SIEMENS

APPLICATION GUIDELINES

MCF CONFIGURATION TOOL

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The equipment covered in this manual has been tested and found to comply with the limits for Class A digital devices, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	09/22/2016		Initial release
A.1	04/01/2021	3 and 6	Updated for clarity of content. Added details for new product interfaces and features, which include: • MTSS • iLOD • WAG • GCP 3000+ • Digitalization and diagnostic data reporting

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NOTES, CAUTIONS, AND WARNINGS

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

⚠ WARNING	**WARNING** **INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.**
⚠ CAUTION	**CAUTION** REFERS TO PROPER PROCEDURES OR PRACTICES WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.
NOTE	**NOTE** Generally used to highlight certain information relating to the topic under discussion.

If there are any questions, contact Siemens Mobility, Inc. 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 Mobility, Inc. 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.
- 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.

GLOSSARY

TERM	DESCRIPTION
AAR	Association of American Railroads – An organization that establishes uniformity and standardization among different railroad systems.
AC	Alternating current
AREMA	American Railroad Equipment Manufacturing Association – An organization that supersedes AAR.
ATCS	Advanced Train Control System – A set of standards compiled by the AAR for controlling all aspects of train operation.
CFR	Code of Federal Regulations
DHCP	Dynamic Host Configuration Protocol
ECD	External Configuration Device – A serial EEPROM (Flash Memory) device mounted inside the chassis of the GEO unit. The ECD is used to store site-specific configuration data (MCF, SIN, UCN, and card parameters) for the CPU.
EX Value	the phase of the received signal, which is the measure of the impedance of the track ballast. This measurement identifies how much current is leaking from one rail to another.
EZ Value	the measure of the received signal level.
GCP	Grade Crossing Predictor
GFT	Ground Fault Tester
I/O	Input/Output
IP	Internet Protocol
IPv4	Internet Protocol version 4
MEF	Module Executable File – The executive software running in the CPU or I/O Modules. The user can download the MEF through the Diag port to update the software.
MCF	Module Configuration File – The GCP application logic file.
MCT	MCF Configuration Tool

TERM	DESCRIPTION
SIN	Site Identification Number – The 12-digit ATCS address for the SIN has the form 7.RRR.LLL.GGG.SS stored in binary coded decimal, with each digit in one nibble. The digit 0 is represented by “A” and 0 is used as a null byte.
Site Location	the location where GCP unit is installed.
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UI	User Interface
VPI	Vital Parallel Input – A module input circuit the function of which affects the safety of train operation.
VRO	Vital Relay Output – A module output circuit the function of which affects the safety of train operation.
Web UI	Web-browser User Interface
WI	Wayside Inspector
WiMag	Wireless Magnetometer

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CHAPTER 1 – INTRODUCTION

1.1 PURPOSE

This manual provides the information needed by application engineers to create Module Configuration Files (MCFs) for and to program the Wayside Inspector (WI) for use at crossings. This manual provides information to program the WI for 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 is useful to application engineering personnel intending to program the WI for 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 REFERENCE MATERIAL

Table 1-1 Reference Documents

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 (GCP 4000) Field Manual	SIG-00-08-10
	Model 4000 Grade Crossing Predictor Plus (Model 4000 GCP Plus) Field Manual	SIG-00-12-68
	Model 4000 Grade Crossing Predictor (GCP 4000) Application Guidelines	SIG-00-08-06
Model 5000 Grade Crossing Predictor	Model 5000 Grade Crossing Predictor (GCP 5000) Field Manual	SIG-00-13-03
	Model 5000 Grade Crossing Predictor (GCP 5000) Application Guidelines	SIG-00-13-04
Model 3000+ Grade Crossing Predictor	Model 3000+ Grade Crossing Predictor (GCP 3000+) Application Guidelines	SIG-00-17-04
	Model 3000+ Grade Crossing Predictor (GCP 3000+) Field Manual	SIG-00-18-01
	Model 3000+ Grade Crossing Predictor (GCP 3000+) Instruction and Installation	SIG-00-17-03
Electronic Bell	User Guide, A80301	SIG-00-04-09
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
Mini Trackside Sensor Package	User Guide. Part of SEAR II accessory group, includes MTSS (A80285, A80286-2), Gate Tip Sensor (A80281) and Electronic Bell (A80301)	SIG-00-03-05-001
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 Inspector	Wayside Inspector Installation and Instruction Manual	SIG 00-16-03
Wayside Inspector	MCF Configuration Tool Application Guidelines Manual	SIG 00-16-05
Wayside Inspector	Wayside Inspector Web Application User Manual	SIG-00-20-02

CHAPTER 2 – WAYSIDE INSPECTOR 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 WAYSDE INSPECTOR CANNOT BE USED TO PERFORM, EITHER DIRECTLY OR INDIRECTLY, ANY VITAL FUNCTIONS.

ENSURE THE WAYSIDE INSPECTOR IS INSTALLED PER MANUFACTURER'S INSTRUCTIONS, AND/OR ALL EQUIPMENT INTERCONNECTIONS ARE IN COMPLIANCE WITH RAILROAD PROCEDURES AND SPECIFICATIONS.

The Wayside Inspector (WI) system automates periodic inspections for crossings by monitoring the state of discrete I/O signals, battery voltages, and AC power at a crossing. From that information, the WI analyzes the operation of the crossing warning system and automatically performs periodic inspections of the crossing warning system. The WI can send alarms and automated inspection results to an office system using several possible communications methods. The inspections are performed by the WI by executing programmable logic contained in a Module Configuration File (MCF). Figure 2-1 shows the context of the WI installed at a crossing.

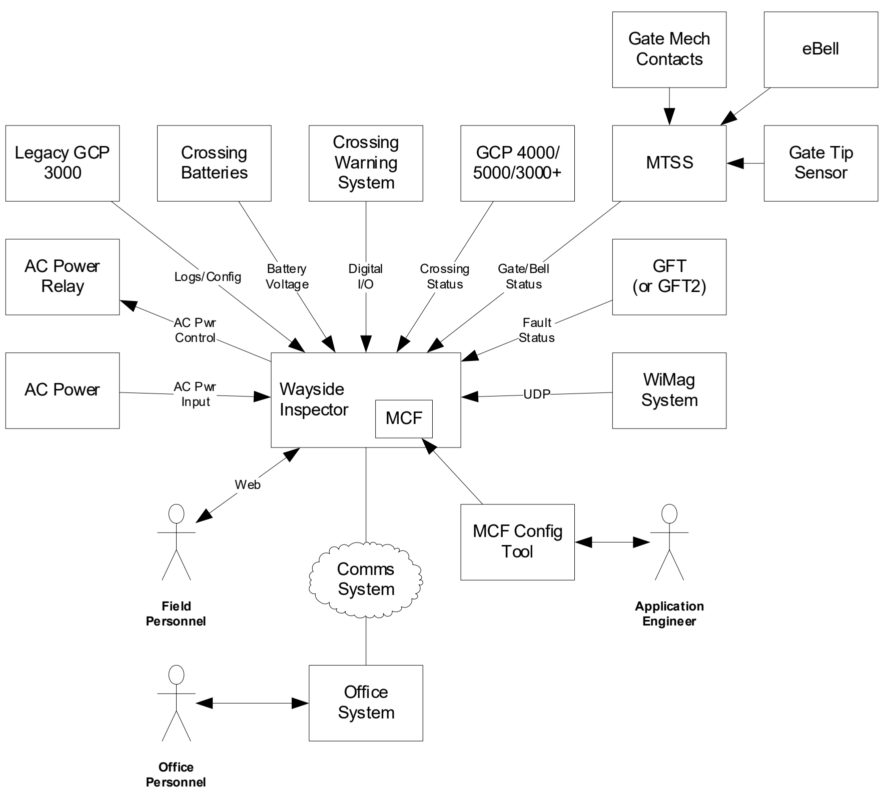


Figure 2-1 Context of WI Installed at Crossing

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 Gate Crossing Predictor (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 interact with the WI using a web browser user interface (WebUI). The WebUI allows field personnel to adjust system settings, view status, view inspection results, and download logs.

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).

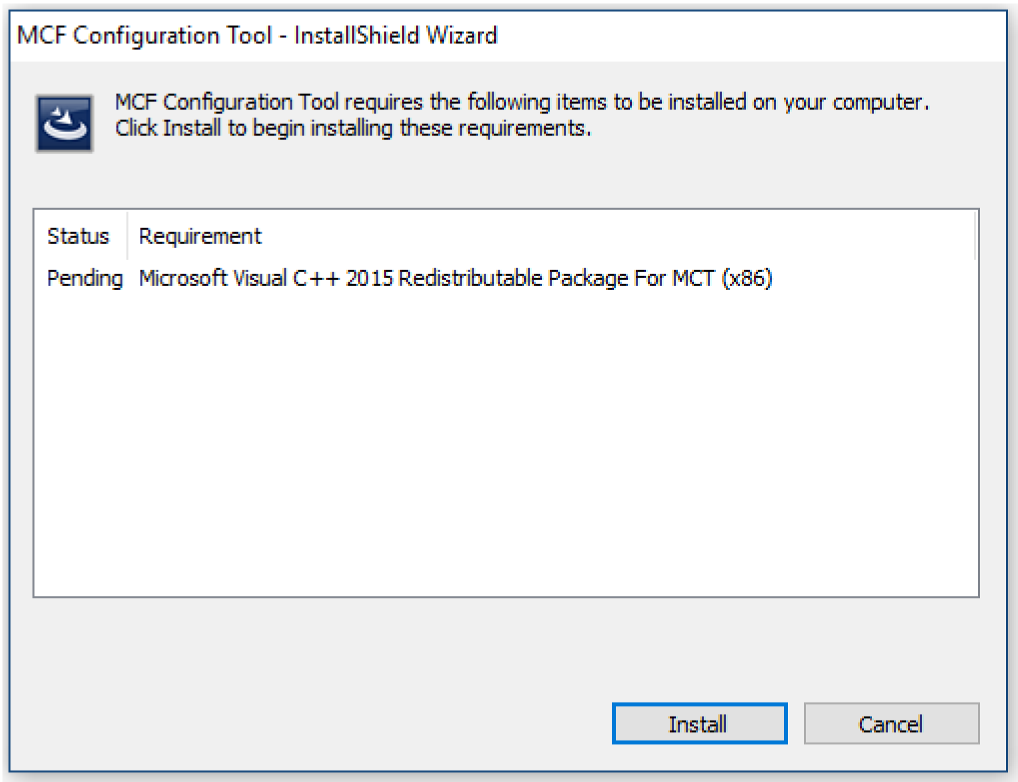
CHAPTER 3 – MCF CONFIGURATION TOOL

Application engineers use the MCF Configuration Tool to create the Module Configuration File (MCF). The MCF contains the site-specific logic and default settings for the location. The application engineer should be familiar with crossing warning systems to create effective MCF logic. The MCF logic defines the relationships between the various inputs, outputs, inspections, and alarms.

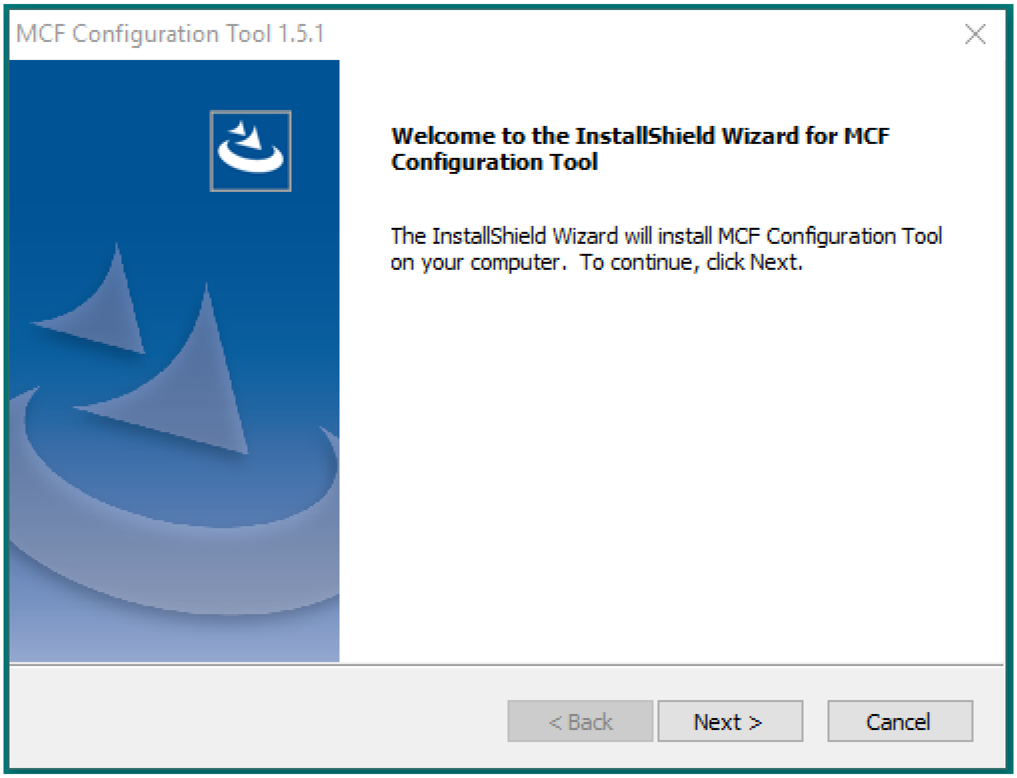
3.1 INSTALLING THE MCF CONFIGURATION TOOL

To install the MCF Configuration Tool:

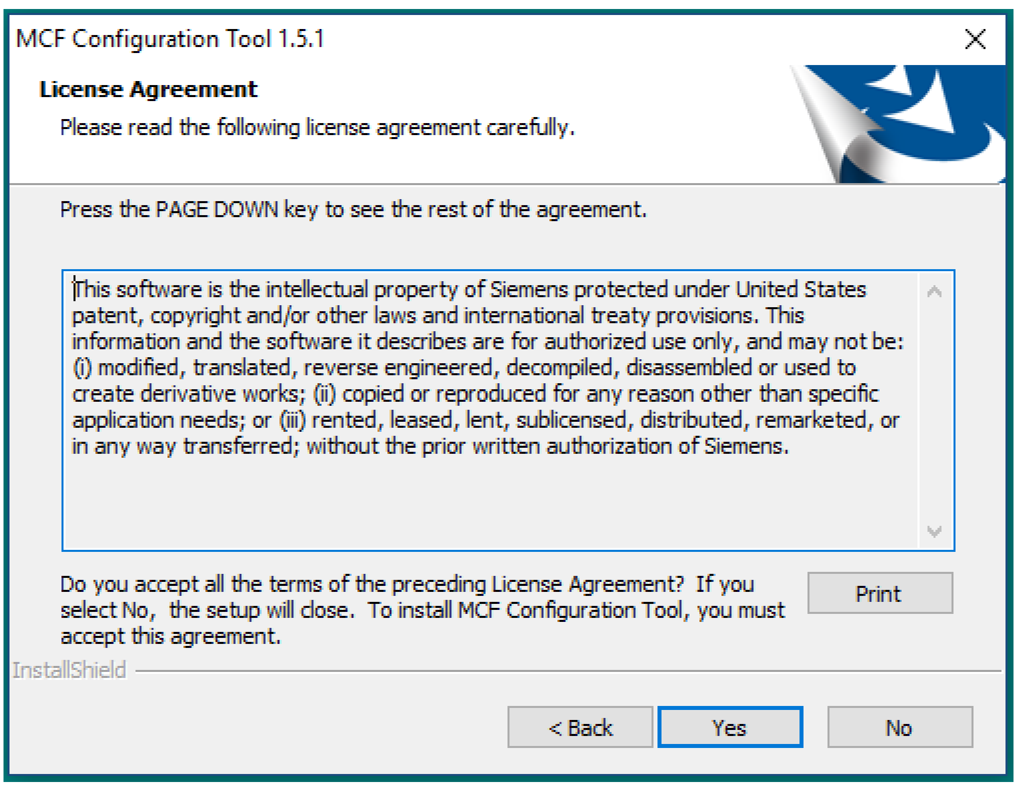
1. Locate the MCF Configuration Tool Software installation files.
2. Locate and double-click the setup.exe file. This file is located in the root folder: MCT.x.x.x where x.x.x is the version.
3. A dialog box will appear. Follow the instructions to install the software.
    a. Click on install if prompted to install the Microsoft Visual C++ Redistributable Package for the MCF Configuration Tool.



