Interface Settings

Setting	Default Value	Range	Comments
DHCP Client	No	Yes or No	If Yes, enables DHCP client functionality.
IP Address	192.168.2.100	IPv4 Address	Not shown if DHCP Client is Yes.
Subnet Mask	255.255.255.0	IPv4 Mask	Not shown if DHCP Client is Yes.
Default Gateway	None	IPv4 Address	Not shown if DHCP Client is Yes.

NOTE**NOTE**

The Wayside Inspector does not support IP version 6.

3.13 DOMAIN NAME SYSTEM

The WI supports the Domain Name System (DNS). The executive software will resolve symbolic names into IP addresses by requesting from up to 2 DNS servers. The user can set the server IP addresses using the web browser user interface. By default, the addresses are blank (no DNS).

NOTE**NOTE**

If the user specifies DNS server IP addresses and uses DHCP client, the user-specified server addresses will take precedence over addresses assigned by the DHCP server.

3.14 WIMAG SENSOR 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.

3.15 ATCS/IP FIELD COMMUNICATION

Because the Model 4000 GCP uses ATCS messages for communication, each site must be programmed with a unique ATCS address (known as the Site Identification Number, or SIN). The railroad design office usually assigns the ATCS address.

ATCS addresses consist of twelve digits in the format: **7.RRR.LLL.GGG.SS** where:

7 is the wayside equipment type

RRR is the railroad number (this number is assigned by the ATCS committee for each Railroad)

LLL is the line number

GGG is the group number (all equipment at one location has the same group number)

SS is the subnode number

Each unit at a location has a different subnode number. By default:

16 is assigned to the Model 4000/5000 GCP CPU

99 is assigned to the SEAR2i

02 and higher (02, 03, 04, etc.) is assigned to each WAG or WI found within the group

Typically, Model 4000/5000 GCP's that DAX to each other have the same railroad (**RRR**), line (**LLL**), and group (**GGG**) numbers, but have different subnode (**SS**) numbers. When communicating with WAG Modules connected to Model 4000 GCPs, both the group (**GGG**) and subnode (**SS**) numbers will differ.

3.16 GCP INTERFACE

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 Table 5-11, Table 5-12, Table 5-13, and Table 5-14 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.

3.17 TRAIN SPEED

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.

3.17.1 Speed Calculations

The WI can calculate the train speed based on the timing between two input changes and a known distance.

The MCF logic drives the speed calculation process and cooperates with the executive software. The executive software performs the actual speed calculation, compares the speed to a given speed, and informs the MCF logic when the result is ready. Table 3-7 shows the logic states available to the MCF logic to coordinate the calculation.

Table 3-7: Speed Calculation Logic States

Logic State	Set/Cleared by	Description
Start Timer	MCF	When Start Timer clears (changes from 1 to 0), the executive software will start an internal timer.
Stop Timer	MCF	When Stop Timer clears (changes from 1 to 0), the executive software will stop the internal timer, calculate the speed, compare the result to Comparison Speed, and inform the MCF logic the result is ready.
Clear Speed Result	MCF	Once the MCF logic has used the speed result, it sets this logic state to clear the results in preparation for the next calculation.
Speed Result	Executive	If set, the calculated speed is greater than or equal to the Comparison Speed. Only valid when Result Ready is set.
Result Ready	Executive	Set when the executive completes a calculation and comparison. This is the signal to the MCF logic that the Speed Result is now valid.

The MCF defines configuration parameters, which the executive software uses in the calculation. Table 3-8 lists the configuration parameters in the MCF.

Table 3-8: Speed Calculation Configuration Settings

Setting	Units	Purpose
Distance	Feet	The distance the train travels during between activations of Start Timer and Stop Timer. The executive will use this distance in the calculation.
Comparison Speed	Miles/hour	The minimum speed needed to consider the train traveling fast enough for the warning time test. The executive will compare the calculation result to this speed.
Time Adjustment	Seconds	Compensation factor to adjust the calculation for de-bounces or other system delays. The Application Engineer must calculate the Time Adjustment factor. It is the delay on Start Timer clearing minus the delay on Stop Timer clearing (see section 3.17.2.3 on page 3-13 for an example).
Calculation Timeout	Seconds	Time limit on completing a speed calculation. If the timer is started and not stopped before this length of time, the executive will abandon the calculation.

The WI uses Equation 3-1 to calculate train speed:

$$Speed = \frac{15}{22} \left(\frac{Distance}{TimerValue + TimeAdjustment} \right)$$

Equation 3-1: Train Speed Calculation

NOTE

NOTE

15/22 is the conversion factor for feet per second to miles per hour.

The *TimerValue* is the number of elapsed seconds (to the tenth of a second) between Start Timer clearing and Stop Timer clearing. When the MCF clears Stop Timer, the executive calculates the speed and compares the result with the Comparison Speed. *Distance* and *TimeAdjustment* are configuration settings. If the calculated speed is greater than or equal to the Comparison Speed, the executive will set the Speed Result logic state. After the comparison, the executive sets Result Ready to let the MCF know the result is available.

3.17.2 Speed Calculation Example

To illustrate speed calculations, consider the following example crossing. The crossing has a single bidirectional track circuit and an island circuit. For this crossing, assume a non-Siemens predictor. Assume the use of a WiMag sensor, which we will use in the speed calculation logic.

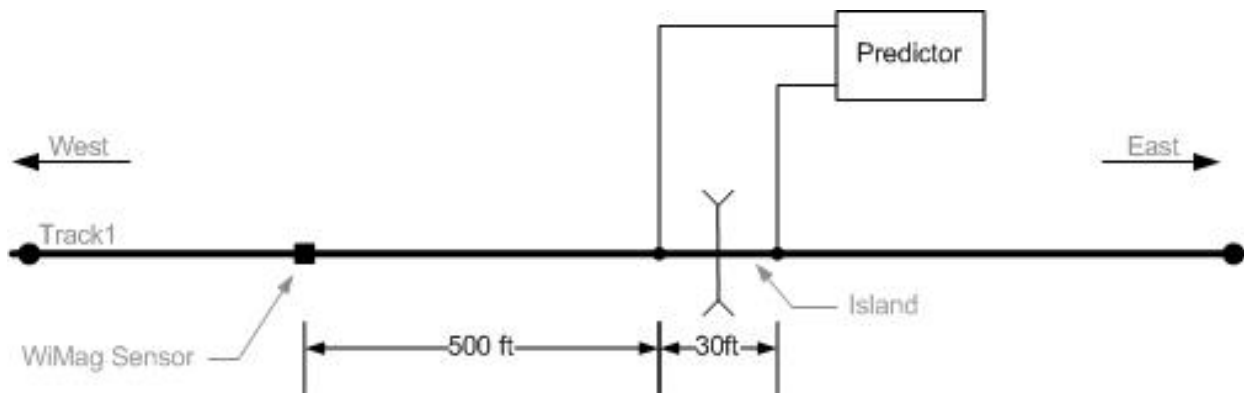


Figure 3-1: Example Bidirectional Crossing

For this crossing, the WI needs to test the warning time for two routes: eastbound and westbound. The MCF will use two Speed Measurement entries, one for each route.

For eastbound trains, the MCF will use Entry 1. The MCF will drive Entry 1 Start Timer from the WiMag sensor status. It will drive Entry 1 Stop Timer from the Island input.

For westbound trains, the MCF will use Entry 2. The MCF will drive Entry 2 Start Timer from the Island input and the Entry 2 Stop Timer from the WiMag sensor status.

3.17.2.1 Comparison Speed

We'll assume the maximum permissible speed for trains in this area is 55 mph. We'll consider trains traveling 50 mph or greater as "fast enough" to count for the warning time test; therefore, the Comparison Speed is 50 mph for both Entry 1 and Entry 2.

3.17.2.2 Distances

For eastbound trains, the train will activate the WiMag sensor first, then the near side of the island. Therefore, the Distance for Entry 1 is 500 feet. For westbound trains, the train will activate the far side of the island first and then the WiMag sensor. Therefore, the Distance for Entry 2 is 530 feet.

3.17.2.3 Time Adjustment

For this example, we'll assume a 500 ms de-bounce on the WiMag sensor status and a 1.0 s de-bounce on the Island input, regardless of train direction.

The Time Adjustment is calculated by taking the delay for the Start Timer and subtracting from that the delay for the Stop Timer. The Time Adjustment is a value in seconds with one decimal place.

For Entry 1 (eastbound trains), the Time Adjustment must be set to -0.5 seconds (0.5 s – 1.0 s). For Entry 2 (westbound trains), the Time Adjustment must be set to +0.5 seconds (1.0 s – 0.5 s).

3.17.2.4 Calculations

For an eastbound train traveling at 55 mph, the MCF will clear Start Timer after the train crosses the WiMag sensor (plus de-bounce). It will take the train 6.2 seconds to travel the 500 feet to the island. When the train reaches the island, the MCF will clear Stop Timer. However, due to de-bounces, the internal timer value will be 6.7 seconds. When Stop Timer clears, the executive will calculate the speed, like so:

$$Speed = \frac{15}{22} \left(\frac{500}{6.7 - 0.5} \right) = 54.9 \approx 55$$

Equation 3-2: Example Eastbound Speed Calculation

NOTE

NOTE

The WI will round the calculated speed to the nearest integer value of mph.

The result is greater than or equal to the Comparison Speed of 50 mph. The executive will set Entry 1 Speed Result, which the MCF logic can use to pass the eastbound train warning time inspection (assuming the warning time was good).

The reverse applies to westbound trains. A 55 mph train travels 530 feet in about 6.6 seconds. However, due to de-bounces, the internal timer will be 6.1 seconds. The following is the resulting calculation.

$$Speed = \frac{15}{22} \left(\frac{530}{6.1 + 0.5} \right) = 54.8 \approx 55$$

Equation 3-3: Example Westbound Speed Calculation

3.17.2.5 Example Logic

The MCF logic rung to pass the warning time inspection for eastbound trains might look something like the following simplified example:

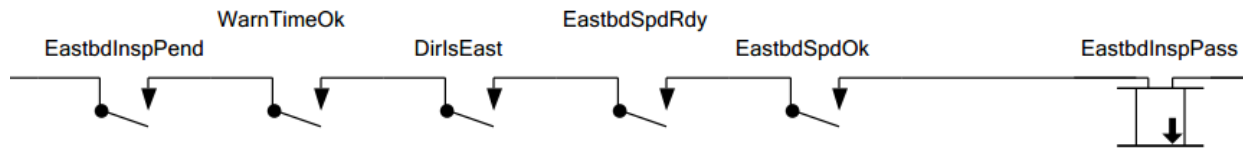


Figure 3-2: Warning Time Inspection Relay Logic

Where:

- EastbdInspPend is the “inspection pending” logic state for the inspection (set when the inspection has been triggered).
- WarnTimeOk is a logic equation that is set when the warning time was good.
- DirIsEast is a logic equation, which is set when the train direction was eastbound.
- EastbdSpdRdy is the Entry 1 Result Ready logic state. The logic must check this bit to ensure the speed result is ready.
- EastbdSpdOk is the Entry 1 Speed Result logic state, which the executive sets if the calculated train speed was greater than or equal to 50 mph.
- EastbdInspPass is the logic state to set to signal the executive to pass the inspection.

The MCF logic rungs for the Entry 1 Start and Stop Timer might look something like the following:

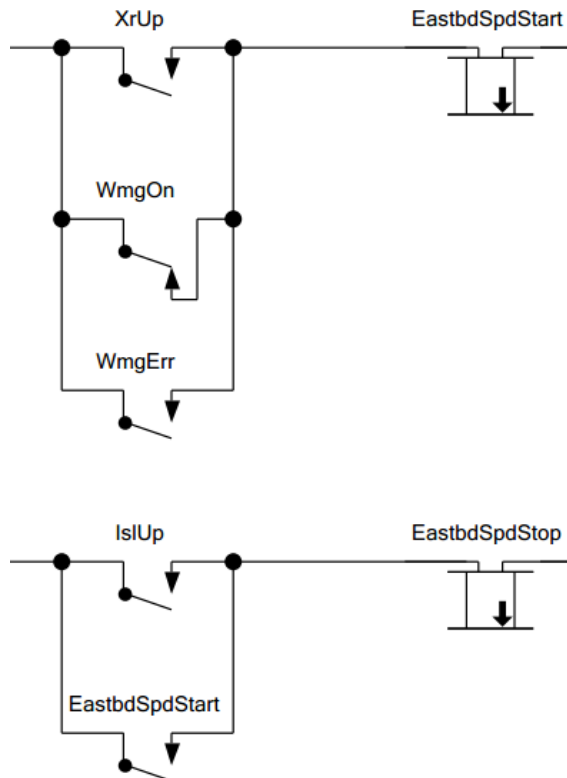


Figure 3-3: Start and Stop Timer Logic Rungs

EastbdSpdStart is Entry 1 Start Timer (variable name is assigned in MCT). The executive starts the speed calculation timer when EastbdSpdStart clears. The EastbdSpdStart equation will clear when XR drops AND the WiMag sensor is on AND there is no WiMag sensor error. The XR was ANDed into the logic just to ensure we don't start a speed calculation when there isn't actually a crossing activation (e.g. WiMag sensor incorrectly reports active).