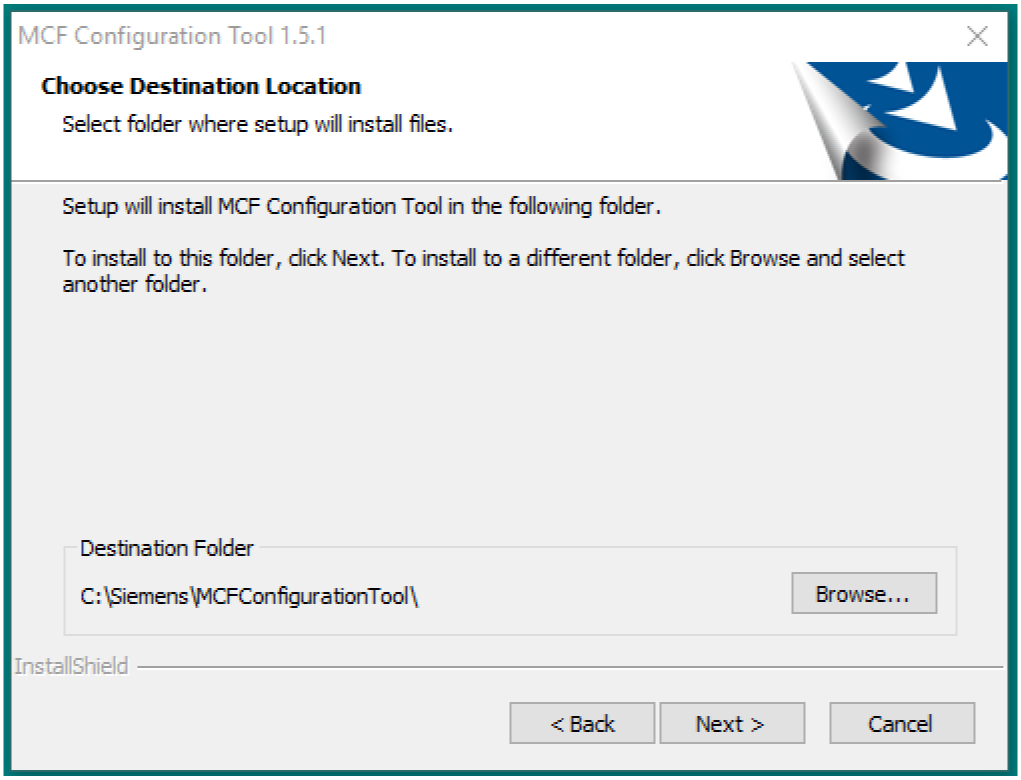
    b. Click on 'Next' when the InstallShield Wizard appears.



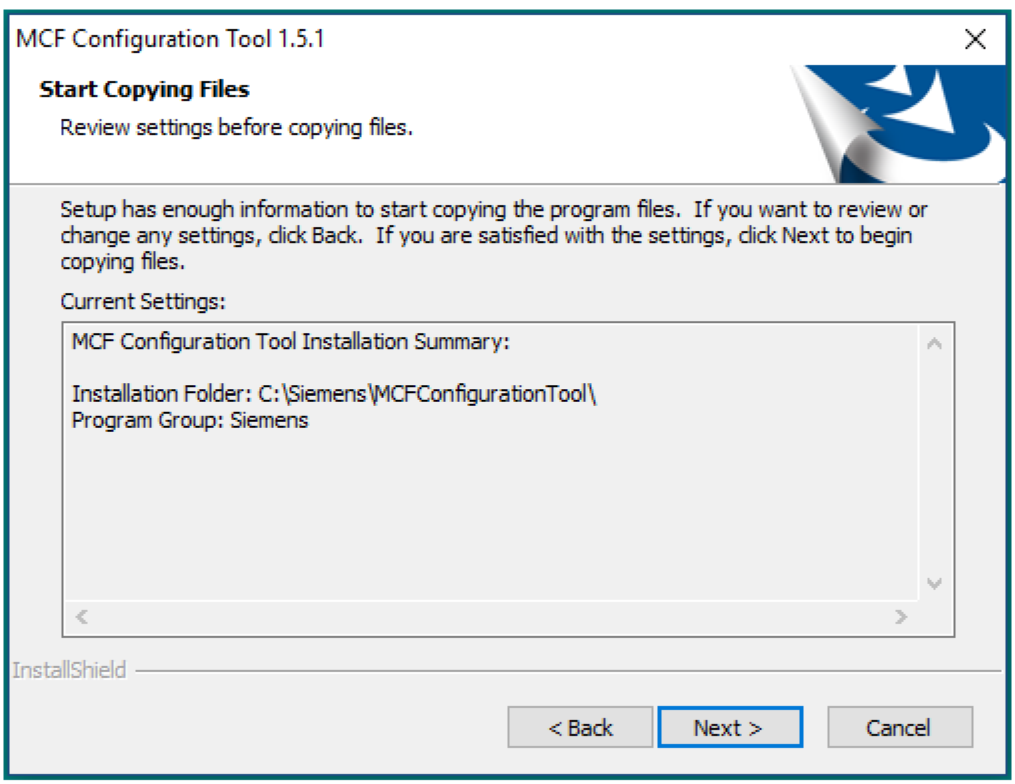
c. Accept all the terms of the License Agreement by selecting ‘Yes’.



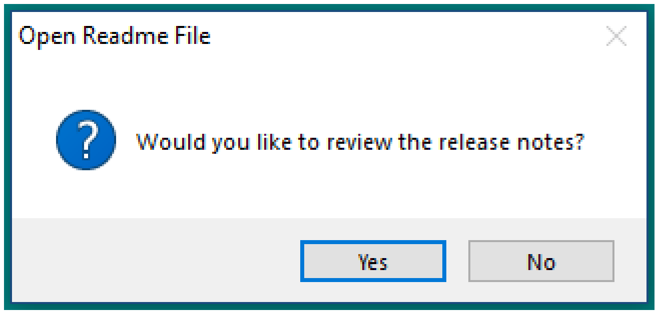
d. Choose the Destination Location or accept the default and then select next.



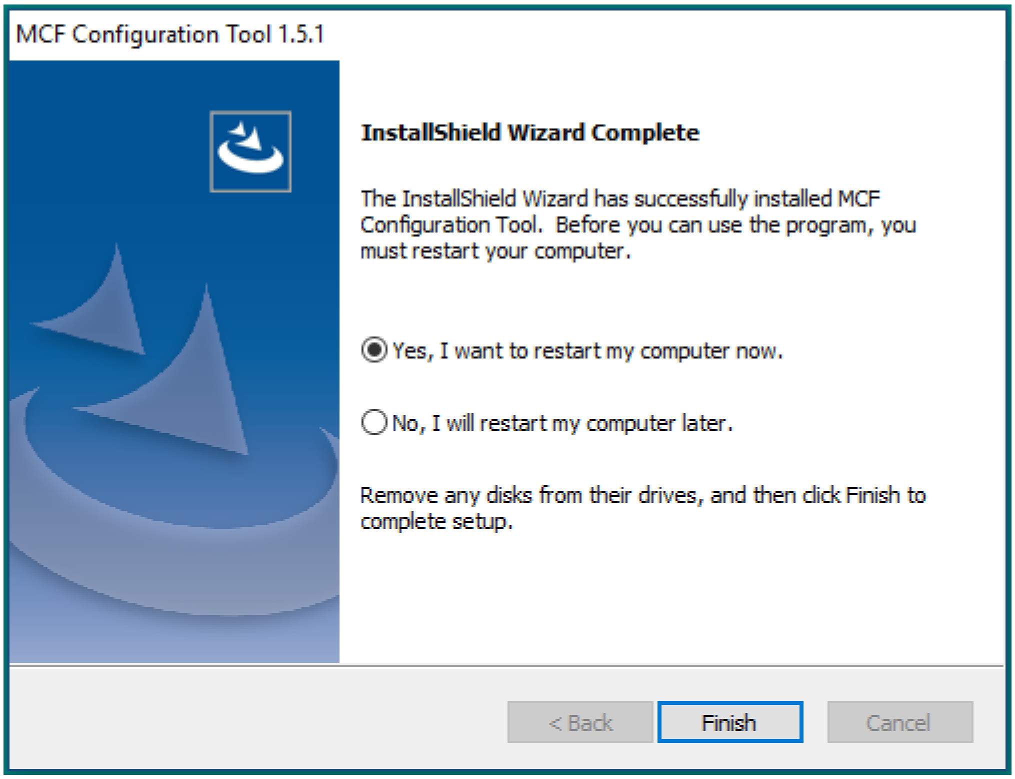
e. Review the selection and select ‘Next’ to start the installation.



f. Select 'Yes' to review the Readme File or select 'No'.



g. The InstallShield Wizard Complete dialog box will appear. Select Finish to complete the installation.

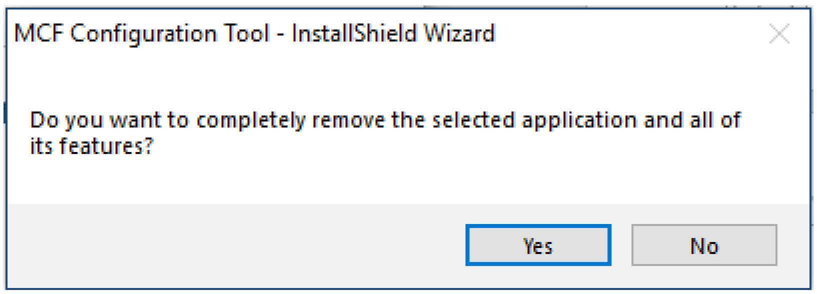


4. The user can now open the MCT from the start menu.

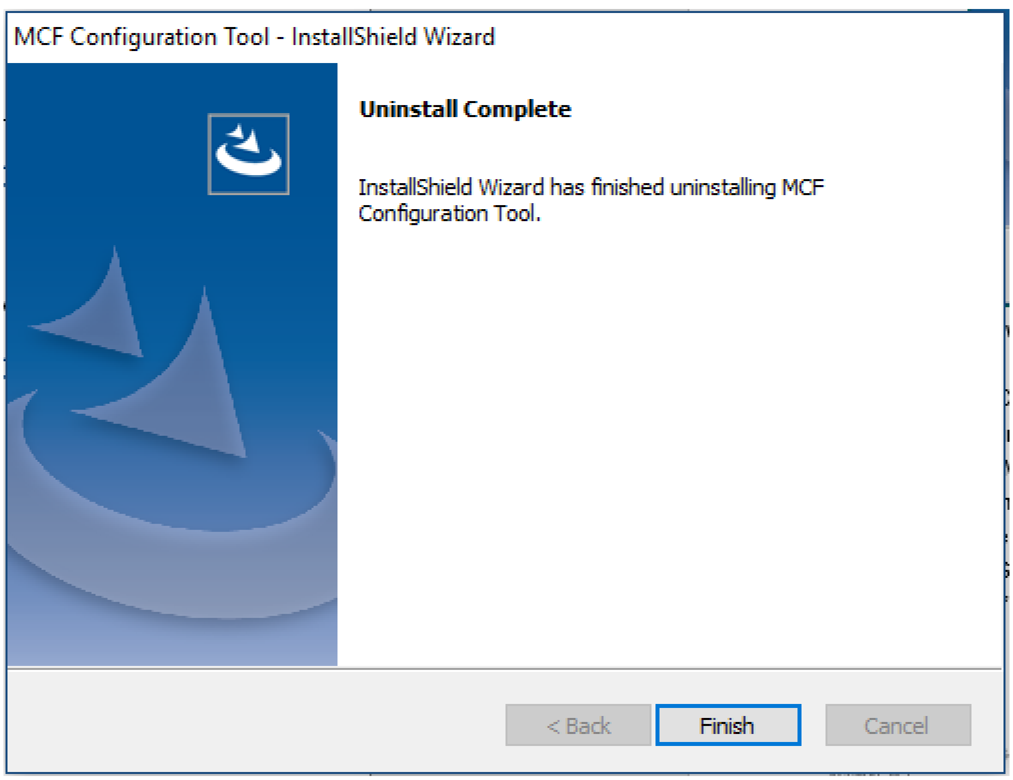
3.2 UNINSTALLING THE MCF CONFIGURATION TOOL

To uninstall the MCF Configuration Tool:

1. Select Settings/App & Feature from the start menu.
2. Search for MCF Configuration Tool.
3. Select 'Uninstall'
4. Confirm that you want to uninstall the software.
5. The InstallShield Wizard will appear.
6. Select 'Yes' to remove the MCF Configuration Tool from this computer.



7. Select 'Finish" when the 'Uninstall Complete' Wizard screen appears.



8. The MCF configuration Tool is now uninstalled from the computer.

3.3 CREATING A PROJECT, FILE LOCATIONS AND WORKSPACE

To create a new project, click the “New” button on the tool bar or select File > New from the menu.

When a new project is created, the dialog box shown in Figure 3-1 will appear.

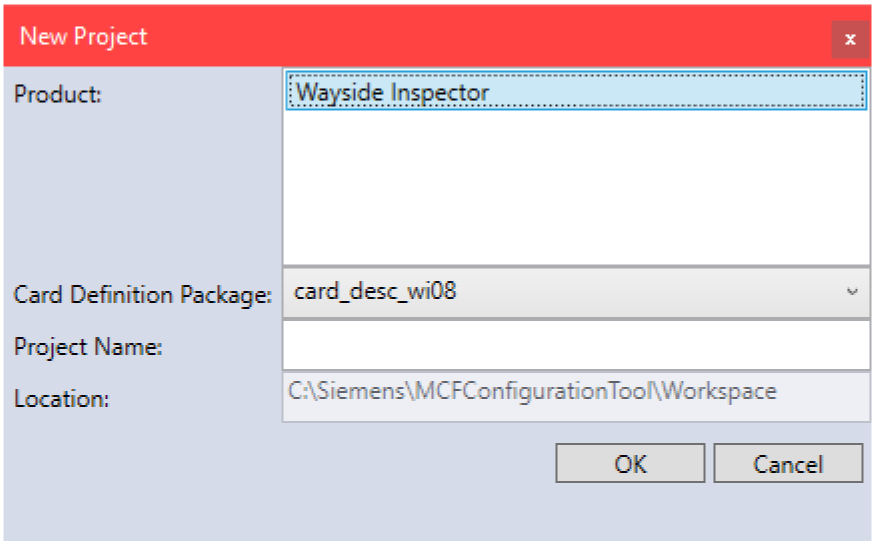


Figure 3-1 New Project Dialog Box

The WI is currently the only product supported by the MCF Configuration Tool.

For the Card Definition package, select the latest version for a new project. If the MCF is for older revisions of executive software in the WI, the user may need to select a different Card Definition Package. Refer to Table 3-1 to select the card definition that goes with the WI executive version.

Table 3-1 Card Definition Package Usage

WI Executive version	*Card Definition Package*
9VD17-A01E and older (nvWI_mef_1.5.2r.tgz)	card_desc_wi04.zip
9VD17-A01F and newer (nvWI_mef_1.6.20r.tgz)	card_desc_wi08.zip

Enter the name of the project. A folder with that project name is created at the location shown in “Location” listed in the dialog box. The location shows the path of the MCF Configuration Tool workspace location.

Once all the fields are set, click the OK button.

A folder is created at C:\Siemens\MCFConfigurationTool\workspace with several subfolders and files, as shown in Figure 3-2.

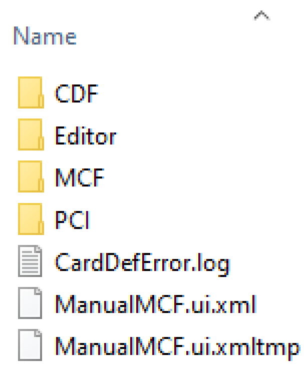


Figure 3-2   Subfolders and Files

The *.ui.xml file contains all the information for the MCF Configuration Tool. It will be named the same as the name of the project. In this example, the project was named “ManualMCF” and the folders and files shown in Figure 3-2 are located in the folder: “C:\Siemens\MCFConfigurationTool\workspace\ManualMCF”.

3.4 OPENING AN EXISTING PROJECT

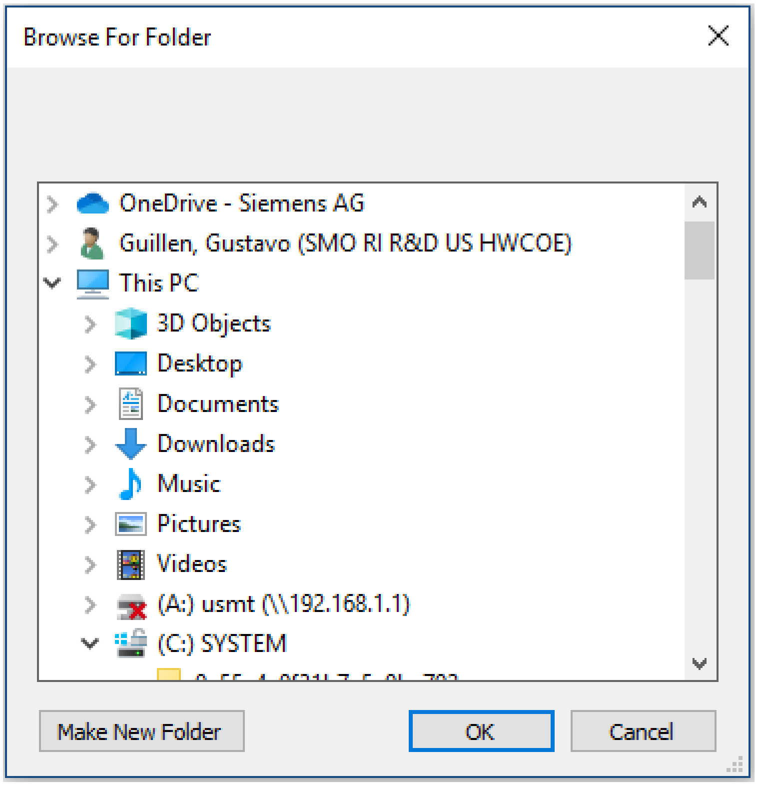
To open an existing project:

- Click the “Open” icon on the tool bar or click File > Open from the menu. A standard “File Open” dialog box will display by default in the workspace location: C:\Siemens\MCFConfigurationTool\workspace
- Double-click the subfolder of the project to be opened.
- Select the *.ui.xml file of the project.
- Click Open. The selected project will open and can be edited.

3.5 CHANGING THE WORKSPACE FOLDER

The workspace is a directory on the disk where the MCT creates the project folder and stores all the project related information. The user can change this at any time from the application.

To change the workspace, go to File > Workspace and select or create the new directory for the new workspace location, as shown below.



- Click on the “Make New Folder” button to create a new folder for the workspace location.
- Click on “OK” to save the new workspace directory.
- Click on “Cancel” to abort the operation.

3.6 EDITING CONFIGURATION PARAMETERS AND LOGIC STATE NAMES

The application engineer edits the MCF configuration parameters and names logic state variables using the WI Editor. The WI Editor is shown when the user clicks the WI Editor icon on the toolbar (as shown in Figure 3-3) or when the user selects Edit → WI from the menu bar.

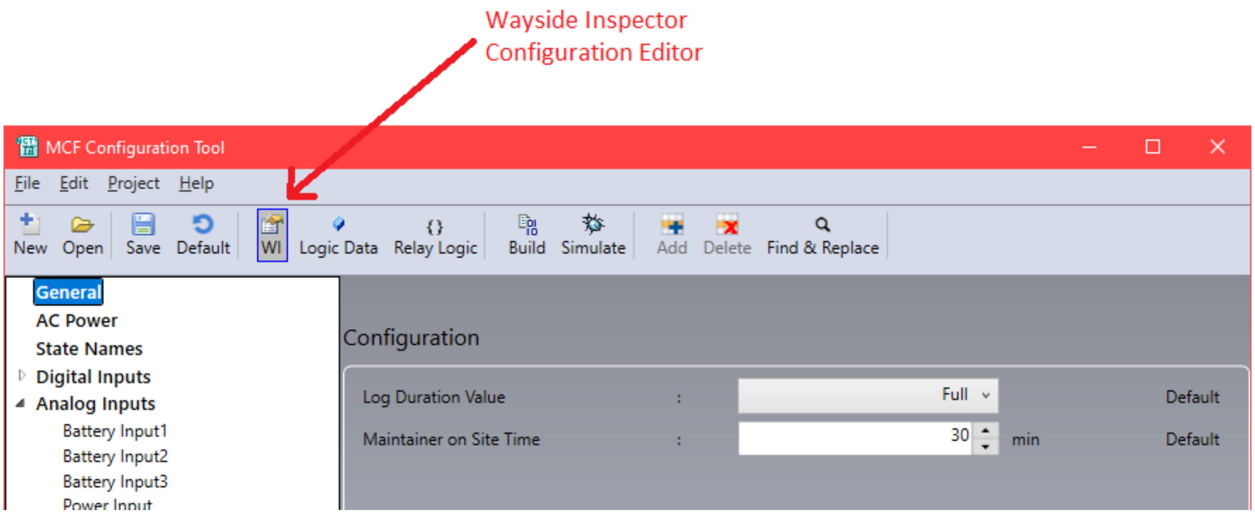


Figure 3-3 WI Editor Icon

The WI Editor screen has three main areas as shown in Figure 3-4:

- the configuration item list
- the configuration parameters
- the logic states.

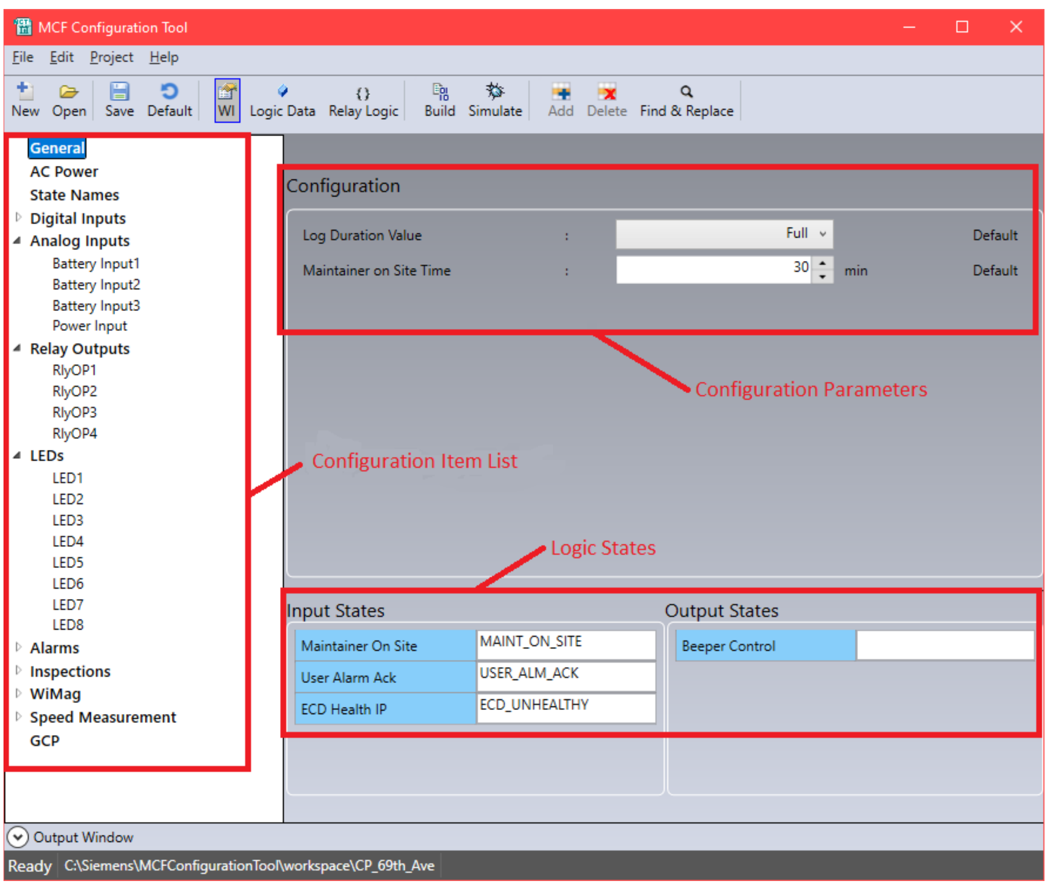


Figure 3-4 WI Editor Screen Areas

Select the specific configuration items to view in the configuration item list and corresponding configuration parameters and logic states for the selected configuration item will be displayed. The following list shows the available configuration items:

- General
- AC Power
- State Names
- Digital Inputs
- Analog Inputs
- Relay Outputs
- LEDs
- Alarms
- Inspections
- WiMag Sensor Systems
- Speed Measurements
- GCP Interface
- iLODs

Chapter 4 of this manual provides details for the configuration parameters and logic states for each configuration item.

3.7 EDITING LOGIC DATA

The application engineer edits the Boolean variables, timers, properties, and submenus using the Logic Data Editor. The Logic Data Editor is shown when the user clicks the Logic Data icon on the toolbar (as shown in Figure 3-5) or when the user selects Edit → Logic Data from the menu bar.

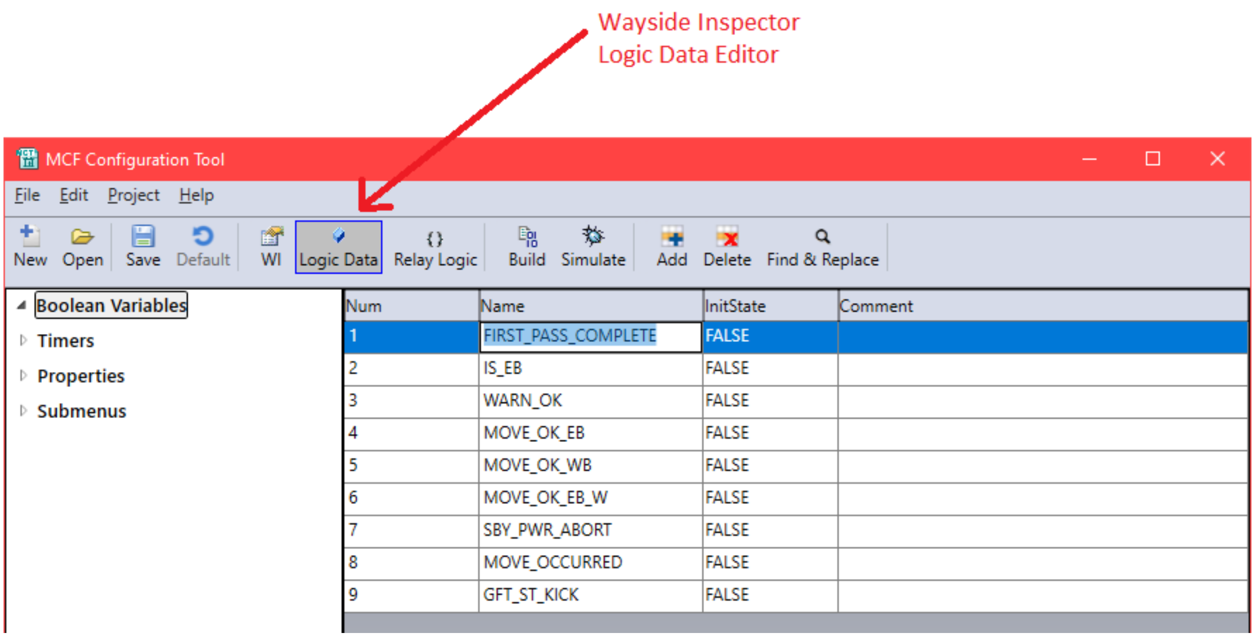


Figure 3-5 Logic Data Editor Screen

3.7.1 BOOLEAN VARIABLES

The application engineer may add and remove intermediate Boolean variables in the Logic Data editor.

3.7.1.1 *ADDING A BOOLEAN VARIABLE*

To add a Boolean variable, select “Boolean Variables” on the left and then click the “Add” icon on the toolbar. The user can name the variable, set the initial state of the variable, and provide a comment on the new variable. The variable name is used in the relay logic equations.

3.7.1.2 *DELETING A BOOLEAN VARIABLE*

To delete a Boolean variable, select “Boolean Variables” on the left, select the variable in the table of variables on the right, then click the “Delete” icon in the toolbar.

3.7.2 TIMERS

The WI supports timer relay coils in the relay logic. Each timer has a logic state to start the timer and a logic state indicating if the timer has expired or not. The start logic state must remain set for the timer to run.

Figure 3-6 shows the timers screen in the MCF Configuration Tool.

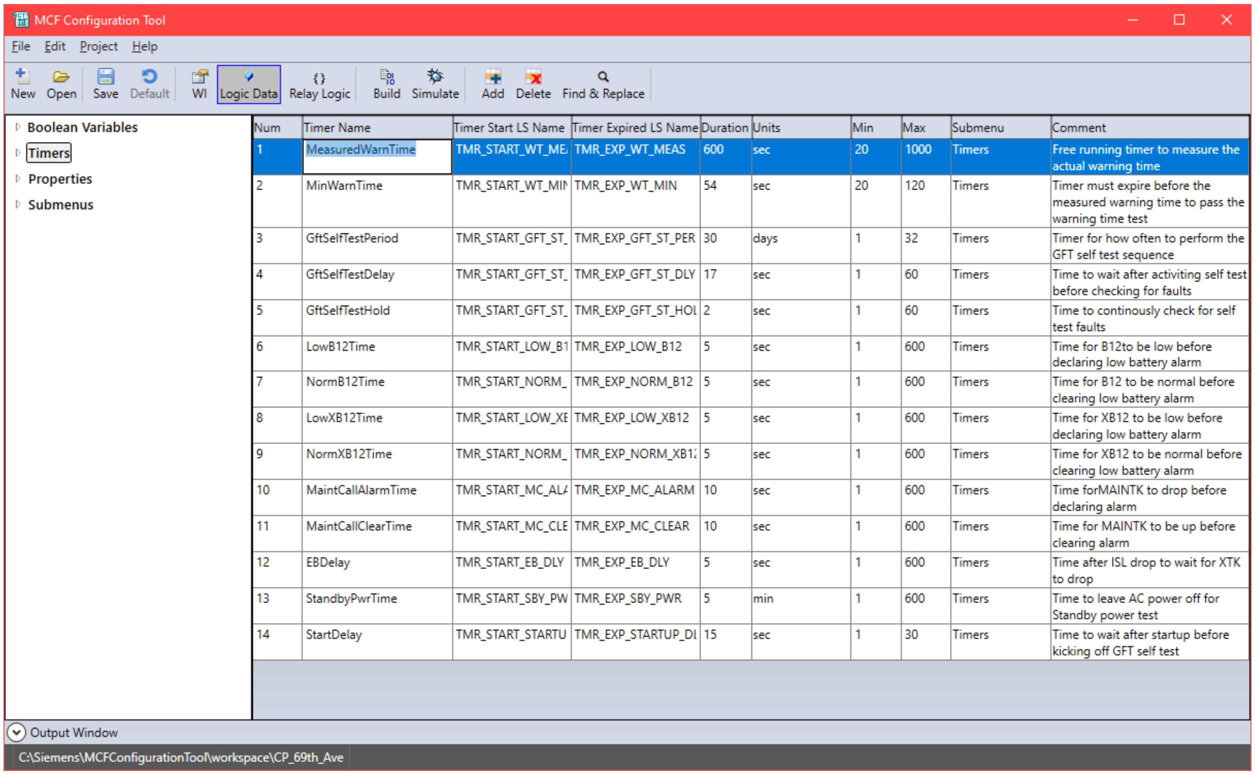


Figure 3-6 Logic Data: Timers Screen

Each timer has the configuration options described in Table 3-2.