EastbdSpdStop is Entry 1 Stop Timer. The executive stops the speed calculation timer and calculates speed when EastbdSpdStop clears. The equation above means the calculation happens when the island drops AND the Entry 1 Start Timer has already been cleared.

The westbound Start and Stop equations are left as an exercise to the reader.

Speed Calculation Recommendations

If the Distance value is small and the train speed is high, small errors in the time measurement will result in large errors in the speed calculation. It is recommended to use as large a Distance as possible to reduce the effect of time measurement errors.

3.17.3 GCP-Reported Speeds

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).

3.18 MAINTAINER ON SITE MODE

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 default length of time for Maintainer on Site mode is set in the MCF.

3.19 WEB-BROWSER USER INTERFACE

Information regarding the Web Browser User Interface is provided in Siemens' Wayside Inspector Installation and Instruction Manual, SIG-00-16-03.

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CHAPTER 4 – WAYSIDE INSPECTOR CONFIGURATION PARAMETER REFERENCE

Table 4-1: Site Configuration Parameter Data

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Site Configuration	Site Name	20 characters	Inspection Site	Per-site	Yes	The name of the site printed on reports and downloads.
	DOT Number	7 characters	000000A	Per-site	Yes	The DOT number assigned to the installation
	Mile Post	20 characters	000.0	Per-site	Yes	The mile post location of the installation.
	Time Zone	Greenwich Mean Time (GMT), Eastern, Central, Mountain, Pacific, Alaska, Atlantic, Arizona (no DST), Newfoundland	Eastern	Per-site	Yes	The time zone of the installation.
	ATCS Address	Type 7 ATCS address	7.620.100.100 .03	Per-site	Yes	The ATCS address of the installation.

Table 4-2: General Configuration Parameter Data

Screen	Parameter Name	Range	Default	Type	UI Change	Description
General Configuration	Log Duration Value	Full, 30 days, 60 days, 90 days, 120 days, 180 days	Full	MCF	No	Sets how the WI will delete old log entries. If set to Full, the WI will only delete entries once the log is full. If set to 30 days, the WI will delete entries older than 30 days, and so on. See section 3.2.4.
	Maintainer On Site Time	10 minutes to 3 hours	30 minutes	MCF	Yes	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. See section 3.18.

Table 4-3: AC Power Parameter Data

Screen	Parameter Name	Range	Default	Type	UI Change	Description
AC Power	AC Pwr Monitor Name	20 characters	ACPWR	MCF	Yes, unless Locked	Name used when logging state changes in the event log and included on the configuration report.
	AC Pwr Monitor Locked	No, Yes	No	MCF	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	MCF	Yes, unless Locked	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	MCF	Yes, unless Locked	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	MCF	Yes	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	MCF	Yes	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	MCF	Yes, unless Locked	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	MCF	No	If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel

Table 4-4: Digital Input Parameter Data

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Digital Inputs	Name	20 characters	DIxx	MCF	Yes, unless Locked	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, GFT, Not Used	Discrete Input	MCF	Yes, unless Locked	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	MCF	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	MCF	Yes, unless Locked	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	MCF	Yes, unless Locked	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	MCF	Yes, unless Locked	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	MCF	Yes	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	MCF	Yes	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.

Table 4-5: Analog Inputs Parameter Data

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Analog Inputs	Name	20 characters	BATTx	MCF	Yes, unless Locked	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).
	Locked	Yes or No	No	MCF	No	If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel
	Resolution	0.1V to 36.0V	0.5V	MCF	Yes	Required change in voltage before the executive will log an entry.
	Sample Period	100ms to 60,000ms	100ms	MCF	Yes	How often the executive will sample the input voltage.
	Average Count	1 to 32	10	MCF	Yes	The number of consecutive samples the executive will average together to determine the input's voltage.
	Voltage Threshold 1	0V to 36V	0V	MCF	Yes	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	MCF	Yes	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	MCF	Yes	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	MCF	Yes	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.

Table 4-6: Relay Outputs Parameter Data

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Relay Outputs	Name	20 characters	RLYx	MCF	Yes, unless Locked	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).
	Locked	Yes or No	No	MCF	No	If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel
	Toggle Period	100ms to 60,000ms	1000ms	MCF	Yes	If commanded to toggle, this is the period of time for each toggle cycle.
	Duty Cycle	5% to 95%	50%	MCF	Yes	If commanded to toggle, the percentage of the toggle cycle for the relay output to be ON.
	On Name	On state name list	On	MCF	Yes, unless Locked	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	MCF	Yes, unless Locked	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	MCF	Yes, unless Locked	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.

Table 4-7: Speed Measurements Parameter Value

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Speed Measurements	Speed Selection	Calculate, GCP Trk 1 Isl Speed, GCP Trk 2 Isl Speed, GCP Trk 3 Isl Speed, GCP Trk 4 Isl Speed, GCP Trk 5 Isl Speed, GCP Trk 6 Isl Speed	Calculate Speed	MCF	No	Selects the method of determining speed. See Table 5-10 for a description of the speed measurement method.
	Name	20 characters	Speed Measurement	MCF	No	The name used for the speed measurement entry in logs and reports.
	Distance	0 to 65535 ft.	0 ft.	MCF	Yes	The distance to use in the speed calculation. <i>Only relevant if Speed Selection is set to Calculate Speed.</i>
	Comparison Speed	0 to 255 mph	0 mph	MCF	Yes	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	MCF	Yes	Time value used to adjust the speed calculation to account for de-bounce or other system delays. <i>Only relevant if Speed Selection is set to Calculate Speed.</i>
	Calculation Timeout	0 to 65535 seconds	180 seconds	MCF	Yes	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. <i>Only relevant if Speed Selection is set to Calculate Speed.</i>

Table 4-8: WiMag Base Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
WiMag Base	UDP Listen Port	1 to 65535	7253	MCF	Yes	The UDP port the WI will listen on for WiMag sensor status messages.
	Base Status Timeout	0s to 255s	10s	MCF	Yes	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.

Table 4-9: WiMag Sensors Parameter Values

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

Table 4-10: GCP General Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
GCP General	Name	20 characters	GCP IF	MCF	Yes	Name used for the GCP interface in logs and reports.
	ATCS Subnode	0 to 99	16	MCF	Yes	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	MCF	Yes	If Yes, the GCP will send status changes on change of state.
	Cfg Msg Period	0 to 60 minutes	0 minutes	MCF	Yes	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	MCF	Yes	Period of status messages. If 0, the GCP will not send periodic status messages.
	GCP Link Timeout	10 to 600 seconds	30 seconds	MCF	Yes	If the WI does not receive messages from the GCP for this length of time, it will declare the link as failed.

Table 4-11: Properties Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Properties	Some Description	No, Yes	No	MCF	Yes	See MCF paperwork for description

Table 4-12: Logic Configuration Timers Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Logic Configuration: Timers	Some Description	No, Yes	No	MCF	Yes	See MCF paperwork for description

Table 4-13: State Names Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
State Names	On Names	1 to 12 Characters	Not Used	MCF	Yes	List of names available to choose from when configuring the “On Names” for inputs and outputs that support discrete states.
	Off Names	1 to 12 Characters	Not Used	MCF	Yes	List of names available to choose from when configuring the “Off Names” for inputs and outputs that support discrete states.
	Toggle Names	1 to 12 Characters	Not Used	MCF	Yes	List of names available to choose from when configuring the “Toggle Names” for inputs and outputs that support discrete states.
	Battery Names	1 to 12 Characters	Not Used	MCF	Yes	List of names available to choose from when configuring the “Battery Names” for GFT input channels.

Table 4-14: Networking: Comms Interface Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Networking: Comms Interface	DHCP Mode	Disabled or Client	Disabled	Per-site	Yes	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	Per-site	Yes	The IPv4 address of the Network Ethernet interface. <i>Only visible if DHCP Mode is Disabled.</i>
	Network Mask	IPv4 Address	255.255.255.0	Per-site	Yes	The network mask of the Network Ethernet interface. <i>Only visible if DHCP Mode is Disabled.</i>
	Default Gateway	IPv4 Address or Blank	Blank	Per-site	Yes	The default gateway of the Network Ethernet interface. Leaving the field blank means no default gateway used. <i>Only visible if DHCP Mode is Disabled.</i>

Table 4-15: Networking: Domain Name System Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Networking: Domain Name System	Name Server 1	IPv4 Address or Blank	Blank	Per-site	Yes	IP address of the primary name server for use with name resolution.
	Name Server 2	IPv4 Address or Blank	Blank	Per-site	Yes	IP address of the secondary name server for use with name resolution.

Table 4-16: Networking: ATCS/IP Field Protocol Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Networking: ATCS/IP Field Protocol	ATCS/IP Field Protocol Enabled	Yes or No	No	Per-site	Yes	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	Per-site	Yes	The UDP port to use for the ATCS messages.
	Broadcast IP Address	IPv4 Address	255.255.255.255	Per-site	Yes	The WI will send ATCS packets to this address if it has not yet discovered the IP address associated with the ATCS destination address.

Table 4-17: Log Setup: Diagnostic Logging Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Log Setup: Diagnostic Logging	Diagnostic Log Verbosity	Error, Warning, Info, Debug	Info	Per-site	Yes	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	Per-site	Yes	Future Feature.
	Routing Logging Enabled	Yes or No	No	Per-site	Yes	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	Per-site	Yes	Future Feature.
	Network Protocol Logging Enabled	Yes or No	No	Per-site	Yes	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.

Table 4-18: ATCS Message Routing Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
ATCS Message Routing	Route Timeout	0 to 172,800 seconds	300 seconds	Per-site	Yes	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.

Table 4-19: Security: Password Parameter Values

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

Table 4-20: Security: Web UI Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Security: WebUI Configuration	Browser Access	Secure (https) or Non-Secure (http)	Secure (https)	Per-site	Yes	Whether or not the web browser is accessed using http or https.

Table 4-21: LEDs Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
LEDs	Name	20 characters	LEDx	MCF	No	LED state changes are not logged. The channel name is provided only to identify the function of the LED in configuration reports and UI screens.

Table 4-22: Alarms Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Alarms	Log	Yes or No	Yes	MCF	No	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.
	Send via SNMP	Yes or No	No	MCF	No	<i>Future Feature</i> If yes, when the application logic sets the alarm's logic state and if the Set Text is not blank, the executive will send an SNMP trap, including the Set Text, Set Code, and Set Value to the configured SNMP destinations. When the application logic clears the alarm's logic state and if the Clear Text is not blank, the executive will send an SNMP trap, including the Clear Text, Clear Code, and Clear Value to the configured SNMP destinations.
	Send to WAMS	Yes or No	No	MCF	No	<i>Future Feature</i>
	Set Text	64 characters	<blank>	MCF	No	Text to include in log entries and alarm messages when the alarm is set.

Screen	Parameter Name	Range	Default	Type	UI Change	Description
	Set Code	0 to 255	0	MCF	No	The code to use for this alarm in alarm messages when the alarm status is set.
	Set Value Type	None, Battery Input Voltage, Timer, Digital Input, Relay Output, Logic Bit	None	MCF	No	The value to include in the log entry or alarm message, when the alarm is set.
	Set Value Channel	0 to 4000	0	MCF	No	The channel that determines where the executive will ready the Set Value from according to the Set Value Type.
	Clear Text	64 characters	<blank>	MCF	No	Text to include in log entries and alarm messages when the alarm is cleared.
	Clear Code	0 to 255	0	MCF	No	The code to use for this alarm in alarm messages when the alarm status is cleared.
	Clear Value Type	None, Battery Input Voltage, Timer, Digital Input, Relay Output, Logic Bit	None	MCF	No	The value to include in the log entry or alarm message, when the alarm is cleared.
	Clear Value Channel	0 to 4000	0	MCF	No	The channel that determines where the executive will ready the Clear Value from according to the Clear Value Type

Table 4-23: Inspections Parameter Values

Screen	Parameter Name	Range	Default	Type	UI Change	Description
Inspections	Name	64 characters	Inspection x	MCF	No	Name of the inspection, which will be used in the event log and reported inspection results.
	Inspection Type	Annual, Quarterly, Monthly	Quarterly	MCF	No	Defines whether the inspection should be performed once per year (annual), once every 3 months (quarterly), or once per month (monthly).
	Pass Value Type	None, Battery Input Voltage, Timer, Digital Input, Relay Output, Logic Bit	None	MCF	No	Inspections may include a value in the log entry and inspection results. This selects the type of value to include.
	Pass Value Channel	0 to 4000	0	MCF	No	This specifies the channel of the pass value type to include in the results (e.g. battery input 1).
	Speed Measurement Used	Yes or No	No	MCF	No	If Yes, the inspection results will also include a speed, in miles/hour (mph), in the log entry and inspection results.
	Speed Measurement Index	1 to 64	1	MCF	No	If Speed Measurement Used is Yes, this determines which entry in the Speed Measurement data to associate with this inspection.