Table 3-2 Logic Data: Timers Options

Option	***Description***
Timer Name	The name of the timer as displayed on the web-browser user interface. Field personnel will see this name when adjusting the timer duration on the web-browser user interface.
Timer Start LS Name	The variable name for the timer start logic state, which is set by the relay logic equations.
Timer Expired LS Name	The variable name for the timer expired logic state, which is read by the relay logic equations.
Duration	The default duration for the timer in the selected “Units”.
Units	The units to use for the timer duration.
Min	The minimum value for the timer. Field personnel cannot adjust the timer to a duration that is shorter than this value.
Max	The maximum value for the timer. Field personnel cannot adjust the timer to a duration that is longer than this value.
Submenu	The submenu on the web-browser user interface where the timer will be shown. The application engineer may organize the timers into any logical grouping of menus that makes sense for their application. See section 3.7.4.
Comment	An optional descriptive comment.

The duration of timers is field programmable on the web-browser user interface. Application engineering specifies the default timer value as well as a minimum time and a maximum time. Application engineering may also specify the submenu on the web-browser user interface where the timer will be listed. The configured Timer Name is displayed on the user interface. Field personnel may adjust the timer to any value between the specified minimum and maximum values.

NOTE

NOTE

If the minimum and maximum values for the timer have been set to the same value, then the timer is not adjustable in the Web UI.

3.7.2.1 *ADDING A TIMER*

To add a timer, select “Timers” on the left of the Logic Data editor screen, then click the “Add” icon on the toolbar. The application engineer can name the timer, provide the name for the start logic state, provide the name for the expired logic state, configure the default duration, minimum, and maximum duration. The submenu of the web-browser user interface as well as a comment can also be provided.

3.7.2.2 *DELETING A TIMER*

To delete a timer, select “Timers” on the left of the Logic Data editor screen, select the variable in the table of variables on the right, then click the “Delete” icon in the toolbar.

3.7.3 PROPERTIES

Properties are field programmable options within the MCF, created by the application engineer. The user can set or clear a property from the web-browser user interface. Properties provide a logic state, which the MCF logic may use to enable or disable features.

The following figure shows the Logic Data properties.

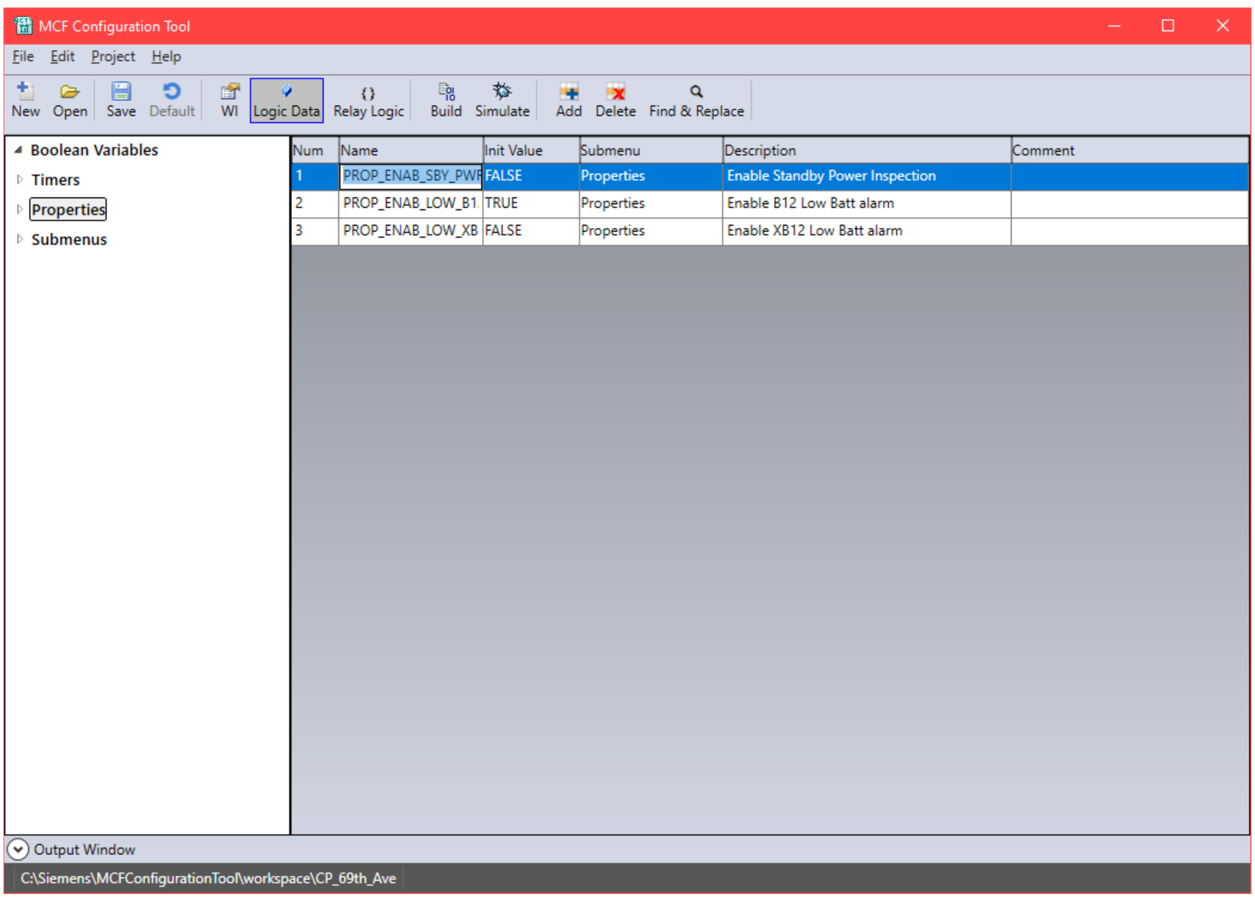


Figure 3-7 Logic Data: Properties Screen

Table 3-3 describes the options available for a property.

Table 3-3 Logic Data: Properties Options

Option	***Description***
Name	The name of the property as displayed on the web-browser user interface. Field personnel will see this name when setting the property on the web-browser user interface.
Init Value	The initial value of the property when the MCF is first loaded into the WI.
Submenu	The submenu on the web-browser user interface where the property will be shown. The application engineer may organize the properties into any logical grouping of menus that makes sense for their application. See section 3.7.4.
Description	A description of the property, which will be displayed to field personnel on the web-browser user interface.
Comment	An optional comment.

3.7.3.1 *ADDING A PROPERTY*

To add a property, select “Properties” on the left of the Logic Data editor screen, then click the “Add” icon on the toolbar.

3.7.3.2 *DELETING A PROPERTY*

To delete a property, select “Properties” on the left of the Logic Data editor screen, select the property in the table on the right, then click the “Delete” icon in the toolbar.

3.7.4 SUBMENUS

Submenus allow the application engineer to organize field programmable timers and properties into a menu structure. The application engineer selects which submenu each timer and property should appear.

Figure 3-8 shows the Logic Data editor screen for submenus.

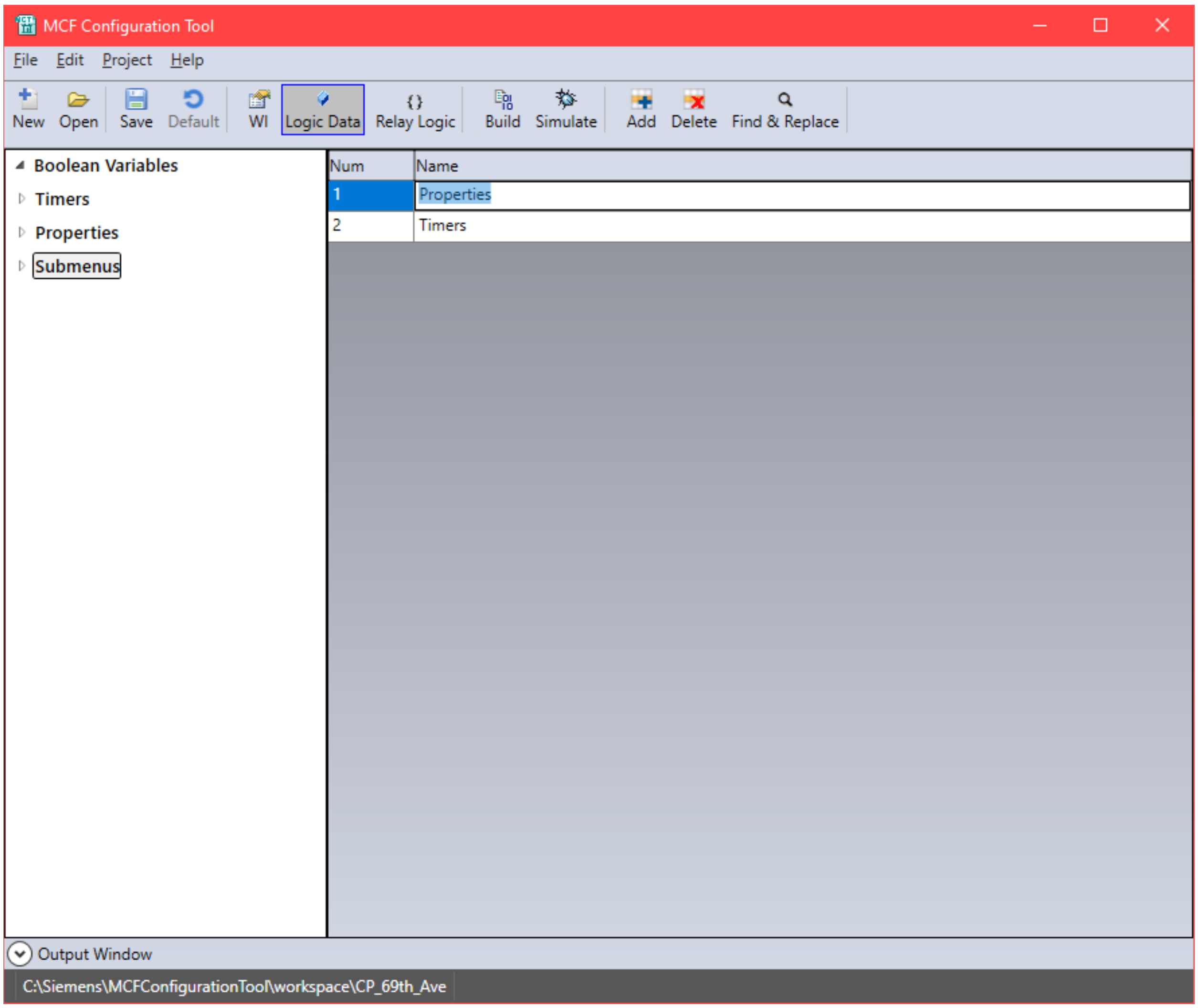


Figure 3-8 Logic Data: Submenus Screen

The web-browser user interface will show the timers and properties under selected submenu under Configuration → MCF Configuration → Logic Configuration as shown in Figure 3-9.

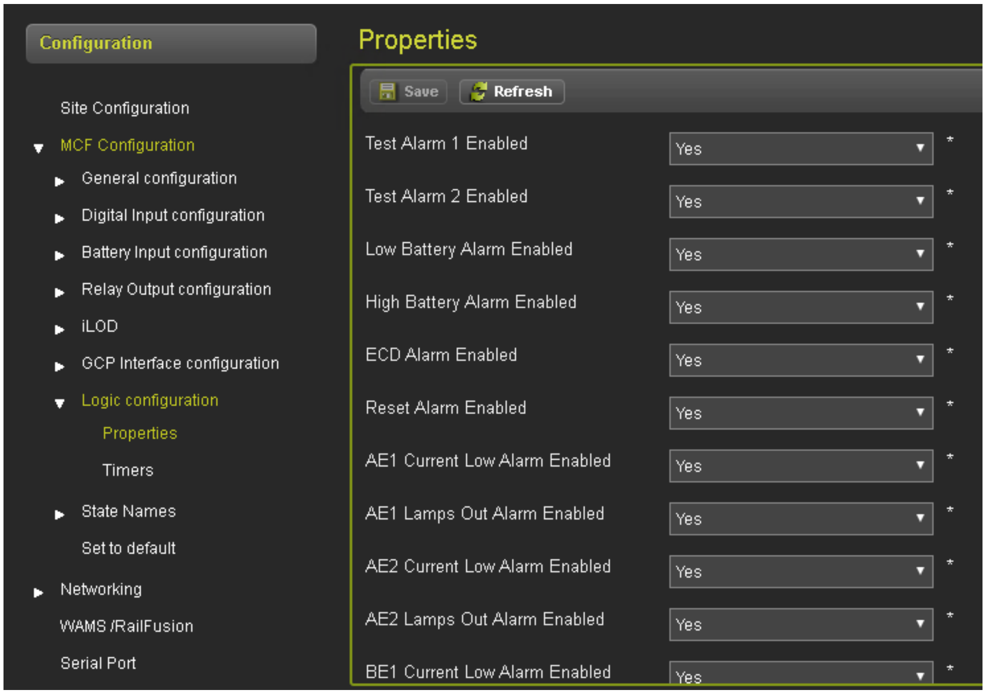


Figure 3-9 Submenus Example on Web-Browser User Interface

3.7.4.1 *ADDING A SUBMENU*

To add a submenu, select "Submenus" on the left of the Logic Data editor screen, then click the "Add" icon on the toolbar

3.7.4.2 *DELETING A SUBMENU*

To delete a submenu, select "Submenus" on the left of the Logic Data editor screen, select the property in the table on the right, then click the "Delete" icon in the toolbar.

3.8 EDITING THE RELAY LOGIC

The application engineer uses the Relay Logic Editor to write the MCF logic. The Relay Logic Editor consists of three parts:

- the left side 'Relay Equation' list view
- the 'Logic Equation Text' box on the bottom
- the 'Relay Circuit Diagram' view in the center black area

This is shown in the following figure.