CHAPTER 5 – WAYSIDE INSPECTOR LOGIC STATE REFERENCE

This section provides a convenient reference to the Application Engineer for every logic state supported by the WI. Logic states are the interface between the MCF and the executive software.

5.1 INPUT LOGIC STATES

Logic states listed as “inputs” are set by the executive software and used as contacts in the MCF’s relay logic. The MCF cannot directly change these inputs. They are controlled by the Executive.

5.2 OUTPUT LOGIC STATES

Logic states listed as “outputs” are set or cleared by the MCF. These logic states trigger the executive software to take some action. The output logic states are typically used as a relay coils in the relay logic. These logic states may still be used as contacts in other relay circuits.

5.3 TYPES OF LOGIC STATES

5.3.1 Standard

These are typical logic states that are set while the condition is present and clear otherwise.

5.3.2 One-Shot

One-Shot logic states are set by the executive for only one cycle of the relay logic. The executive automatically clears the logic state at the end of logic execution. These logic states allow the MCF to respond to an event without the need to write clearing logic.

5.3.3 Set/Reset

Set/Reset logic states stay set until explicitly cleared by a reset command by using a separate logic state. These logic states are used in instances where the executive software must know the MCF logic has detected and responded to an event before clearing the state.

5.4 TIMERS

The Wayside Inspector supports timer 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.

5.5 PROPERTIES

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.

5.6 SUBMENUS

Submenus allow the Application Engineer to organize field programmable Properties and Timers into a menu structure. The Application Engineer selects which submenu each Property and Timer should appear under. The UI will show them under selected submenu.

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Table 5-1: MCT General Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
General	Input	Maintainer On Site	Standard	Set by the Executive when the WI enters "Maintainer On Site" mode, initiated when Field Personnel press the On-site Personnel button. The Executive clears the logic state when the Maintainer On Site Timer expires. See section 3.18 on page 3-15.
		User Alarm ACK	One-shot	Set by the Executive when Field Personnel select the "Clear Alarm" button from the user interface. The state stays set for one logic cycle and automatically clears at the end of logic execution. The relay logic can use this logic state to clear alarms that do not auto clear or to ensure Field Personnel have seen an alarm before it is cleared. See section 3.9 on page 3-6.
		ECD Health IP	Standard	Set while the ECD is considered healthy. Cleared when the ECD health check fails. The relay logic can use this logic state to generate an ECD failure alarm and/or display an LED status to inform Personnel of the failure.
	Output	Beeper Control	Standard	The relay logic may set this logic state to turn on the Beeper. The Beeper will stay on while the logic state is set and turn off when the bit

Table 5-2: MCT Power Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
AC Power	Input	AC Power Monitor	Standard	Set when the AC Power Monitor input is considered ON and clear when considered OFF.
(Section 3.7 on page 3-6)	Output	AC Power Control	Standard	The relay logic may set this logic state to turn ON the AC Power Control relay output (energize the relay's coil to close the contacts). Typically, this is used in the Standby Power test to turn off AC power to the location.

Table 5-3: Digital Input Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
Digital Inputs (Section 3.4 on page 3-5)	Input	On State	Standard	Set when the digital input is declared ON. <i>Only visible if the digital input channel is a Discrete Input.</i>
		Toggle State	Standard	Set when the digital input is declared TOGGING. The On State may be either OFF or ON and is not relevant if the digital input is TOGGING. <i>Only visible if the digital input channel is a Discrete Input.</i>
		Is Discrete Input	Standard	Set if the digital input channel is configured as a Discrete Input.
		Is GFT	Standard	Set if the digital input channel is configured as a GFT input.
		Battery 1 Fault	Standard	Set if the GFT is reporting a ground fault on battery input 1. <i>Only visible if the digital input channel is a GFT input</i>
		Battery 2 Fault	Standard	Set if the GFT is reporting a ground fault on battery input 2. <i>Only visible if the digital input channel is a GFT input</i>
		GFT Health	Standard	Set if the GFT is not healthy. Clear if the GFT is healthy. <i>Only visible if the digital input channel is a GFT input</i>
		GFT Mode	Standard	Set if the GFT is in test mode. Clear if it is in normal mode. <i>Only visible if the digital input channel is a GFT input</i>
		Line Stuck High	Standard	Set if the GFT data signal is stuck high (energized continuously). <i>Only visible if the digital input channel is a GFT input</i>
		Line Stuck Low	Standard	Set if the GFT data signal is stuck low (no data signal present). <i>Only visible if the digital input channel is a GFT input</i>

Table 5-4: Analog Input Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
Analog Inputs (Section 3.5 on page 3-5)	Input	Above Threshold 1	Standard	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 1.
		Above Threshold 2	Standard	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 2.
		Above Threshold 3	Standard	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 3.
		Above Threshold 4	Standard	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 4.

Table 5-5: Relay Output Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
Relay Outputs (Section 3.6 on page 3-6)	Output	On State	Standard	If set, the executive will turn ON the relay output channel.
		Toggle State	Standard	If set, the executive will toggle the relay output at the configured toggle period and duty cycle. The exec will ignore the On State logic state if this logic state is set.

Table 5-6: LED Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
LEDs (Section 6.8 on page 6.6)	Output	On State	Standard	If set, the executive will turn ON the LED channel.
		Toggle State	Standard	If set, the executive will toggle the LED channel. The executive will ignore the On State logic state if this logic state is set.

Table 5-7: Alarms Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
Alarms (Section 3.9 on page 3-6)	Input	Alarm ACK State	One-shot	Reserved for future use.
	Output	Alarm Set State	Standard	When this logic state changes from clear to set, the executive will initiate the configured actions, unless the "Set Test" is blank. When this logic state changes from set to clear, the executive will initiate the configured actions, unless the "Clear Text" is blank.

Table 5-8: Inspections Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
Inspections (Section 3.10 on page 3-7)	Input	Inspection Pending State	Set/Reset	The executive sets this logic state to trigger the application logic to run the inspection the next time the conditions are right (e.g. next train move). The executive will set this logic state when the scheduled inspection date is reached, when manually triggered by a user, or by back-office message. The logic state will stay set until the application logic sets the Inspection Passed State or a user manually clears it via the UI.
	Output	Inspection Passed State	Standard	The application logic sets this logic state to pass an Inspection. When set, the executive will log the current inspection results into the event log. It may also send the inspection results to the back-office.

Table 5-9: WiMag Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
WiMag (Section 3.14 on page 3-9)	Input	Base Comms Status	Standard	Set by the executive while the communication link with the WiMag Access Point (base station) is good.
	Input	Sensor Detected State	Standard	Set by the executive when the WiMag sensor is detecting a train over it and clear otherwise.
		Sensor Error State	Standard	Set if there is a problem with the sensor (sensor h/w failure or comms timeout with this sensor).

Table 5-10: Speed Measurement Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
Speed Measurement (Section 3.17 on page 3-10)	Input	Speed Result	Set/Reset	The executive sets this logic state when the measured speed or GCP reported speed is greater than or equal to the configured "Comparison Speed". The MCF should AND this logic state with the Result Ready logic state since the value is not valid until Result Ready is set. Once set, this logic state stays set until the MCF sets the Clear Speed Result logic state (see below).
		Result Ready	Set/Reset	The executive sets this logic state when a speed comparison completes. This bit indicates the Speed Result is now valid.
	Output	Clear Speed Result	Standard	The MCF sets this logic state when finished with the Speed Result. The executive will clear the Speed Result and Result Ready logic states in response.
		Start Timer	Standard	If the Speed Selection configuration parameter is Calculate for this entry, the MCF clears this logic state to start the timer used for a speed calculation. See section 3.17.1 on page 3-10. If the Speed Selection configuration parameter is one of the GCP speeds, this logic state is not used.
		Stop Timer	Standard	If the Speed Selection configuration parameter is Calculate for this entry, the MCF clears this logic state to stop the timer used for a speed calculation. Clearing this bit triggers the executive to calculate the speed, compare the speed to Comparison Speed, set or clear Speed Result, and then set Result Ready. See section 3.17.1 on page 3-10. If the Speed Selection configuration parameter is one of the GCP speeds, this logic state is not used.

Table 5-11: GCP General Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
GCP General (Section 3.16 on page 3-10)	Input	Link Health	Standard	Is set while the communication link to the GCP is healthy. Clears when it is unhealthy.
		AND 1 XR State	Standard	Follows the AND 1 XR state in the GCP.
		AND 1 XR Enable	Standard	Follows the AND 1 XR Enable state in the GCP.
		AND 2 State	Standard	Follows the AND 2 state
		AND 2 Enable	Standard	Follows the AND 2 Enable state
		AND 2 Used	Standard	Set if AND 2 is used in the GCP.
		AND 2 Enable Used	Standard	Set if AND 2 Enable is used in the GCP
		Adv Preempt IP Used	Standard	Set if the Advance Preempt is used.
		Adv Preempt IP State	Standard	Set if the Advance preempt input is energized.
		GCP On Standby	Standard	Set if the GCP is running on standby instead of main.

Table 5-12: GCP Track Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
GCP Track (Section 3.16 on page 3-10)	Input	Track x Used	Standard	Set if the track card is used in the GCP configuration. The following GCP Track logic states should be ignored if the track is not used.
		Island Occupied	Standard	Clears when the island is occupied.
		Prime State	Standard	Clears when the crossing is activated.
		Prime UAX Used	Standard	Set if the Prime UAX status is used in this configuration.
		Prime UAX State	Standard	Clears when UAX activates the crossing
		Train Inbound	Standard	Clears when there is an inbound train (train moving toward the island).
		Train On Approach	Standard	Clears when a train is on the approach.
		Direction Available	Standard	Set if direction statuses can be used in logic.
		Direction Isl Tx to Rx	Standard	Set if the direction of the train is from the transmitter towards the receiver.
		Direction Isl Rx to Tx	Standard	Set if the direction of the train is from the receiver towards the transmitter.
		IN x.1	Standard	Set if input 1 on this track card is energized.
		IN x.2	Standard	Set if input 2 on this track card is energized.

Table 5-13: GCP SSCC Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
GCP SSCC (Section 3.16 on page 3-10)	Input	SSCC x Used	Standard	Set if the SSCC card is used in the GCP configuration. The following SSCC logic states should be ignored if the SSCC is not used.
		SSCC x GC	Standard	Set if the gate control output is energized.
		SSCC x Lamps Flashing	Standard	Set if the lamp outputs are flashing.
		IN x.1	Standard	Set if this input is energized.
		IN x.2	Standard	Set if this input is energized.
		IN x.3	Standard	Set if this input is energized.
		IN x.4	Standard	Set if this input is energized.
		IN x.5	Standard	Set if this input is energized.

Table 5-14: GCP RIO Parameter Logic States

MCT Screen	I/O	Logic State Name	Type	Functional Description
GCP RIO (Section 3.16 on page 3-10)	Input	RIO x Used	Standard	Set if the RIO card is used in the GCP configuration. The following RIO logic states should be ignored if the RIO is not used.
		IN x.1	Standard	Set if this input is energized.
		IN x.2	Standard	Set if this input is energized.
		IN x.3	Standard	Set if this input is energized.
		IN x.4	Standard	Set if this input is energized.

CHAPTER 6 – MCF CONFIGURATION TOOL

The Application Engineer uses the Module Configuration File (MCF) Configuration Tool to create location specific MCFs for the WI. The Application Engineer should be very familiar with crossings so as to create effective relay logic structures. The relay logic is then used in conjunction with the state names to define the relationships between the various inputs, outputs, and timers used to validate the logic.

6.1 THE GENERAL CONFIGURATION SCREEN

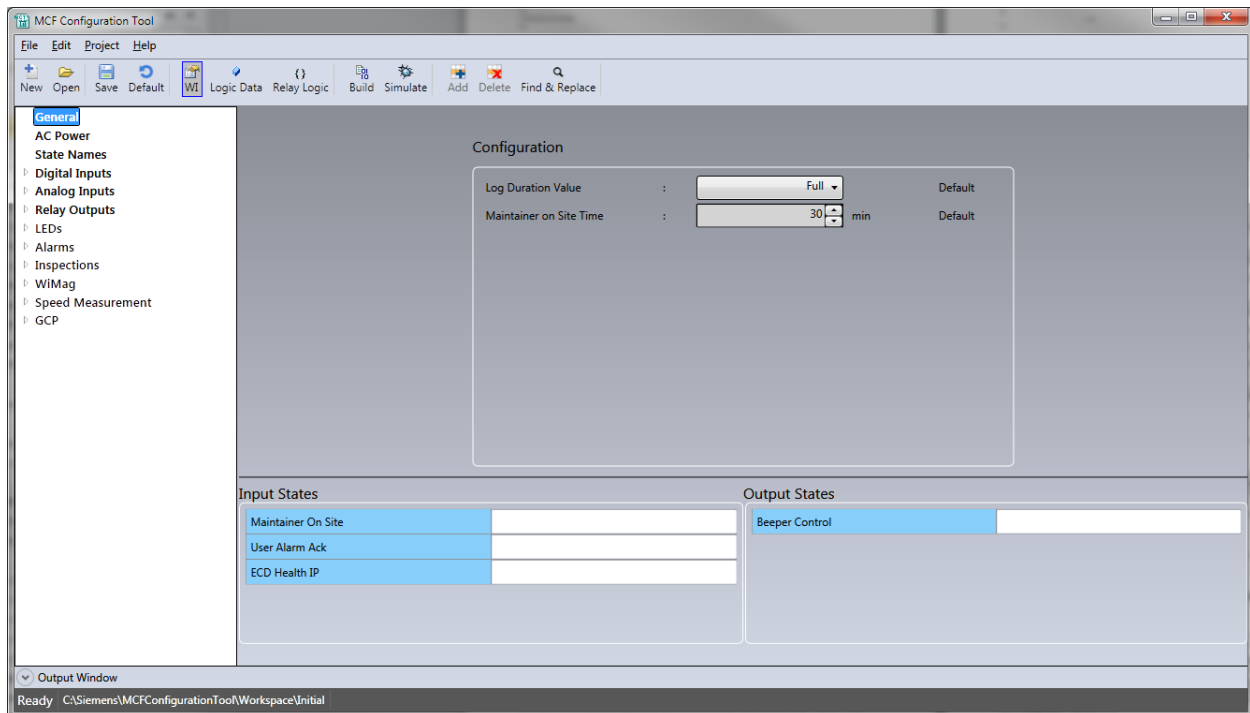


Figure 6-1: The General Configuration Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.3 & 3.18
Parameter Configuration	Table 4-2
Parameter Logic State	Table 5-1

6.2 THE AC POWER SCREEN

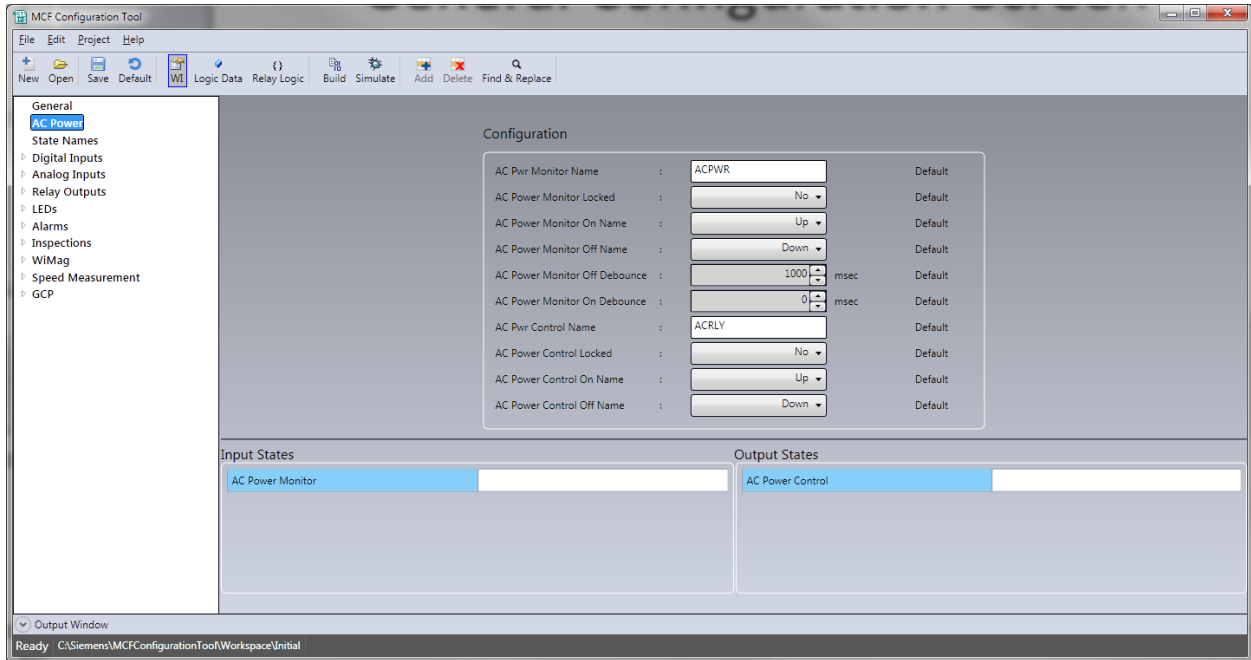


Figure 6-2: The AC Power Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.7
Parameter Configuration	Table 4-3
Parameter Logic State	Table 5-2

6.3 THE STATE NAMES SCREEN

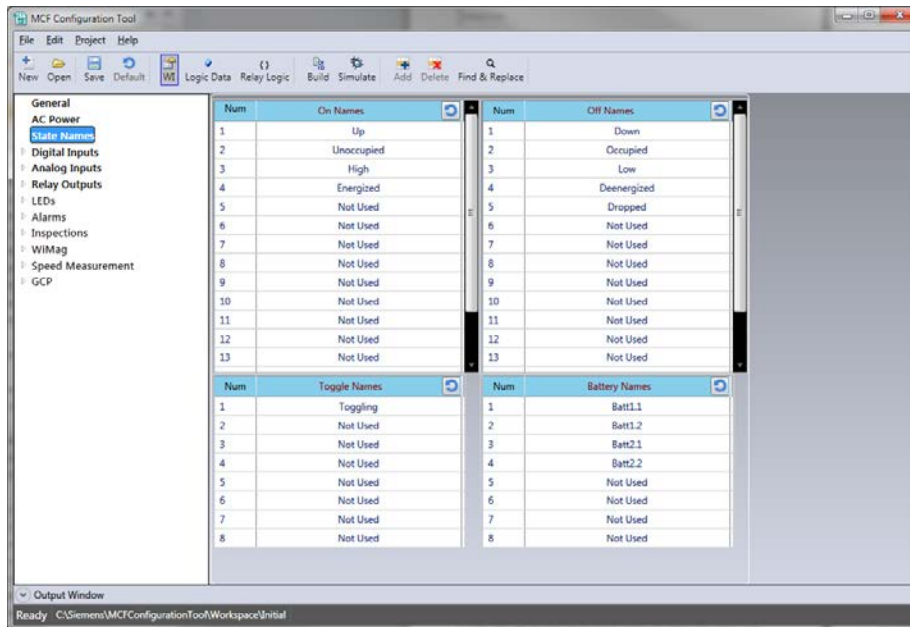


Figure 6-3: The State Names Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	NA
Parameter Configuration	Table 4-13
Parameter Logic State	NA

6.4 THE DIGITAL INPUT SCREEN

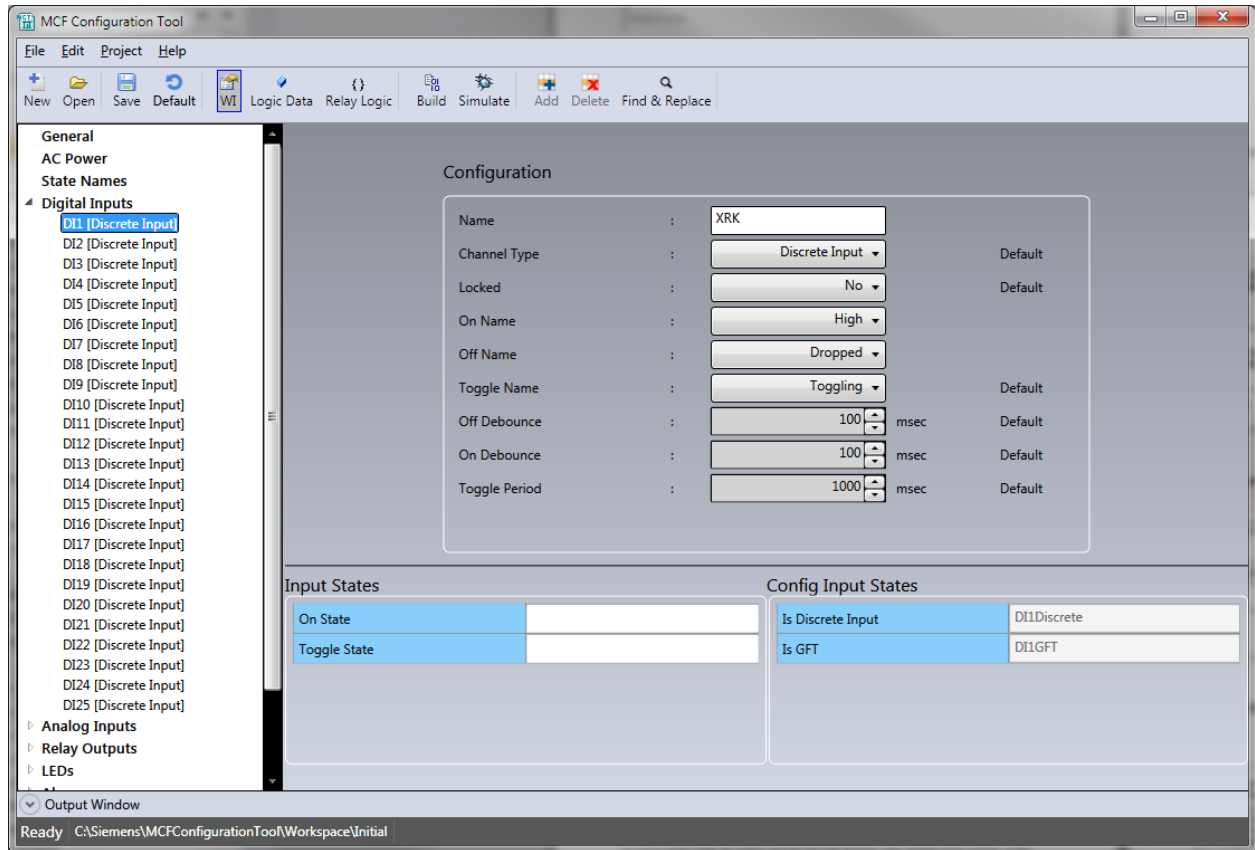


Figure 6-4: The Digital Input Screen

For further information regarding the configuration parameters covered in this screen, refer to Table 4-4.

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.4
Parameter Configuration	Table 4-4
Parameter Logic State	Table 5-3

6.5 THE ANALOG INPUT SCREEN (BATTERY INPUT)

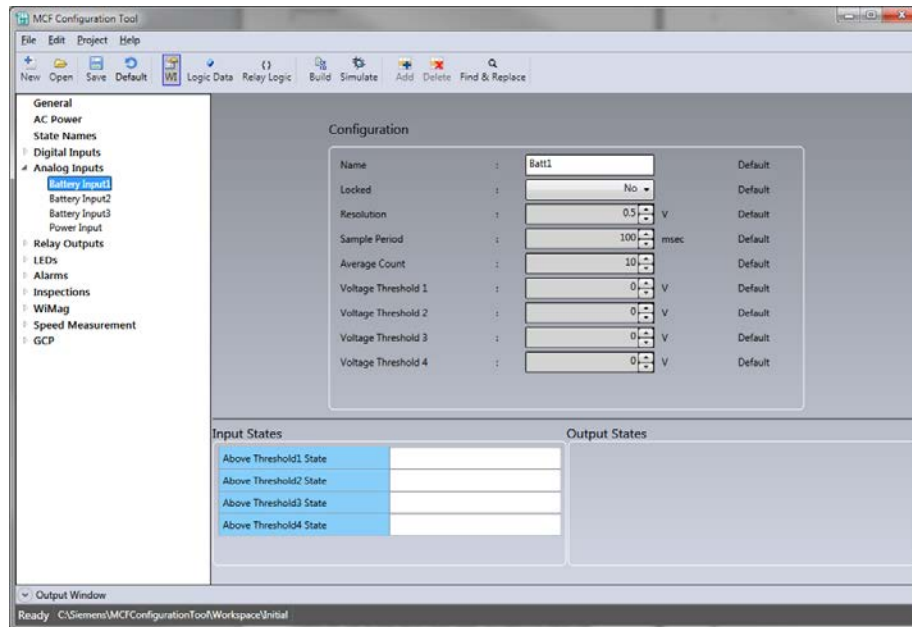


Figure 6-5: The Analog Input Screen (Battery Input)

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.5
Parameter Configuration	Table 4-5
Parameter Logic State	Table 5-4