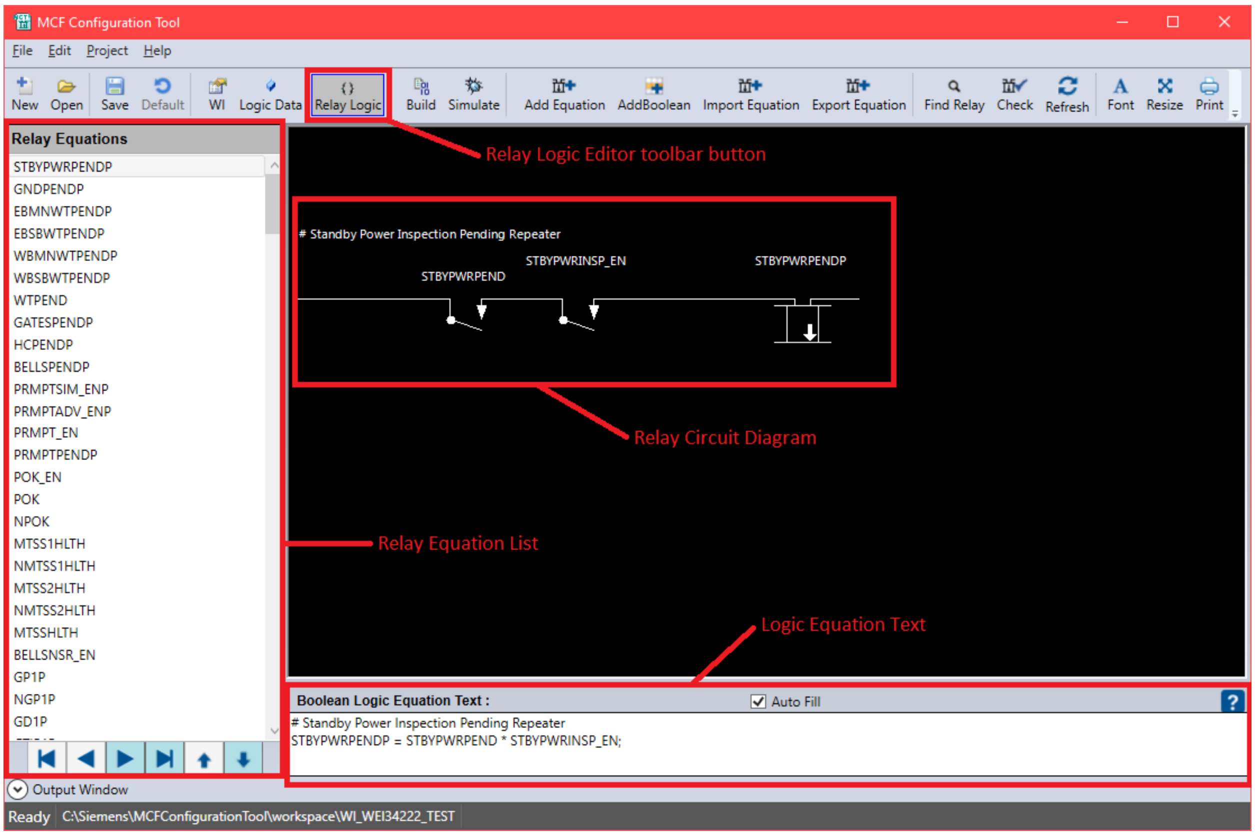


Figure 3-10 Relay Logic Editor Screen

3.8.1 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.

3.8.2 THE LOGIC EQUATION TEXT BOX

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

3.8.3 THE RELAY CIRCUIT DIAGRAM VIEW

The ‘Relay Circuit Diagram’ view displays a relay logic representation of the text equation. To open the Relay Logic Editor, press the ‘Relay Logic’ toolbar button.

3.8.4 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.

The following logic operators can be used in the equations:

- Boolean AND: ‘*’
- Boolean OR: ‘+’
- Boolean NOT: ‘~’
- Assignment: ‘=’
- End of Equation: ‘;’

Right-click an equation on the ‘Relay Equation’ list view to display the shortcut menu. Options are as follows:

- View: displays the selected equation in the relay and text views
- Insert Before: add a new equation and after saving the equation, it appears above the selected equation in the relay equation list view.
- Insert After: add a new equation and after saving the equation, it appears below the selected equation in the relay equation list view.
- Delete: remove the selected equation from the application logic.
- Move Up: moves up the selected equation in the Relay Equation list view.
- Move Down: moves down the selected equation in the Relay Equation list view.
- Cut: cut the selected equation from the Relay Equation list view.
- Paste: 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.

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.

3.8.5 ADDING A BOOLEAN LOGIC STATE

The user may add a new Boolean logic state from the Relay Logic editor without switching to the Logic Data editor first. Click the Add Boolean button on the toolbar to display the dialog box shown in Figure 3-11.

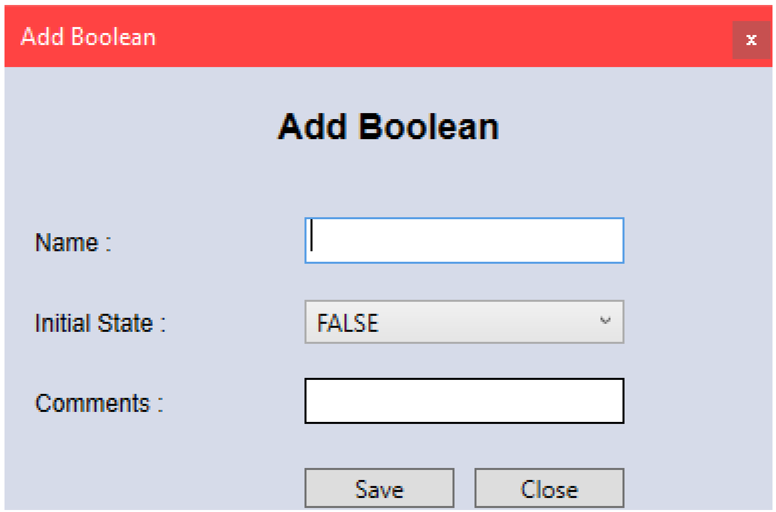


Figure 3-11 Add Boolean Dialog Box

Enter the name, initial state, and comments in this dialog box. This makes the logic state available to the relay logic and adds the logic state to the Boolean Variables shown in the Logic Data editor view.

3.8.6 IMPORTING AND EXPORTING EQUATIONS

All the relay logic equations can be exported to a file using the Export Equation button on the toolbar. Those equations can then be imported into another project by clicking the Import Equation button on the toolbar.

3.8.6.1 *EXPORTING EQUATIONS*

Click the Export Equation button to open a “Save As” dialog box. Name the file and save in any location on the computer file system. This saves a *.eq file, which includes all the equations in the current project.

3.8.6.2 *IMPORTING EQUATIONS*

Click the Import Equation button to open a “File Open” dialog box. Select the *.eq file from the computer file system. This imports all the equations included in that *.eq file.

If logic states do not exist yet in the project for the imported equations, the dialog box shown in Figure 3-12 will display.

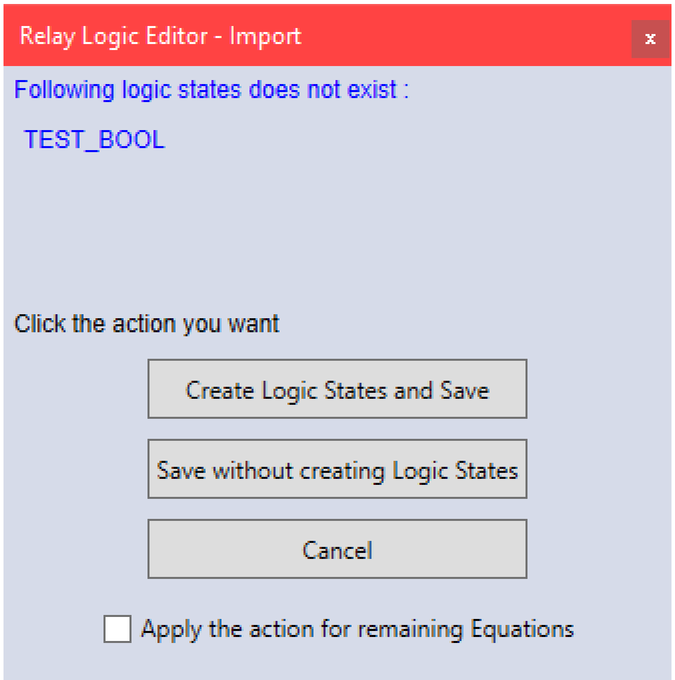


Figure 3-12 Import Equation Dialog Box

Click the “Create Logic States and Save” button to create a Boolean variable logic state for the missing variable.

The user can also leave the logic state undefined and define the logic state later by clicking the “Save without creating Logic States” button. The user can cancel the import by clicking the “Cancel” button.

The selected action can be applied to the remaining equations in the *.eq file by checking the “Apply the action for remaining equations” option.

3.8.6.3 *EDITING *.EQ FILES*

For advanced users, the *.eq files are text files that users can manually edit. The file can be edited with any text editor, such as Notepad. The user may change, add, or remove relay logic equations using the text editor and then later import them into the MCF Configuration Tool project.

3.8.7 FINDING RELAY CONTACT OR COIL

Search for a relay contact or coil by clicking the “Find Relay” button on the toolbar. When the user clicks the “Find Relay” button, the dialog box shown in Figure 3-13 will display.

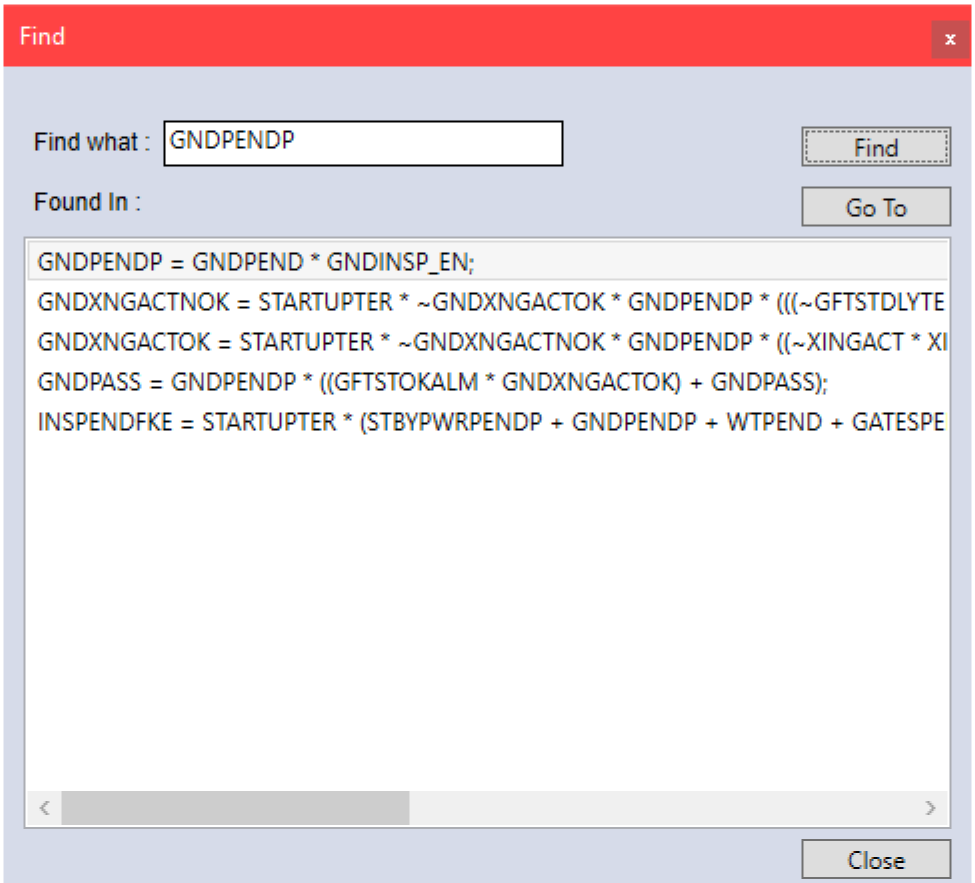


Figure 3-13 Find Relay Dialog Box

Type the name of the logic state in the “Find what” box and click find. All instances of the logic state will then be displayed in the dialog box. Select the equation of interest and click the “Go To” button to go to that equation in the relay logic editor. Then, click the “Close” button to close the dialog box.

3.8.8 CHECKING RELAY EQUATIONS

The relay logic equations can be checked to ensure all the logic states are defined and the logic is consistent by clicking the "Check" button on the toolbar as shown in Figure 3-14.

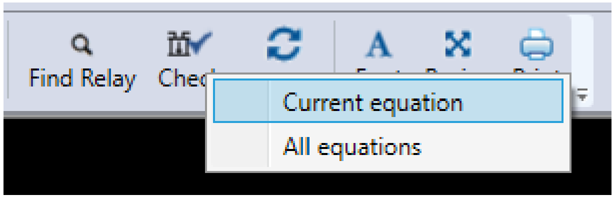


Figure 3-14 Check Button Options

When clicking the "Check" button, the user can choose to check only the currently displayed equation or all the equations in the project.

The "Current equation" option will check the syntax of the selected equation and it will also check if all logic states in the equation exist or not. The MCT will display an error to the user if a logic state does not exist. The "All equations" option has the same function for all equations in the project.

3.8.9 REFRESHING THE RELAY LOGIC CIRCUIT DISPLAY

The display may be refreshed by clicking the "Refresh" button on the toolbar.

3.8.10 PRINTING RELAY LOGIC

If the Relay Logic editor view is selected, the user may print the relay logic circuit diagrams by selecting the File > Print option from the menu or by clicking the Print button on the toolbar.

Clicking the Print button displays a dialog box showing the progress of the print output. After the print output is created, the Print preview dialog box displays as shown in the following figure.

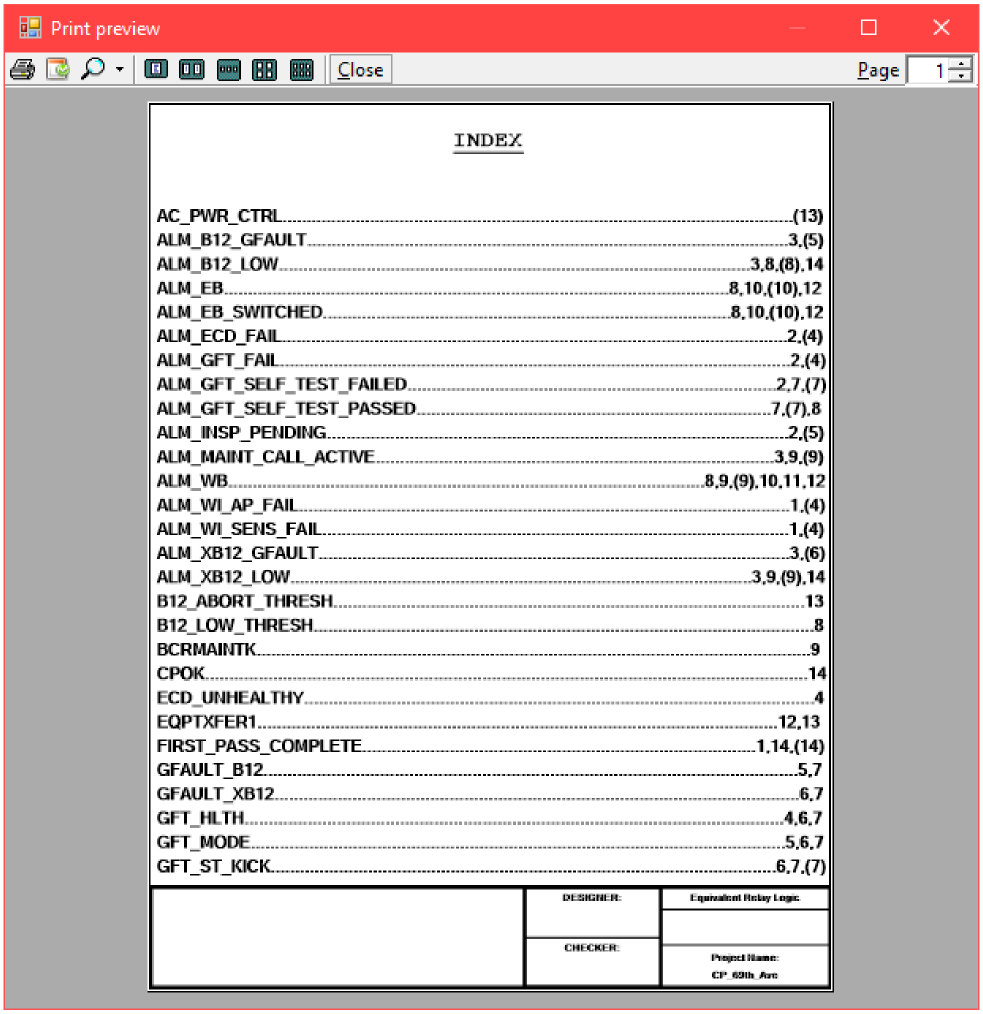


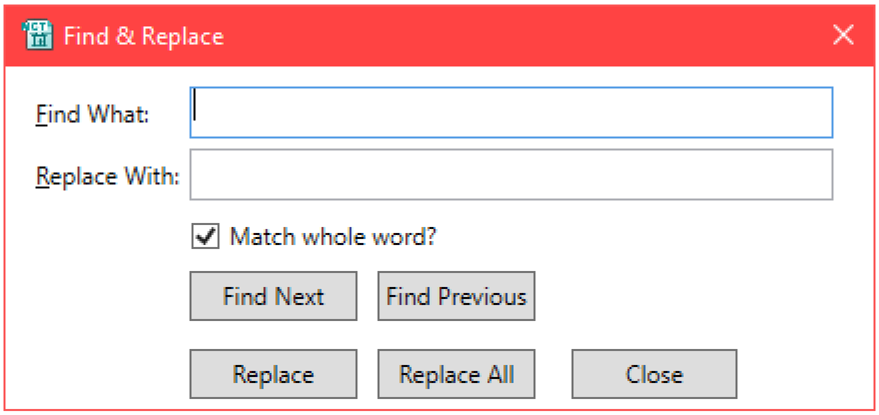
Figure 3-15   Print Preview Dialog Box

From the print preview dialog box, the output can be viewed before printing and the output can be sent to a printer on the computer running the MCF Configuration Tool.