6.6 THE ANALOG INPUT SCREEN (POWER)

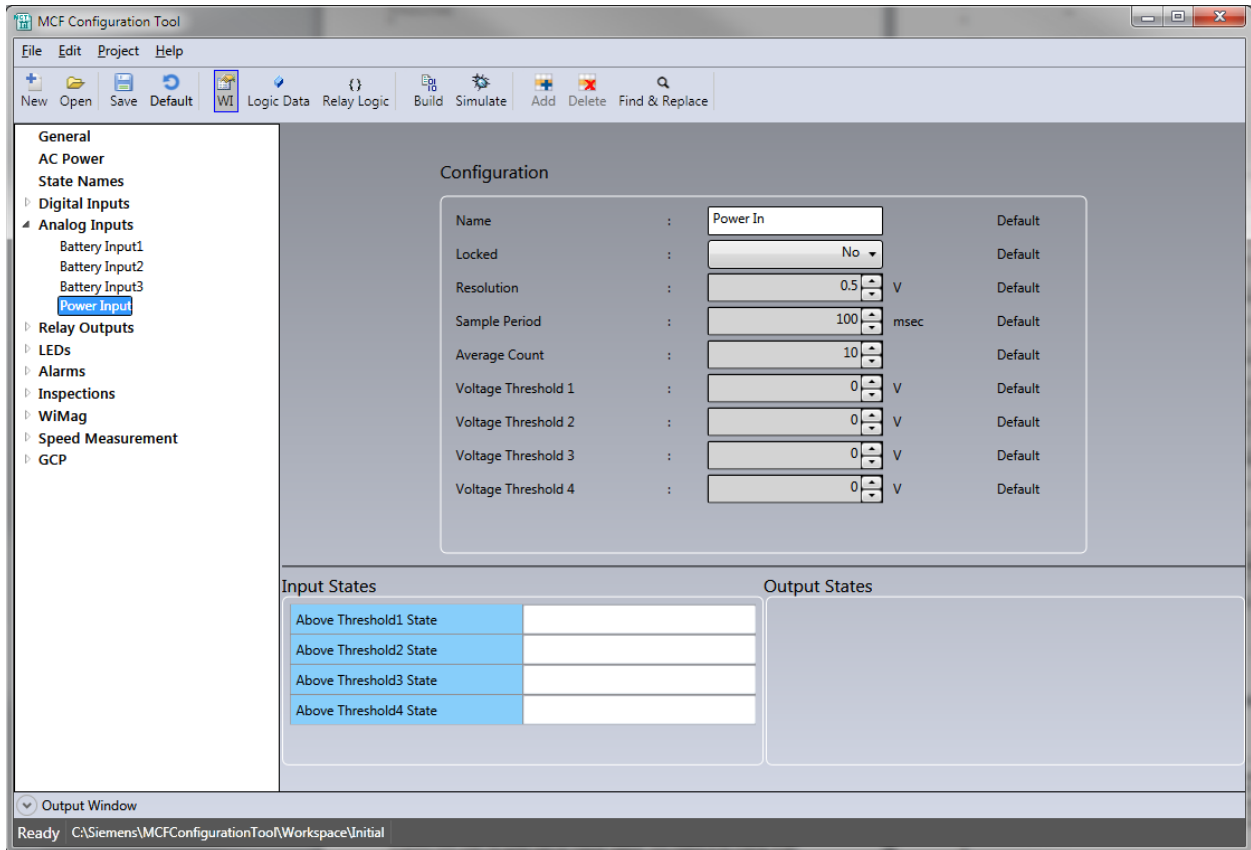


Figure 6-6: The Analog Input Screen (Power Input)

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.7
Parameter Configuration	Table 4-5
Parameter Logic State	Table 5-4

6.7 THE RELAY OUTPUT SCREEN

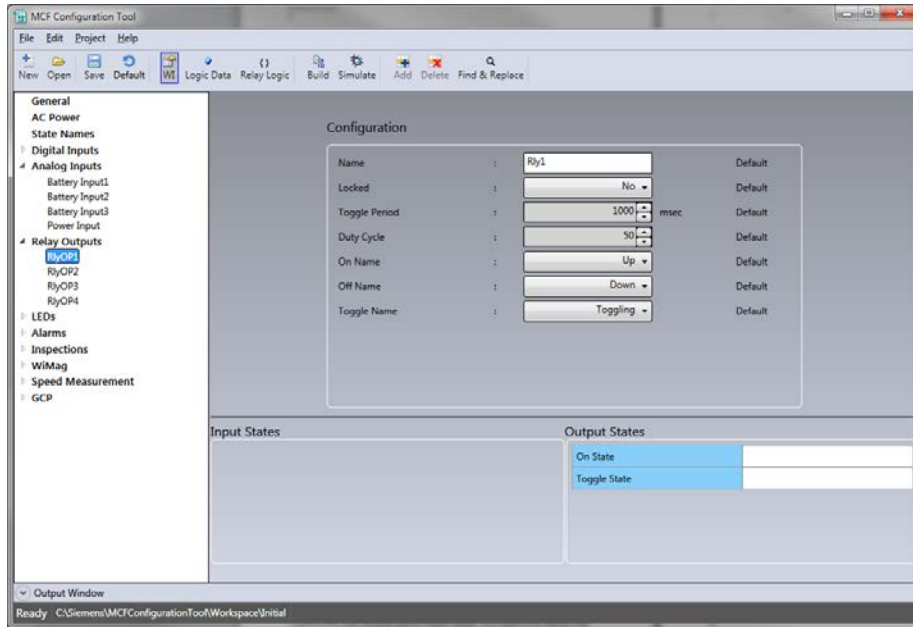


Figure 6-7: The Relay Output Screen

For further information regarding the parameters covered in this screen, refer to Table 4-6.

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.6
Parameter Configuration	Table 4-6
Parameter Logic State	Table 5-5

6.8 THE LEDS SCREEN

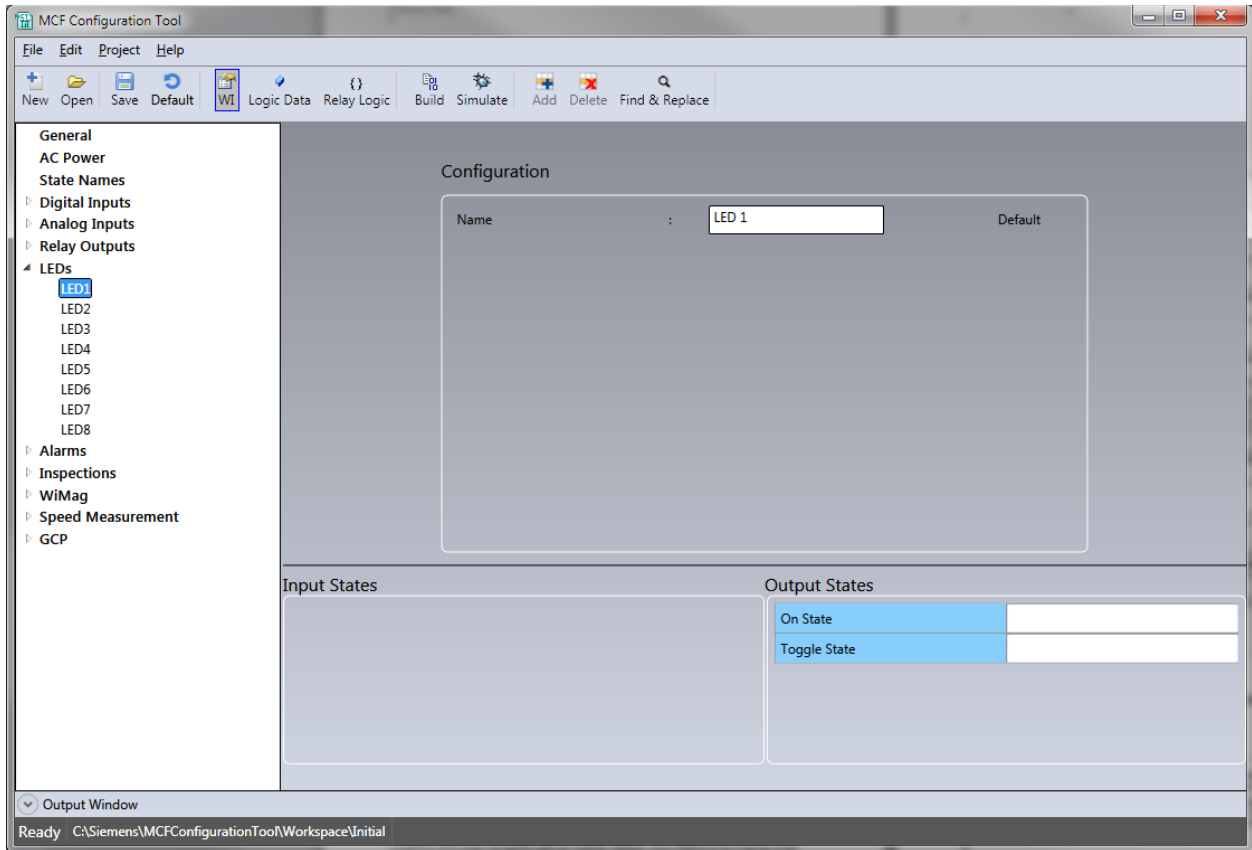


Figure 6-8: The LEDs Screen

For further information regarding the parameters covered in this screen, refer to Table 4-21.

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3-8
Parameter Configuration	NA
Parameter Logic State	Table 5-6

6.9 THE ALARM SCREEN

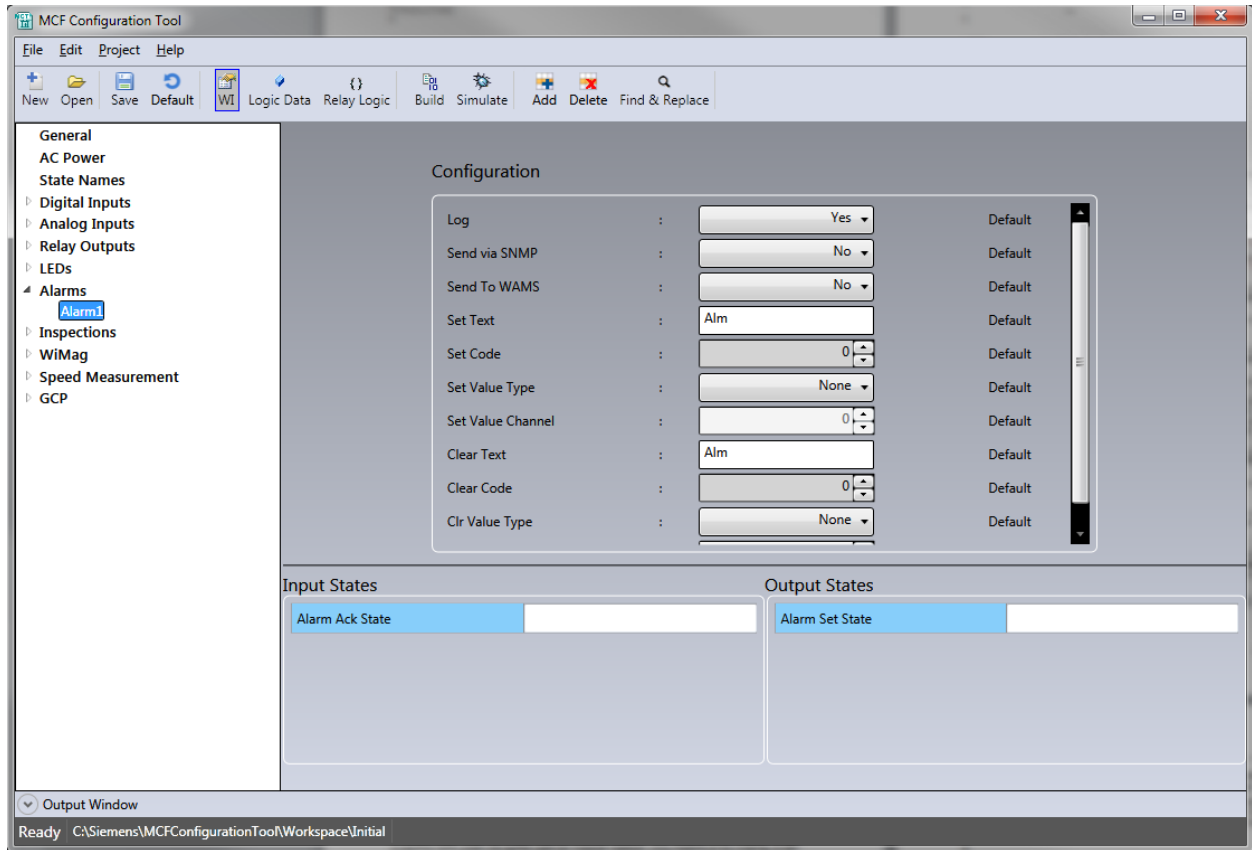


Figure 6-9: The Alarm Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.9
Parameter Configuration	Table 4-22
Parameter Logic State	Table 5-7