To select the printer, click the “Printer Properties” button. This is the second button located on the print preview toolbar as shown in the above figure. Select the printer to send the output to, or choose to save the output as a PDF on the computer. After the printer properties have been set, click the “Print” button on the print preview toolbar, to print the file.

3.9 FINDING & REPLACING LOGIC STATES

Use the Find & Replace option to search and replace logic states in the Logic Data Editor.



1. Go to Edit > Replace
2. Enter the text to be located in the “Find What” box.
3. Enter the new text in the “Replace With” box.
4. Select Find Next until the logic state to be updated is found.
5. Select “Replace” to replace the text in the selected logic state.
6. Select “Replace All’’ to update all logic state instances at once in the editor.
7. Select “Close” to close the “Find & Replace” dialog box.

3.10 COMPILING THE MODULE CONFIGURATION FILE

The MCF Configuration Tool compiles the configuration settings and relay logic equations into the Module Configuration File (MCF).

To compile the MCF, click the “Build” icon on the toolbar or select Project > Build MCF from the menu.

After triggering the compilation process, the compile output window will output on the bottom of the application. The compile output window will show details about the compilation and if any errors are detected in the compilation process. The following figure shows the MCF Configuration Tool compile output window.

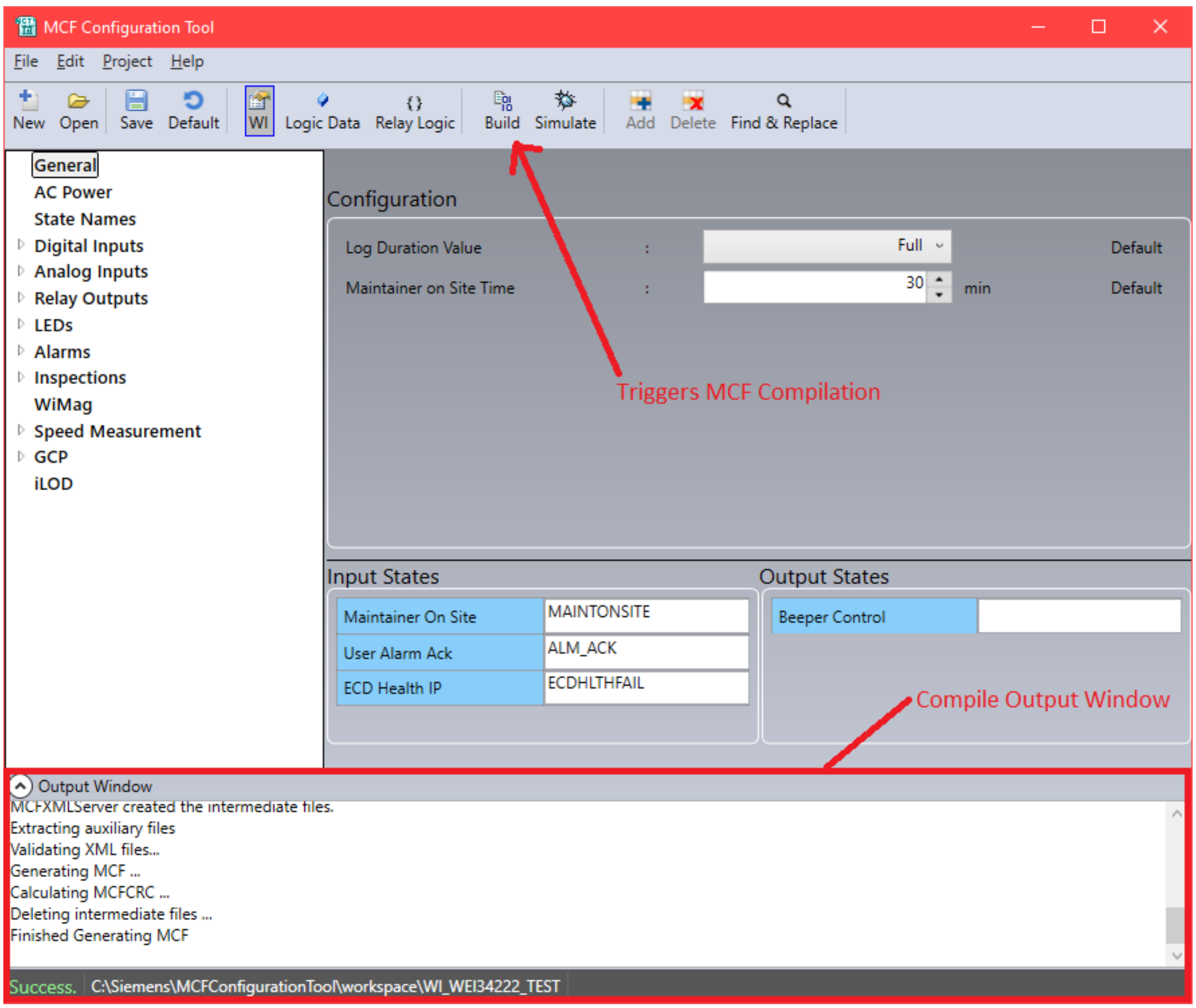


Figure 3-16 Build Icon

After the compilation process completes, the MCF file can be found in the path shown in the status bar of the MCF Configuration Tool. The file name includes the project name, the MCF version (as set under Project > Project Properties), and the “MCF” file name extension.

For the example shown in Figure 3-16 and with the MCF version set to 3, the resulting file name is: WI_WEI34222_TEST003.MCF.

If there are any compilation errors, they will be shown in the Output Window. Table 3-4 describes each possible error and how to fix it.

Table 3-4 Compilation Errors

Error	***Solution***
Duplicate internal state name: Internal State	Change the logic state name to make it unique.
Following logic states does not exist: GATESDOWNALL in equation: GATESDOWNALL = STARTUPTER * MTSSHLTHY * ((~GATETIP_EN * GD1 * GD2) + (GATETIP_EN * GTIP1 * GTIP2));	Define the missing logic state.
Logic State name can't be numeric.	Change the logic state name to start with a letter.
Error in converting equation: GFTSTOFF = ~GFT_ST (GFTSTOFF * ~GFTSTON)	Correct equation syntax. In this example either a ‘+’ or a ‘*’ is missing between “~GFT_ST” and the first parentheses.
Error in GetTimerCardSectionElement section of xml document.	Timer name can’t be numeric. Change the timer name to start with a letter.
Error in creating properties of a card section.	Property name can’t be numeric. Change the property name to start with a letter.
The 'normvalue' element is invalid - The value 'FALSEx' is invalid according to its datatype 'ui_enum_true_false' - The Enumeration constraint failed.	Correct the normal value of the logic state.

3.11 DECOMPILING AN EXISTING MCF

The MCF file contains all project files and information needed to edit the MCF in the MCF Configuration Tool. If the original folder and files from the MCF Configuration Tool are missing, they can be recreated from the MCF file by decompiling the MCF.

To decompile the MCF, click the Project > Decompile MCF option from the menu as shown in Figure 3-17.

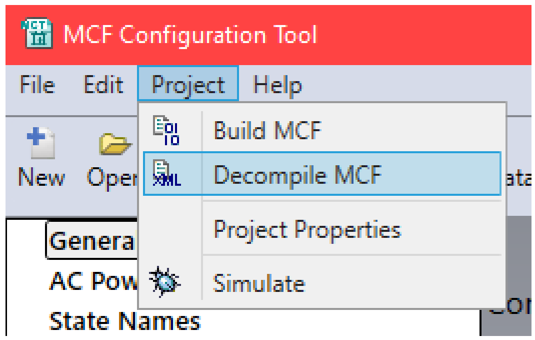


Figure 3-17 Decompile MCF

When selecting the Decompile MCF option, the currently open project will need to first be closed. The dialog box shown in Figure 3-18 will display. Select Yes to close the currently open project or select No to cancel the decompile process.

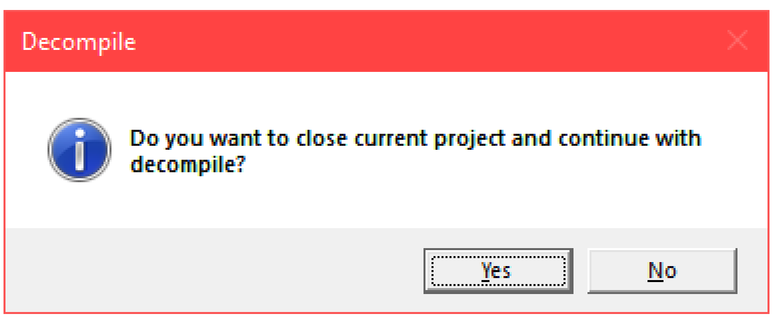


Figure 3-18 Decompile Dialog Box

Selecting Yes will display a standard File Open dialog box. Select the MCF file from the computer's file system and click the Open button. This action will create a file in the workspace folder named from the selected MCF and will create all the necessary subfolders and data files. If there is already a folder in the workspace with that name, the MCF Configuration Tool will ask if you want to create a new folder as shown in Figure 3-19.

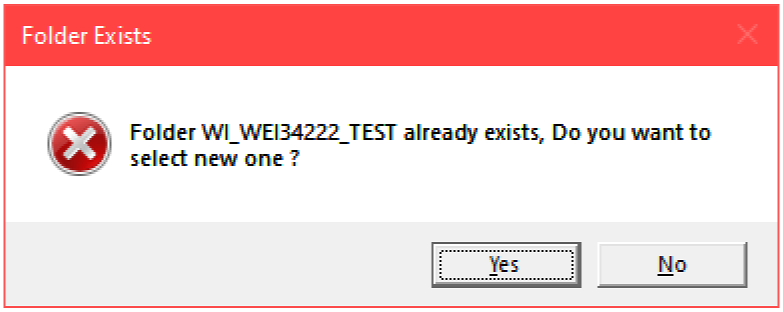


Figure 3-19 Folder Conflict Dialog Box

Select Yes and the project name dialog box will display as shown in Figure 3-20.

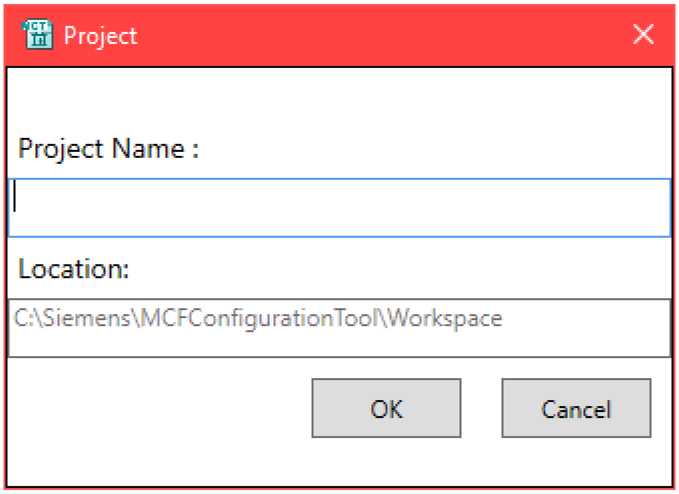


Figure 3-20 Project Name Dialog Box

Enter the new project name and click OK to create the new project folder and corresponding files in the workspace folder. Details about the de-compilation will be displayed in the output window at the bottom of the application.

3.12 SETTING PROJECT PROPERTIES

Set the version of the MCF and the Card Definition package for the MCF using the Project Properties dialog box shown in Figure 3-21.

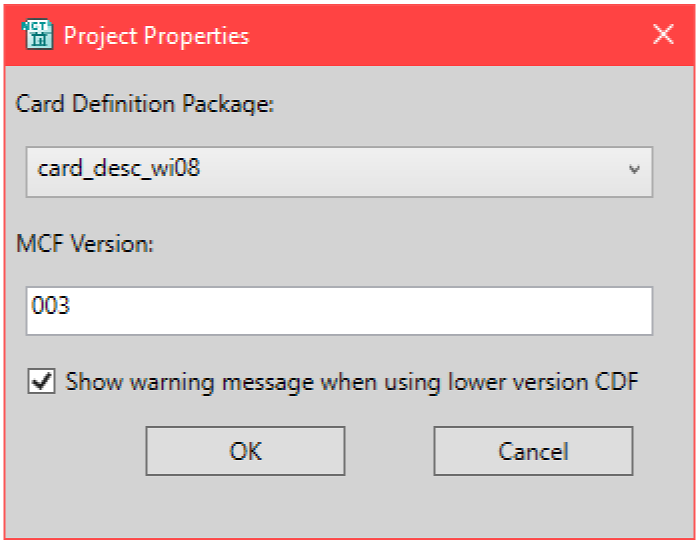


Figure 3-21 Project Properties Dialog Box

The MCF version will be included in the file name of the compiled MCF when the MCF is built and will be shown on the WI when viewing the MCF version.

The card definition package can be changed in the Project Properties. Typically, the default package shown does not need to be changed. For details on selecting the card definition see section 3.3.

3.13 SIMULATING THE MCF LOGIC

The MCF Configuration Tool can simulate the operation of the MCF as it would execute when loaded in a WI. The simulator view can be opened by clicking the Simulate button on the toolbar. The Simulate view is shown in Figure 3-22.

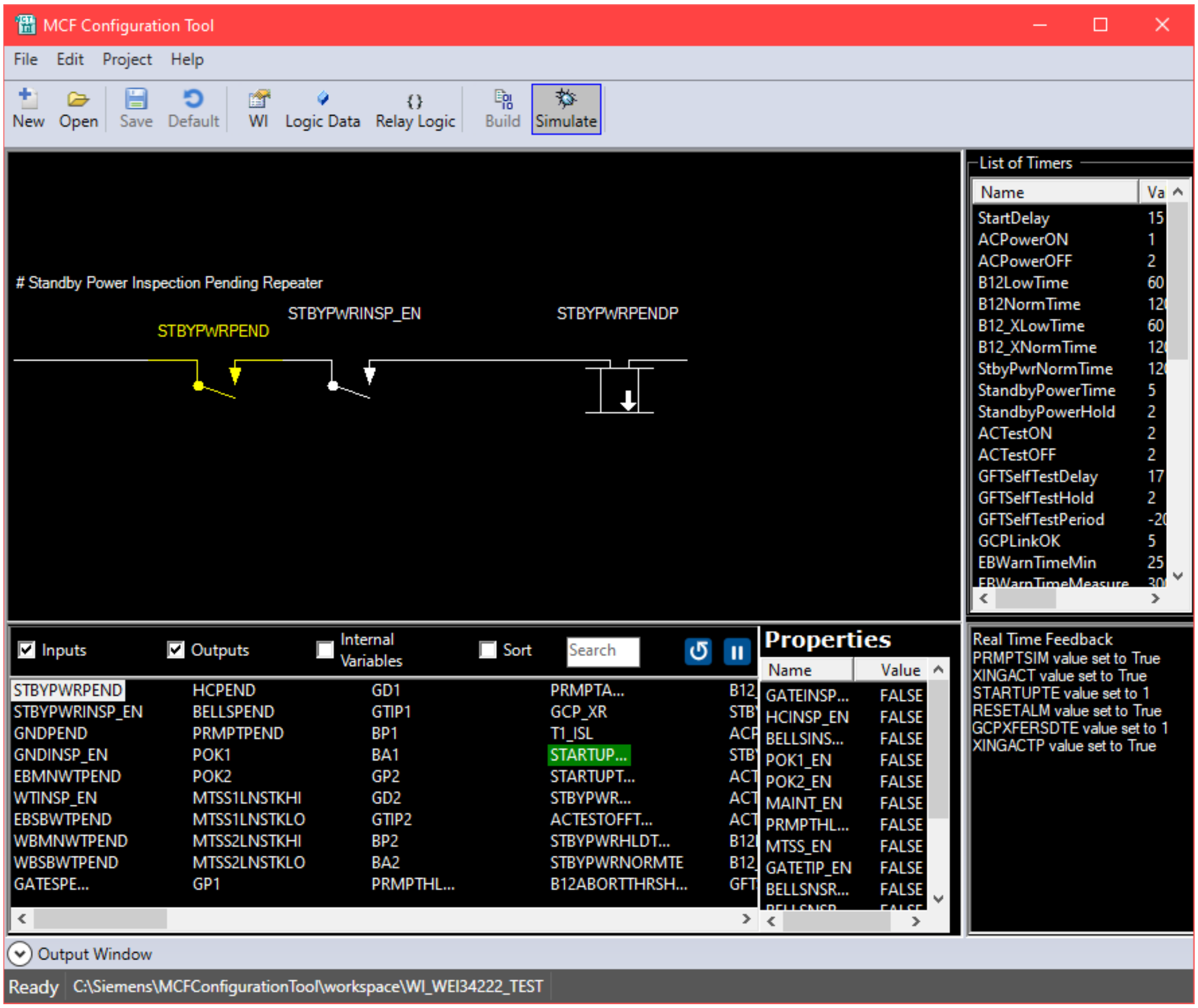


Figure 3-22 Simulate Screen

3.13.1 LIST OF LOGIC STATES

The MCF Configuration Tool shows the logic states in the bottom pane of the simulator view. The logic states can be filtered using the “Inputs”, “Outputs”, and “Internal Variables” checkboxes. The “Sort” checkbox will update the logic states list to show in alphabetical order. Logic states that are set (have a value of TRUE) are shown with a green background. Logic states that are clear (have a value of FALSE) have a black background. The currently selected logic state has a blue or white background.

3.13.2 CHANGING A LOGIC STATE

Change the value of a logic state on the displayed relay circuit diagram by right-clicking the contact in the diagram and selecting Toggle State, as shown in Figure 3-23. This will update the diagram to show the new state. The MCF Configuration Tool will execute the logic with the new state change and update all logic states accordingly to the defined relay logic equations. Changing a logic state does not advance timers. Timers must be advanced manually. See section 3.13.5 for information on running timers.

The user may only toggle the state of contacts if they are not driven by another relay circuit in the logic. Right-click the contact and select "Show Logic" to go to the logic driving that contact to change the state.

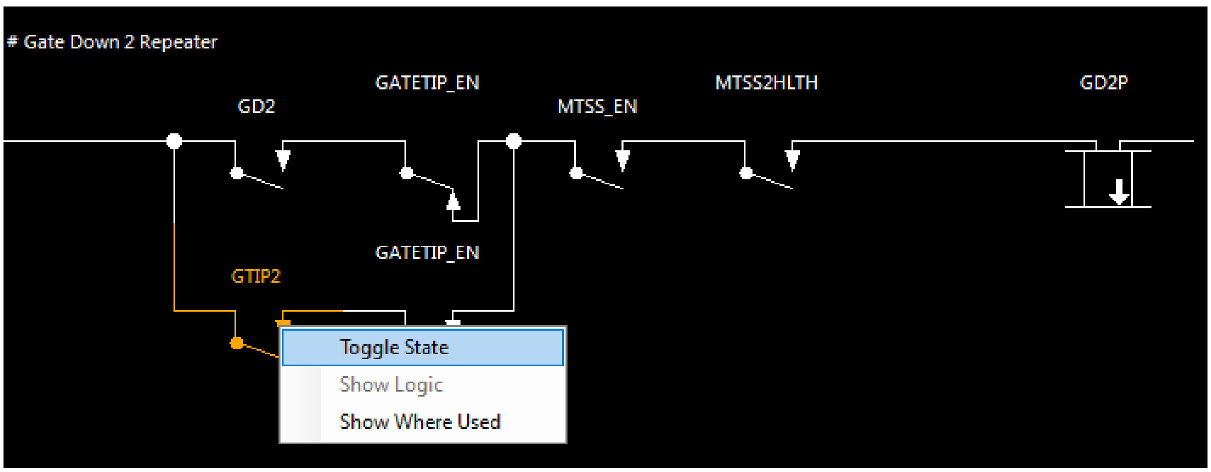


Figure 3-23 Toggle Logic State from Relay Circuit Diagram

The user can also change the value of a logic state by right-clicking the logic state in the logic state list pane as shown in Figure 3-24.

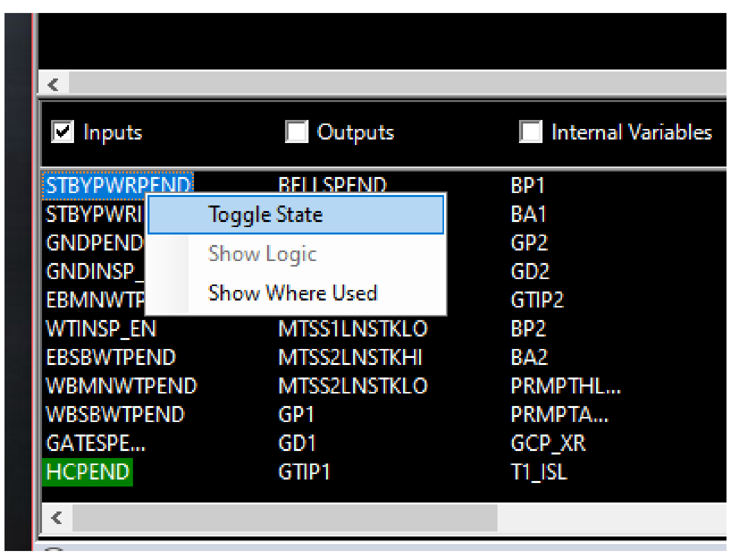


Figure 3-24 Changing Logic State

3.13.3 SELECTING THE RELAY LOGIC CIRCUIT TO VIEW

There are multiple ways to select the relay circuit diagram to view on the relay circuit diagram area. The user can right-click a logic state in the list of logic states in the bottom pane and select "Show Logic" if that logic state is a relay coil. The user can select "Show Where Used" to see other relay circuits that use the coil and to find relay circuits that use a contact. The user can also right-click a contact in the currently shown relay circuit diagram and select "Show Logic" or "Show Where Used" to find other equations using the logic state. Logic states can be searched for by name in the "Search" box.

3.13.4 CHANGING PROPERTIES

The properties for the MCF can be changed in the "Properties" pane in the simulation view. Double-click the property to change the TRUE or FALSE value as shown in Figure 3-25. When the properties value is changed, the MCF Configuration Tool automatically executes the logic with that change and updates the displayed states on the relay circuit diagram and in the logic state view.

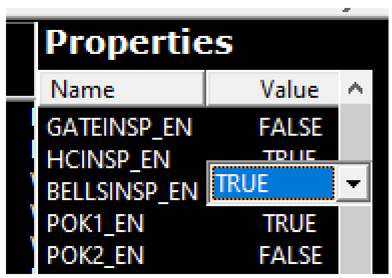


Figure 3-25 Changing a Property

3.13.5 RUNNING TIMERS

Timers are manually expired by right-clicking the timer in the "List of Timers" pane and selecting "Expire Timer". The MCF Configuration Tool will not let the user expire a timer that does not have the input circuit to the timer set (TRUE).

The "Pause" button will stop the automatic execution of the logic when the user changes a logic state. That enables the user to set multiple inputs states and have them all applied at once. The "Play/Resume" button start the execution of the logic after the logic states have been changed.

3.13.6 REAL TIME FEEDBACK OF CHANGES

The Real Time Feedback pane in the lower right corner shows the history of logic states changes during the simulation. As the simulator executes the logic, the simulator updates this list of changes with the new values of logic states that changed.

3.13.7 RESETTING THE SIMULATOR

The simulation can be reset to the initial state by clicking the Reset Simulator button as shown in Figure 3-26.

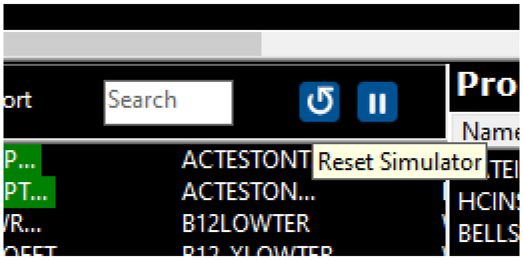


Figure 3-26 Reset Simulator Button

After clicking the button, the user is prompted to confirm they want to perform the reset. If confirmed, all logic states will be returned to their default initial values and the simulation can start again.

3.14 VIEWING MCF CONFIGURATION TOOL VERSION INFORMATION

To view the version of the MCF Configuration Tool, click Help > About MCF Configuration Tool from the menu.

The version dialog box also shows the version of the components used by the MCF Configuration Tool. This information may be copied and pasted when sending version information to Siemens Mobility, Inc by clicking the “Copy” button. The version dialog box is shown in Figure 3-27.

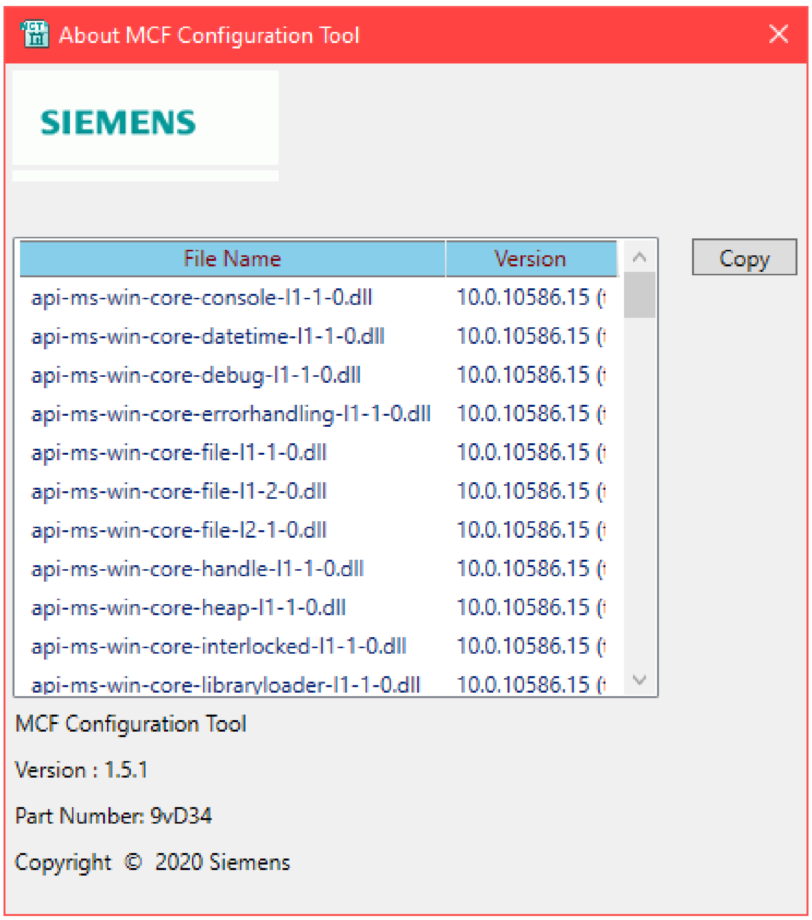


Figure 3-27 About MCF Configuration Tool Dialog Box

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CHAPTER 4 – FUNCTIONS, CONFIGURATION PARAMETERS, & LOGIC STATE DEFINITIONS

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 Boolean equations and relay logic diagrams.

This document provides guidance regarding MCF content. This chapter provides a reference to the application engineer for all WI configuration settings and their purpose, and provides a reference to the application engineer for all WI logic states, which are available to the MCF logic.

4.1 LOGGING

The WI keeps three logs: the Event Log, the Diagnostic Log, and the Application 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 Application Log contains only the Event Log entries created by the MCF. The Application Log is useful for troubleshooting the MCF logic used with a particular installation.

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.

The WI logs have a circular structure. When a WI log is full and a new entry is added to the log, the new entry overwrites the oldest entry.

4.1.1 EVENT LOG ENTRIES

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
```

Table 4-1 describes the fields contained in each event log entry.

Table 4-1 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-ordered 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 of the log entry. AI is for analog input (a.k.a. Battery Input). See Table 4-4 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.

4.1.2 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
```

Table 4-2 describes the fields in each diagnostic log entry.

Table 4-2 Diagnostic Log Entry Fields

Example Text	***Field***	***Description***
DA75	CRC	When downloading a diagnostic log, 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-ordered 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 4-3 for a description of each verbosity level.
TMON	Entry Type	The entry type mnemonic shown the type of event entry. See Table 4-4 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 logging function 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 4-3 lists the verbosity levels and their meanings.

Table 4-3 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 that the system cannot 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.

4.1.3 APPLICATION LOG ENTRIES

The Application Log is a filtered version of the Event Log and each entry has the same information. The Application Log includes only the entries the MCF logic adds to the event log using the “alarms” capability described in section 4.10.

The following is an example of an Application log entry.

```
A0D7  02-Dec-2019 11:52:38.45  APPL   iLOD-2 HEALTH BAD
```

4.1.4 ENTRY TYPE MNEMONICS

Table 4-4 lists the log entry type mnemonics and their meaning.

Table 4-4 Log Entry Type Mnemonics

Mnemonic	***Meaning***
AC, ACPW	Entries relating to the AC power input and AC power control relay.
AI	Entries for battery inputs (a.k.a. analog inputs).
AIPF	ATCS/IP Field protocol logging entries
AIPO	ATCS/IP Office protocol logging entries
APPL	Messages added by the MCF as defined in the application logic.
CFG	Entries concerning configuration data changes.
COMM	Communications-related log entries
DBUG	Debugging entries
DI	Digital inputs
ECHL	Echelon device communication entries
ETH	Ethernet port
EXEC	General events logged by the executive software
GCP	GCP 4000, GCP 5000, and GCP 3000+ interface entries
GCP3	Legacy GCP 3000 interface entries
GFT	Ground fault test entries
GNFA	ATCS/Genisys Field protocol logging entries
iLOD	iLOD module logging entries
INIT	Entries relating to system initialization.
INSP	Inspection entries
L7	Message tracing entries for ATCS layer 7 messages
MCFE	MCF logic engine entries
MOSM	Maintainer on Site mode
MTSS	Mini-trackside sensor entries
PATH	Office primary and backup failover entries
PBTN	On-site personnel button
PMGR	Port manager
RLY	Relay outputs
RTE	Message tracing entries for routing of ATCS layer 3 packets
SDPM	Siemens digitalization protocol entries
SER	Serial port
SW	Software upgrade entries
SYS	General system entries
TIME	Date/time changes and time related entries
TMON	Internal task monitor entries
UI	Web-browser user interface entries
UUDC	Uploading/downloading configuration data file entries
WAMS	Wayside Alarm Management System protocol entries
WMAG	Wireless Magnetometer entries

4.1.5 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 (178,000 entries). The application engineer may choose to only keep a specific duration of log data instead of the full storage capacity. For example, the customer may want to keep only the last 90 days of log entries. If the application engineer sets a Log Duration Value in the MCF, the WI will delete entries older than the Log Duration Value, each day at midnight.

The application engineer sets the Log Duration Value when creating the MCF. Field personnel may not change the Log Duration Value and it is not visible on the WebUI.

See section 4.3 for how to set the Log Duration Value in the MCF.

4.2 CONFIGURATION STORAGE

The WI stores all system configuration 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 reprogramming the configuration parameters again.