6.10 THE INSPECTION SCREEN

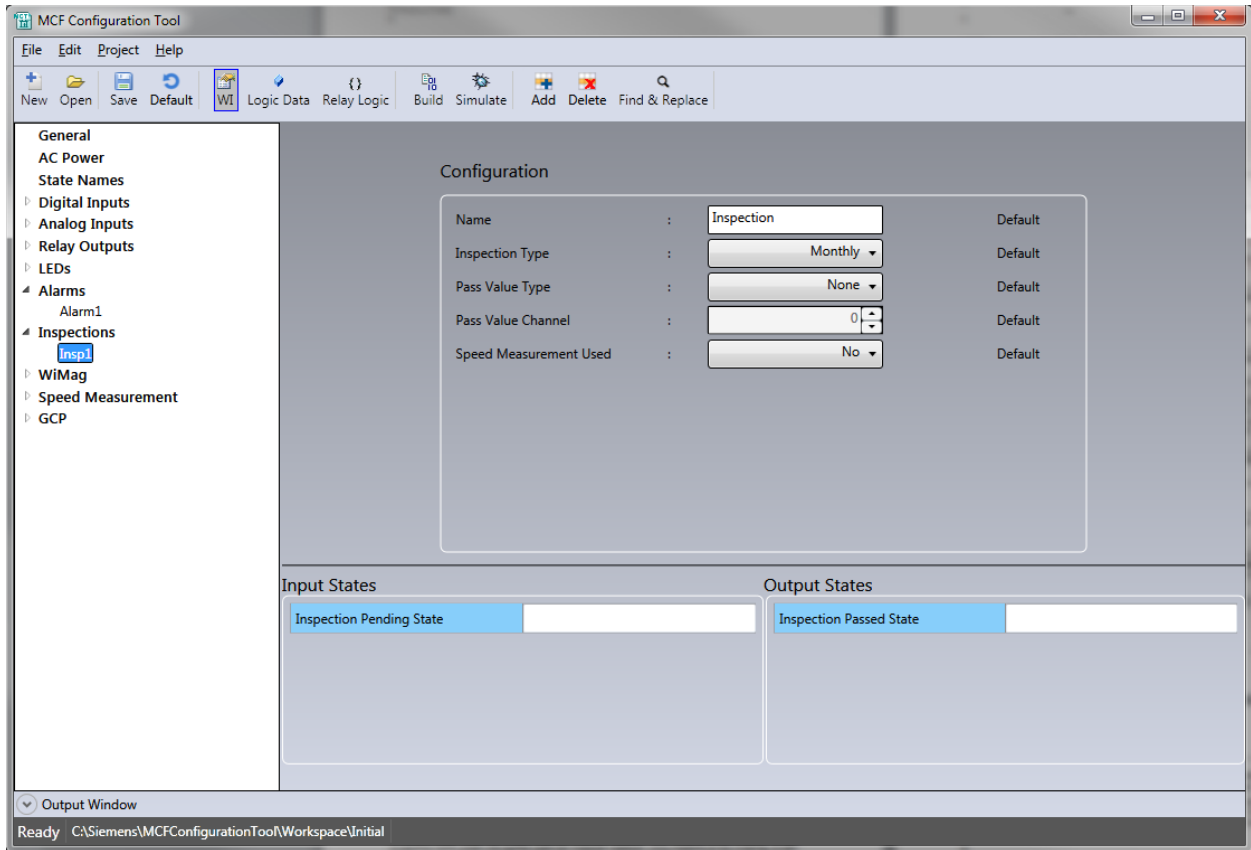


Figure 6-10: The Inspection Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.10
Parameter Configuration	Table 4-23
Parameter Logic State	Table 5-8

6.11 THE WIMAG SCREEN

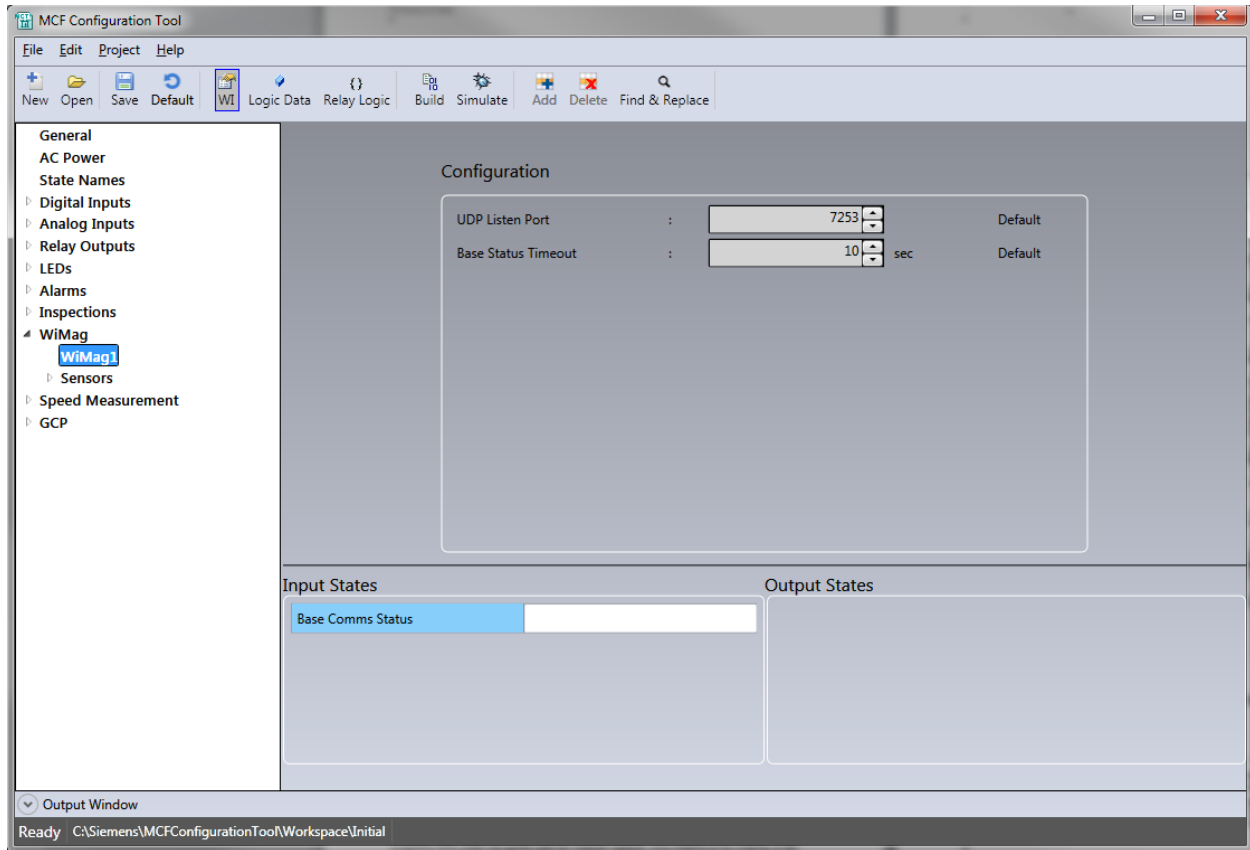


Figure 6-11: The WiMag Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.14
Parameter Configuration	Table 4-8
Parameter Logic State	Table 5-9

6.12 THE WIMAG SENSORS SCREEN

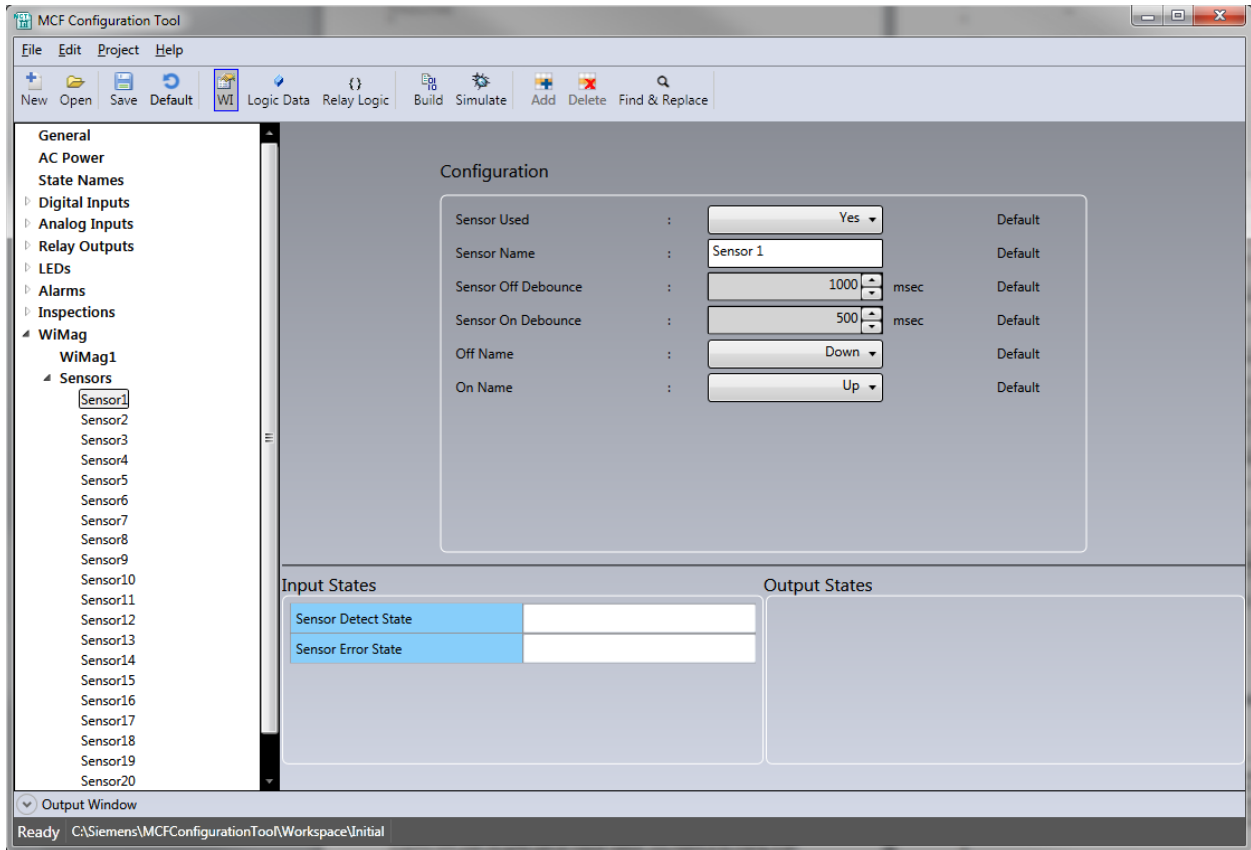
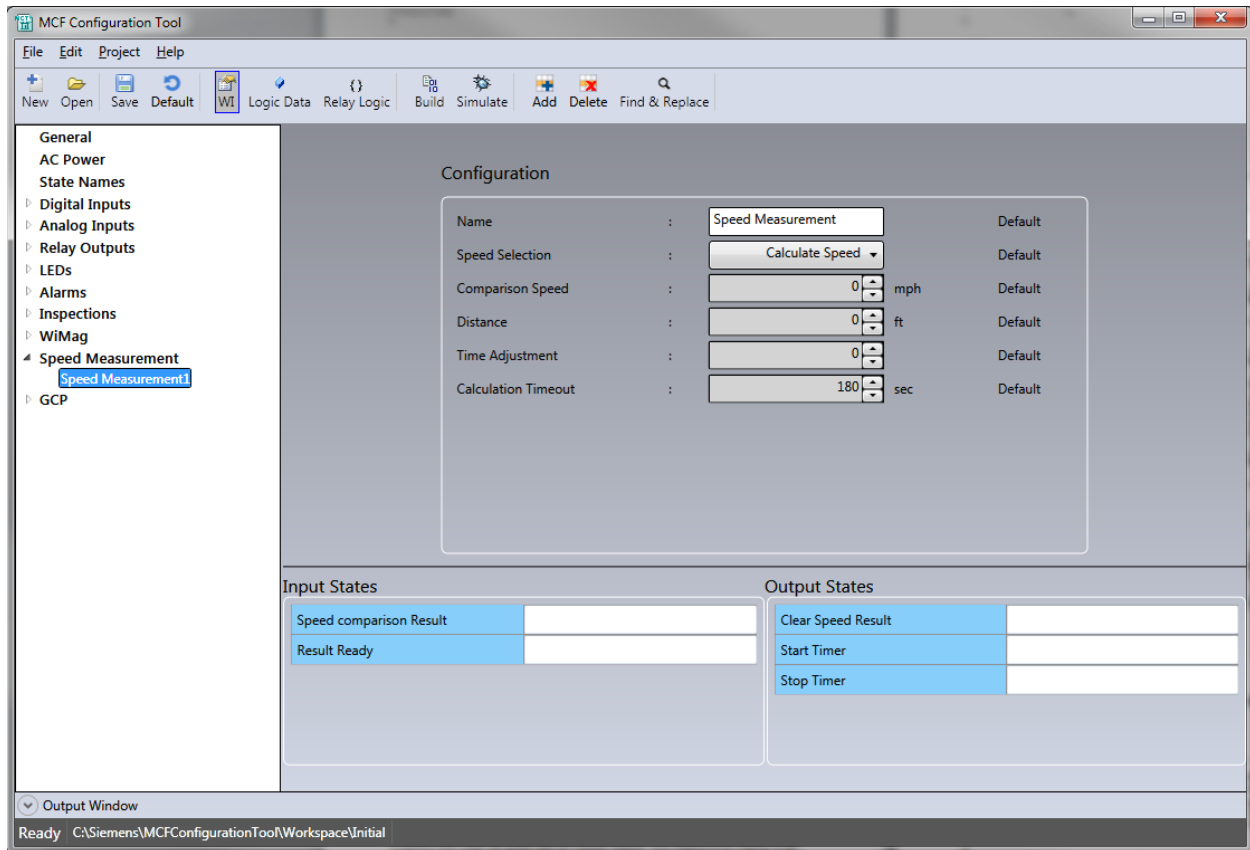


Figure 6-12: The WiMag Sensor Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.14
Parameter Configuration	Table 4-9
Parameter Logic State	Table 5-9

6.13 THE SPEED MEASUREMENT SCREEN



For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.18
Parameter Configuration	Table 4-7
Parameter Logic State	Table 5-10

6.14 THE GCP GENERAL SCREEN

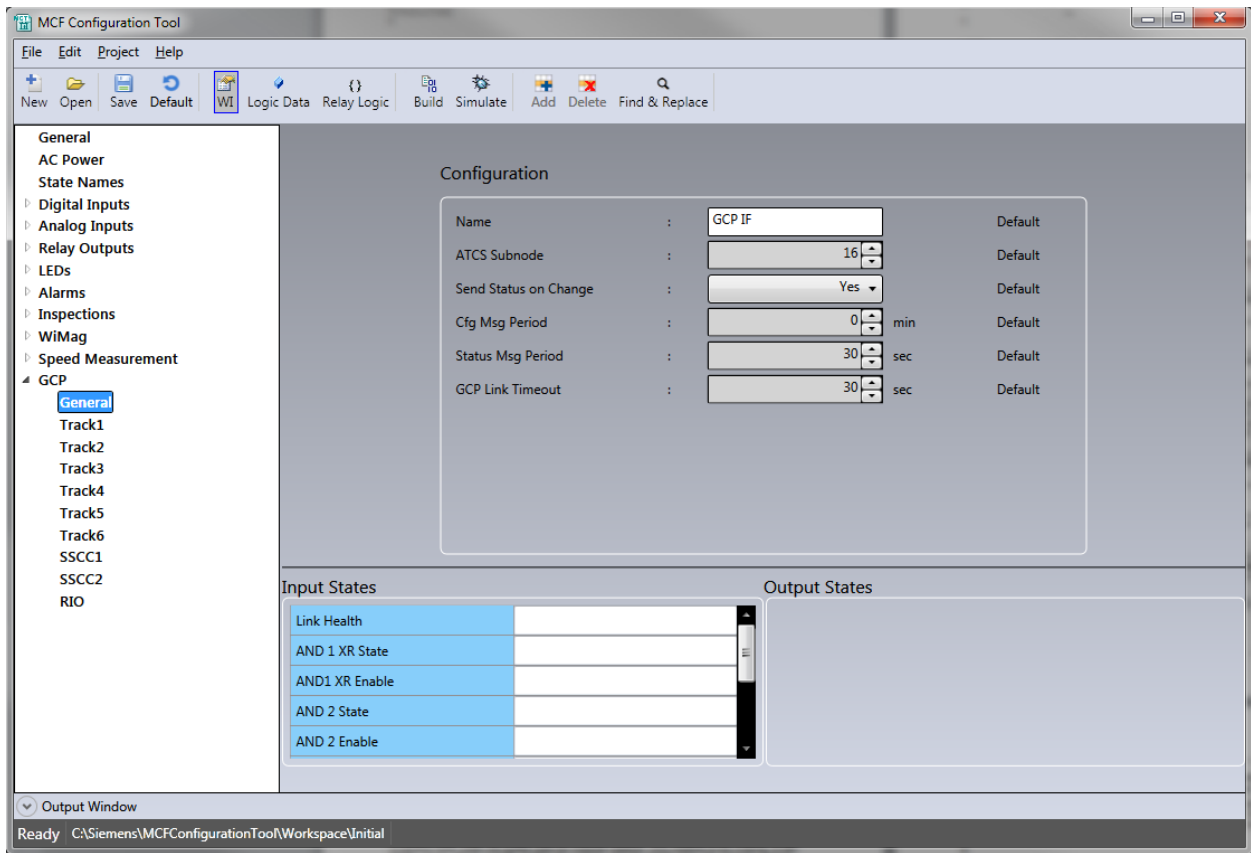
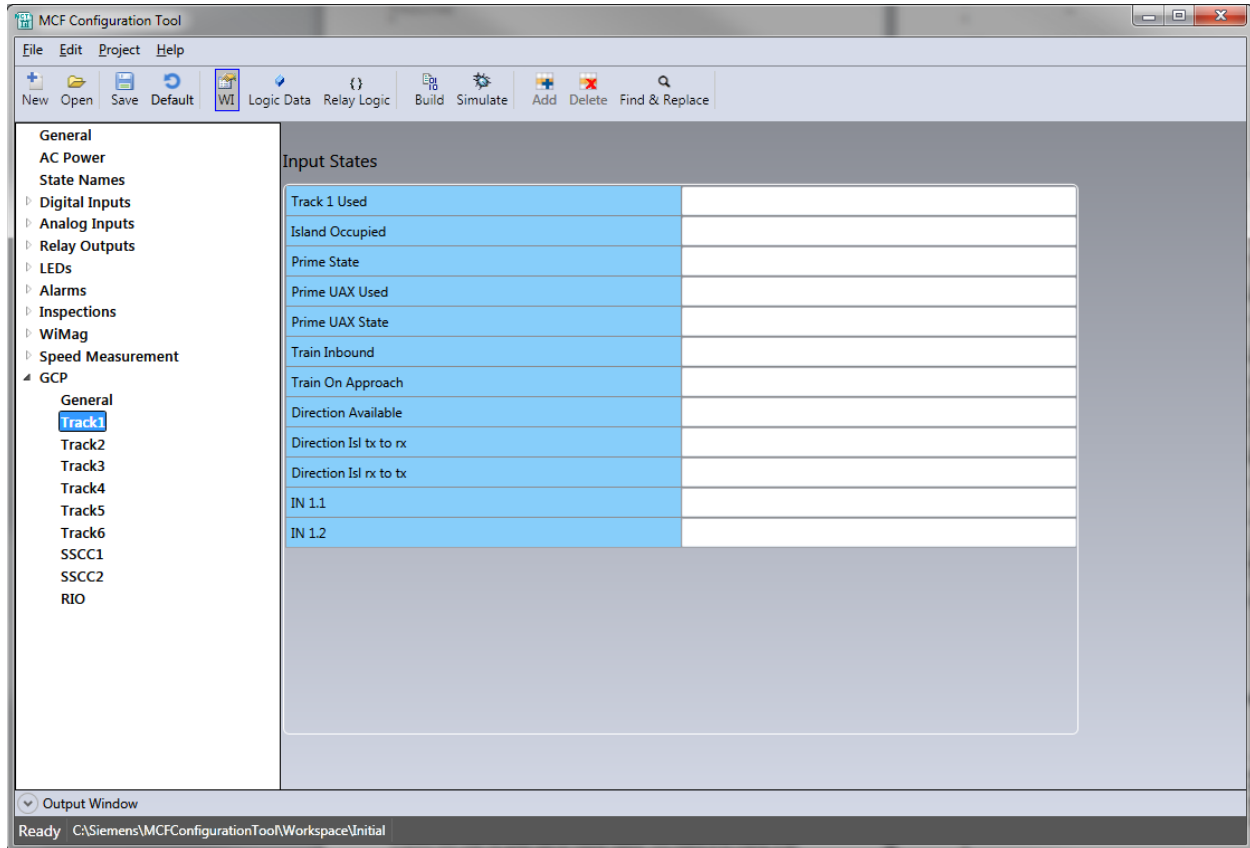


Figure 6-13: The GCP General Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.17
Parameter Configuration	Table 4-10
Parameter Logic State	Table 5-11

6.15 THE GCP TRACK 1 – 6 SCREEN



For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.17
Parameter Configuration	NA
Parameter Logic State	Table 5-12

6.16 THE GCP SSCC 1 – 2 SCREEN

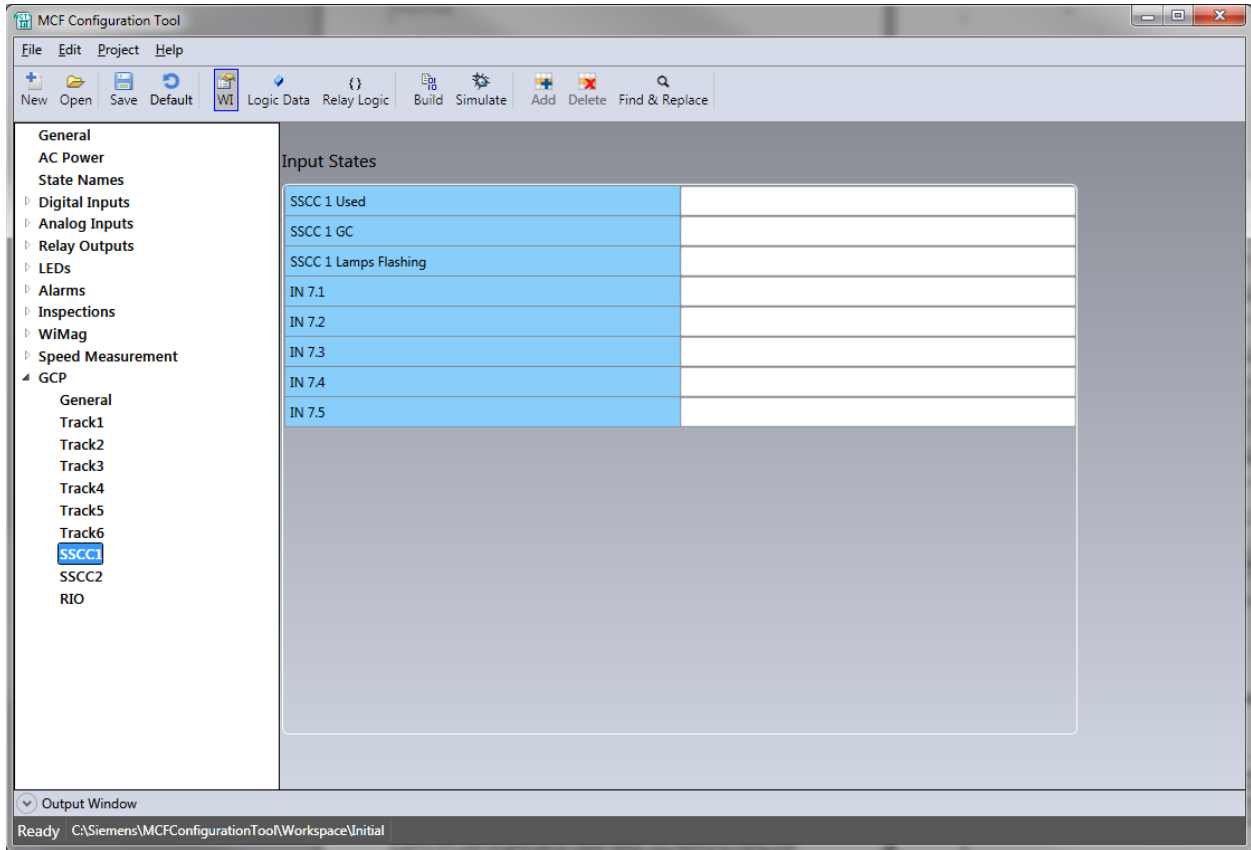


Figure 6-14: The GCP SSCC 1 – 2 Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.17
Parameter Configuration	NA
Parameter Logic State	Table 5-13

6.17 THE GCP RIO SCREEN

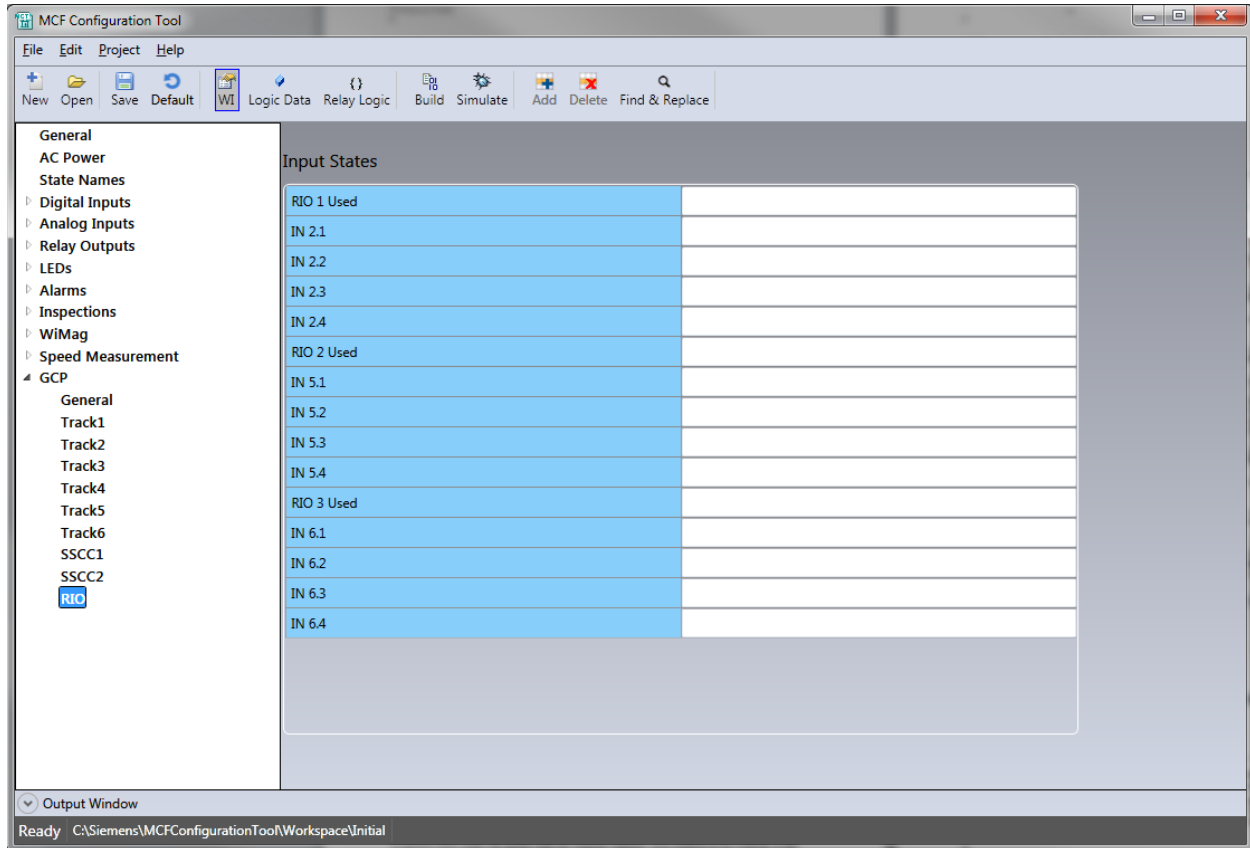


Figure 6-15: The GCP RIO Screen

For further information regarding the parameters covered in this screen, refer to.

Parameter Definition	Section 3.17
Parameter Configuration	NA
Parameter Logic State	Table 5-14

6.18 THE LOGIC DATA SCREEN

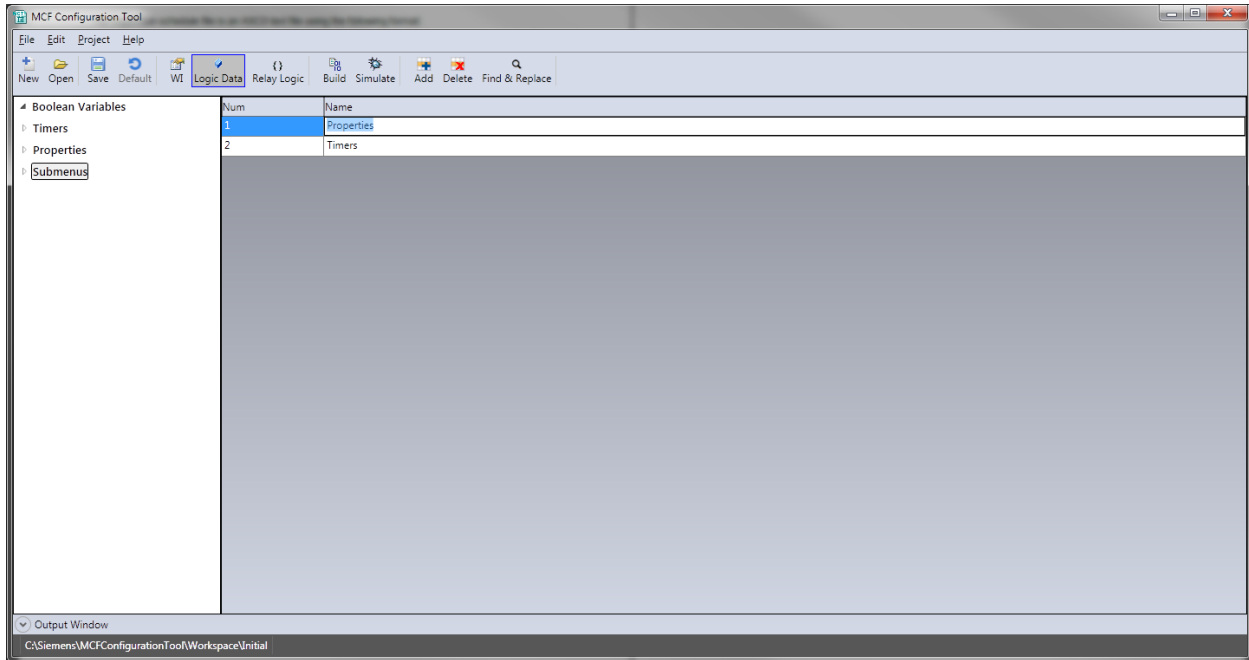


Figure 6-16: The Logic Data Screen

6.18.1 The Logic Data Editor

The Logic Data Editor shall be used to add:

- Boolean variable
- Field configurable timers and
- Field configurable properties

The user shall click on the 'Logic Data' toolbar button to open the Logic Data Editor

6.18.1.1 Boolean Variable

The user can add new internal logic states by selecting 'Boolean Variable' on the right side menu and clicking on the 'Add' button. The user shall enter:

- Name
- Initial value (default is false) and
- comment

The user shall click on the 'Save' toolbar button to save the Boolean variable information.

6.18.1.2 Timers

The user can add field configurable timers by selecting 'Timers' on the right side menu and then press the 'Add' toolbar button. The user shall specify for each timer:

- Name
- Timer Start Logic State Name
- Timer Expired Logic State Name
- Duration
- Unit

- Minimum allowed value
- Maximum allowed value
- Submenu
- Comment

The 'Timer Start Logic State Name' and 'Timer Expired Logic State Name' will be used to reference the state of the Start or end logic state of the timer in the application logic equations.

6.18.1.3 Properties

The field configurable properties can be used to tailor an application that can be used in multiple sites to a specific location. The user can enter:

- Property Name
- Initial Value
- Submenu
- Description and
- Comments

The property name will be used to reference the state of the property in the application logic.

The submenu specifies the menu option/page where the property can be configured in the WebUI.

The user can add field configurable properties by selecting 'Properties' on the right side menu and the pressing the 'Add' toolbar button.

6.18.1.4 Submenu

The submenu option shall be used to create the timer and properties menus that appear in the WebUI.

To add a submenu select 'Submenu' on the right side menu and then press the 'Add' toolbar button.

6.19 THE RELAY LOGIC SCREEN

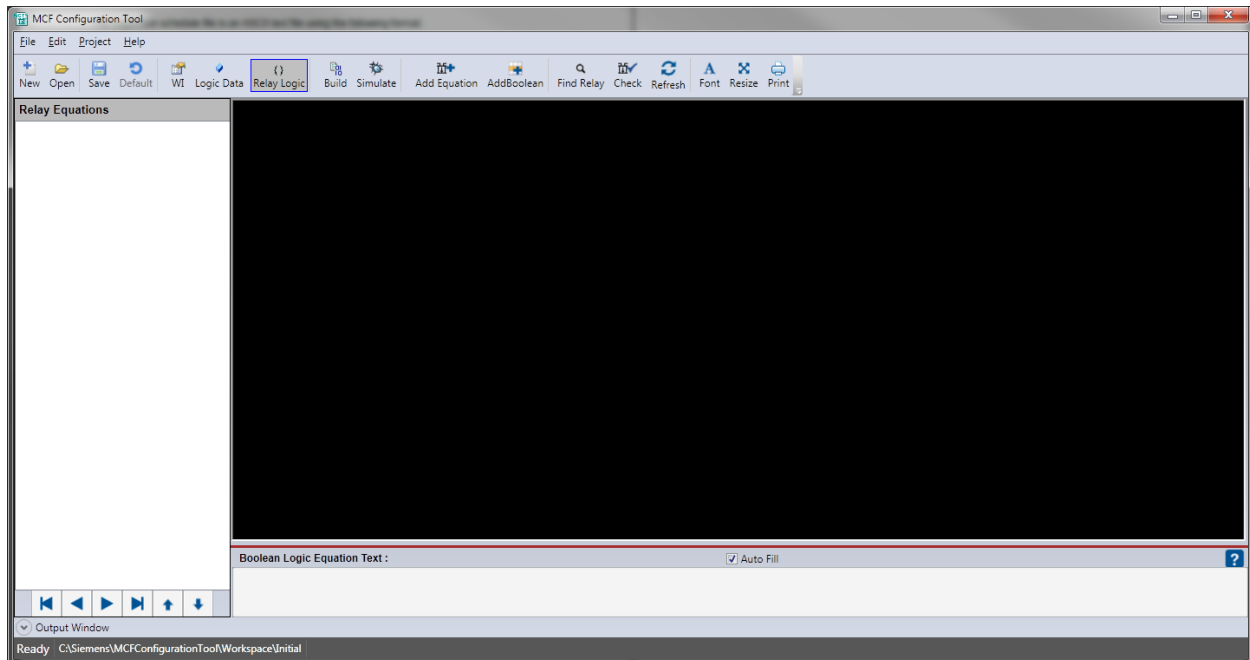


Figure 6-17: The Relay Logic Screen

6.20 THE RELAY LOGIC EDITOR

The Relay Logic Editor is being used to write the application logic. The Relay Logic Editor consist in three parts:

- The left side 'Relay Equation' list view
- The 'Logic Equation Text' box on the bottom and
- The 'Relay Logic View' in the center black area

6.20.1 The Relay Equation List View

The 'Relay Equation' list view is used to navigate through the equation and/or to change the order of the equations.

6.20.2 The Logic Equation Text Box

The 'Logic Equation Text' box is used to enter new equations or modify existing equations.

6.20.3 The Relay Logic View

The 'Relay Logic View' displays a relay logic representation of the text equation. To open the Relay Logic Editor, press the 'Relay Logic' toolbar button.

6.20.4 Adding Equations

To add equations to a project, press the 'Add Equation' toolbar button' and type the equation in Boolean format in the text box. Press the 'Save' button to save the logic equation. After saving the logic equation,

the relay logic version of the equation appears in the relay logic area of the editor and the name of the equation appears on the left side menu.

Following logic operators can be used in the equations:

- Boolean AND: '*'
- Boolean OR: '+'
- Boolean NOT: '~'
- Assignment: '='
- End of Equation: ','

A shortcut menu popup when the user right click an equation on the 'Relay Equation' list view:

- View
- Insert Before
- Insert After
- Delete
- Move Up
- Move Down
- Cut
- Paste

The 'View' option displays the selected equation in the relay and text views.

The 'Insert Before' option add a new equations and after saving the equation, it appears above the selected equation in the relay equation list view.

- The 'Insert After' option add a new equation and after saving the equation, it appears below the selected equation in the relay equation list view.
- The 'Delete' option remove the selected equation from the application logic.
- The 'Move Up' option moves up the selected equation in the Relay Equation list view.
- The 'Move Down' option moves down the selected equation in the Relay Equation list view.
- The 'Cut' option cut the selected equation from the Relay Equation list view.
- The 'Paste' option paste the previously cut equation into the selected position in the Equation list view.

Equations can be cut and pasted from another source using the standard Ctrl-c and Ctrl-v

Once the project has too many equations, the user can use the 'Find Relay' option to find where logic state are used. To find equations, the user enter an string in the 'Find what' text box and then press 'Find'; the MCT will list then the equations that contains the string. Double clicking an equation in the list box will display the equation in the editor.

- The 'Check' option is used to check that equations are well formed and logic states exist.
- The 'Font' option is used to change font, style and size of the font used in the Relay Logic View.
- The 'Resize' option is used to zoom in and zoom out the Relay Logic View.

CHAPTER 7 – INSPECTION SCHEDULE TEXT FILE FORMAT REFERENCE

The Inspection schedule file is an ASCII text file using the following format:

```
# Lines starting with a pound (#) sign are ignored and can be used for
comments
# Inspection schedule xxx; version 1.0; June 3, 2015
Q 01-JAN-2015 00:00

A 03-APR-2016 23:30 Text following the schedule date and time is
ignored

M 07-MAY-2015 08:45
M 07-JUN-2015 08:45
M 07-JUL-2015 08:45
M 07-AUG-2015 08:45
M 07-SEP-2015 08:45
```

The file format has the following attributes:

- File is in ASCII text
- Blank lines are ignored
- Lines starting with a '#' sign are ignored and can be used for comments
- A schedule entry starts with a single character, signifying the type of inspections for the following date and time: 'A' for annual inspections, 'Q' for quarterly inspections, and 'M' for monthly inspections.
- At least 1 whitespace is required between the data fields in each schedule entry. A whitespace is defined as a space or tab character. Multiple whitespace is allowed.
- Text following the date and time is ignored. At least one whitespace character must follow the time.
- The schedule entries are not required to be in chronological order
- The date must use the following format DD-MMM-YYYY and use all characters where DD is the day number (01-31), MMM is the month (JAN, FEB, MAR, ...), and YYYY is the year (e.g. 2016).
- The time must use the following format hh:mm and use all characters where hh is the hour in 24-hour format (00-23), and mm is the minute (00-59).

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