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

4.2.1 MCF PARAMETERS

The compiled MCF includes the values of all MCF parameters. The application engineer defines the values of these settings when writing the MCF. After field personnel load the MCF into the WI, field personnel can change many of the MCF parameters using the web-browser user interface. Not all MCF parameters are field programmable. Subsequent sections of this chapter identify the MCF parameters that are changeable on the web-browser user interface.

4.2.2 PER-UNIT PARAMETERS

The per-unit parameters are specific to each installation. The values of the per-unit parameters are not included in the compiled MCF. Field personnel must set the value of per-unit parameters while on-site by using the web-browser user interface. Examples of per-unit parameters include the Site Name, Mile Post, DOT Number, networking settings, and protocol options. The per-unit parameters are described in Chapter 5.

4.3 GENERAL CONFIGURATION

The WI Editor of the MCF Configuration Tool provides a screen to edit general parameters of the MCF. Figure 4-1 shows the MCF Configuration Tool screen for the general configuration parameters and logic states.

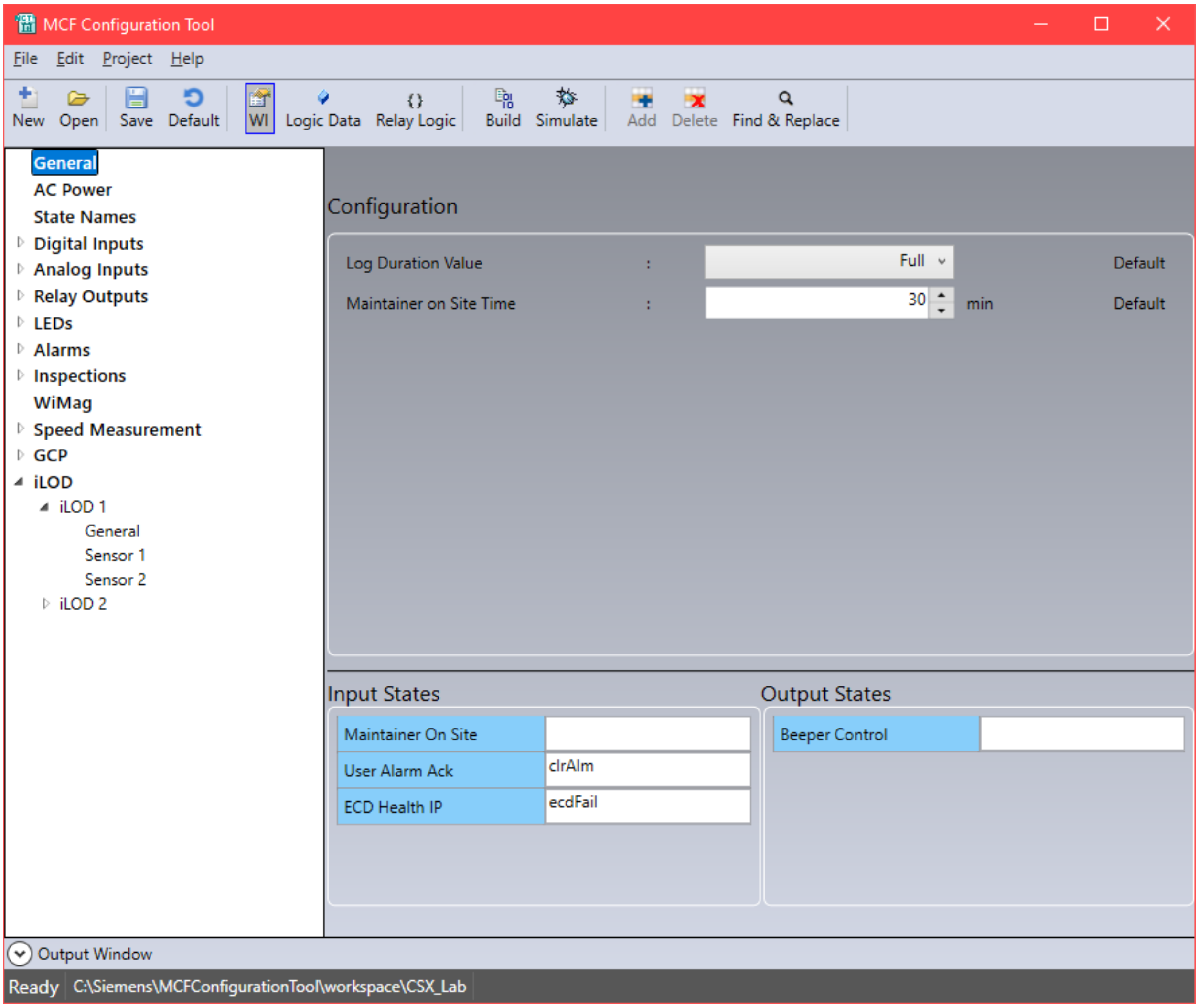

Figure 4-1 General Configuration

Table 4-5 describes the general configuration parameters.

Table 4-5 General Configuration Parameters

Parameter	***Range***	***Default***	***Web UI Editable***	***Description***
Log Duration Value	Full, 30 days, 60 days, 90 days, 120 days, 180 days	Full	No	Sets how the WI will delete old log entries. See section 4.1.5 for how the WI uses the Log Duration Value.
Maintainer On Site Time	10 minutes to 180 minutes	30 minutes	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 4.15 for a description of maintainer on site mode.

Table 4-6 describes the general logic states available to the MCF logic.

Table 4-6 General Logic States

Logic State Label	***Functional Description***
Input Logic States	
Maintainer On Site	Set when a field user presses the on-site personnel push button on the front panel of the WI and the WI enters maintainer on site mode. Cleared when the Maintainer On Site Timer expires. See section 4.15 for a description of maintainer on site mode.
User Alarm Ack	Set when a user selects the “Clear Alarm” button from the web-browser user interface. The logic state stays set for one logic cycle and automatically clears at the end of logic execution. The MCF 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.
ECD Health IP	Clear while the ECD is considered healthy. Set when the ECD health check fails. The MCF logic can use this logic state to generate an ECD failure alarm and display an LED status to inform field personnel of the failure.
Output Logic States	
Beeper Control	When set by the MCF logic, the WI will turn on the beeper. The beeper will stay on while the logic state is set. The WI will turn off the beeper when the MCF logic clears this logic state.

4.4 AC POWER MONITOR AND AC POWER CONTROL

The AC Power Input works the same as a standard discrete input (see section 4.6) except the default de-bounces and toggle period are set to accommodate AC power. Internally, the hardware half-wave rectifies the AC signal, which means 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 “TOGGLING” for AC power; therefore, toggle detection is not enabled. The application engineer may change the default de-bounce settings when creating 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. There is no need to toggle the AC power so automatic toggling of the AC power control relay is not available.

The application engineer configures the settings for the AC Power Monitor input and the AC Power Control output on the screen shown in Figure 4-2.

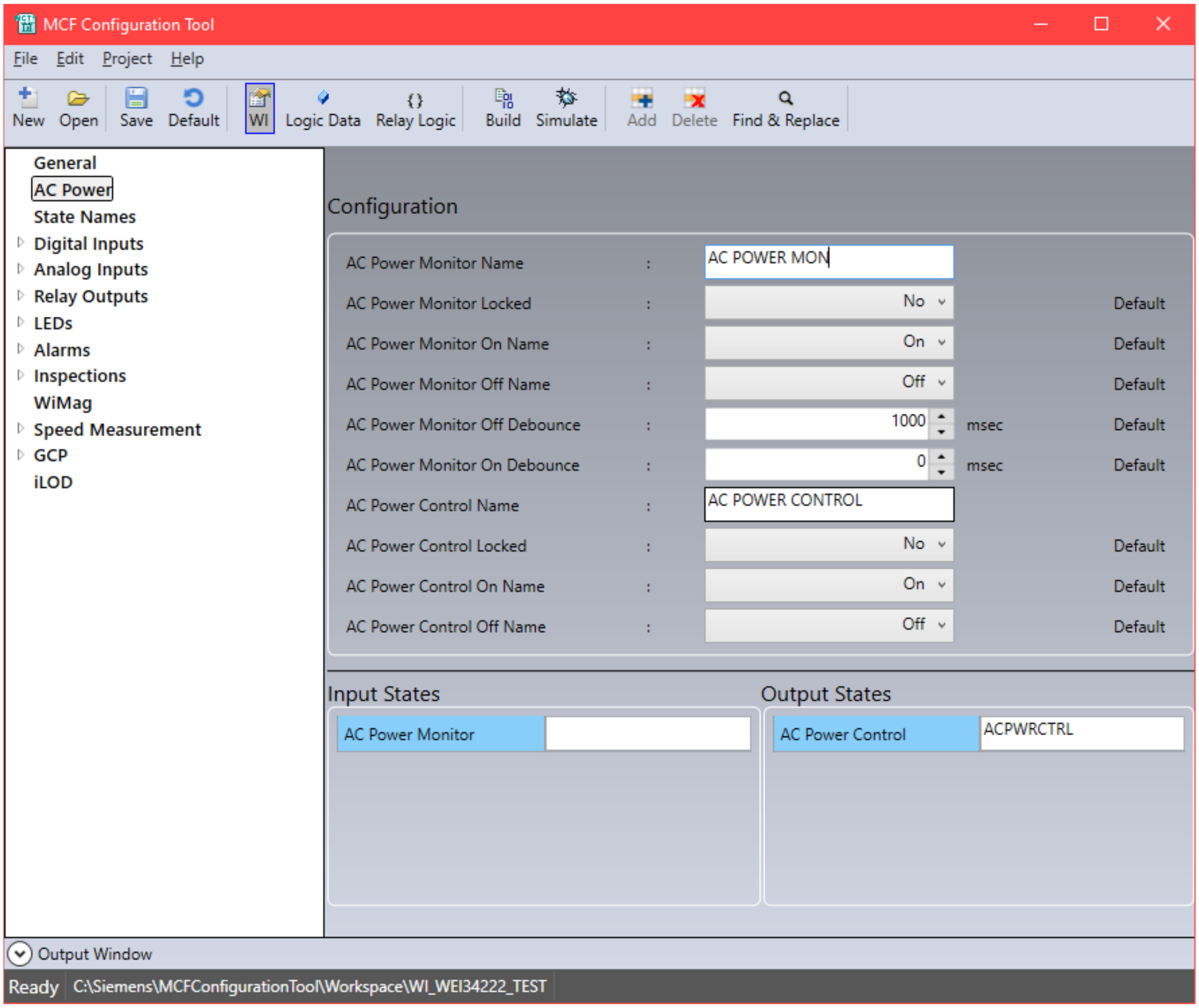

Figure 4-2 AC Power

For a description of each AC Power Monitor and AC Power Control parameter, see Table 4-7.

Table 4-7 AC Power Configuration Parameters

Parameter Name	***Range***	***Default***	***Web UI Editable***	***Description***
AC Pwr Monitor Name	20 characters	ACPWR	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	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	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	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	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	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	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	No	If set to Yes, UI will not allow Field Personnel to change the channel name and state names of this channel

The application engineer enters variable names for the AC Power Monitor and AC Power Control logic states on the screen shown in Figure 4-2. The application engineer uses the variable names in the MCF logic. For a description of the AC Power Monitor and AC Power Control logic states, see Table 4-8.

Table 4-8 AC Power Logic States

Logic State Label	***Functional Description***
Input Logic States	
AC Power Monitor	Set when the AC Power Monitor input is considered ON and clear when considered OFF.
Output Logic States	
AC Power Control	The MCF 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.

4.5 STATE NAMES

State names specify the text to use when logging the change to inputs or outputs. If an input changes to the energized state, the WI will log the selected On Name for that input. When it changes to the de-energized state, the WI will log the selected Off Name for that input.

Figure 4-3 shows the MCF Configuration Tool screen to configure the list of state names. After the state names are entered, they will be available in the list of state names for each of configurable functions, such as Digital Input, GFT Inputs, and Relay Outputs.

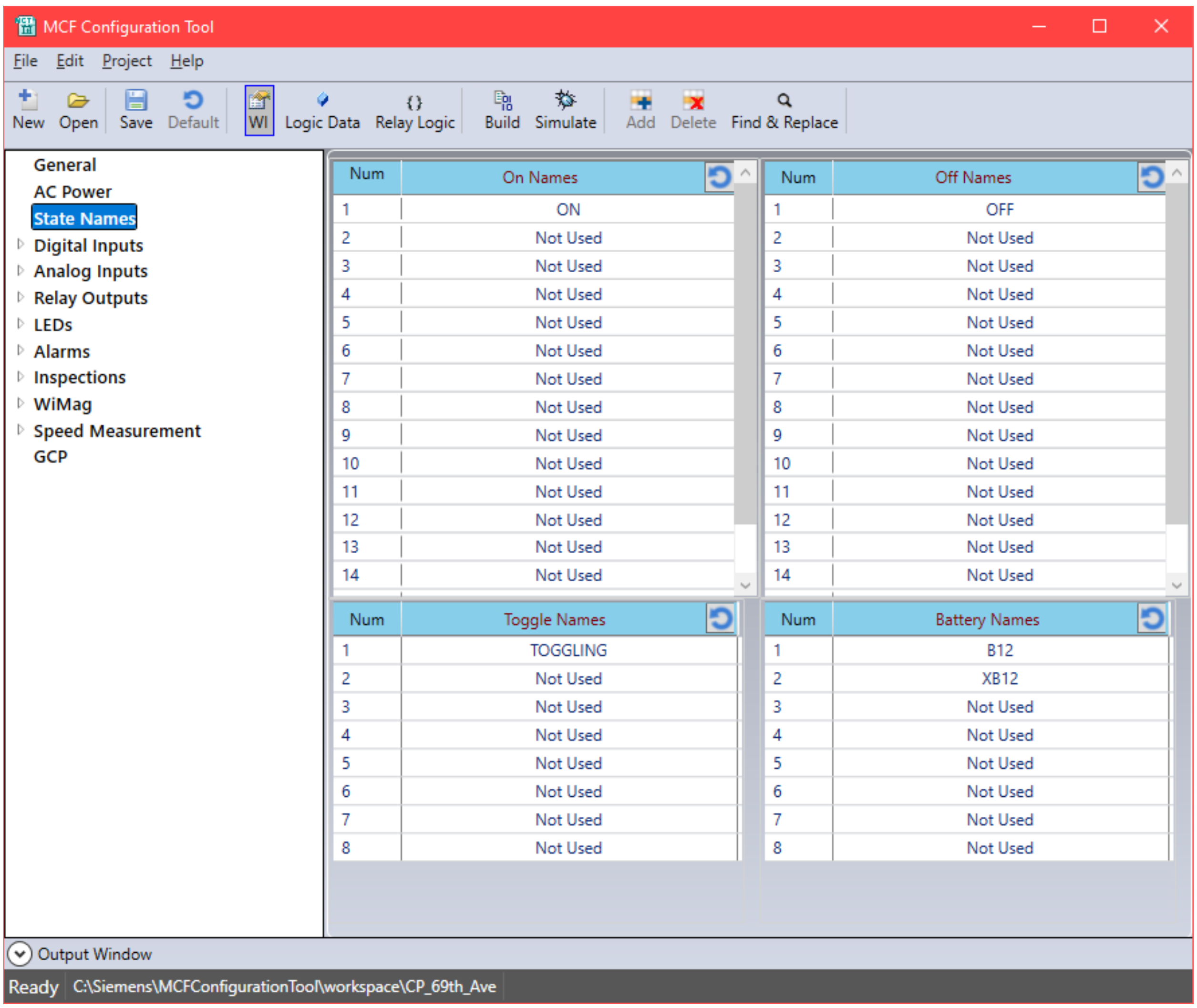

Figure 4-3 State Names

Table 4-9 State Names Configuration Parameters

Parameter Name	*Range*	*Default*	*Web UI Editable*	*Description*
On Names	1 to 12 Characters	Not Used	Yes	The list of on state names, which will be available to choose from when configuring the “On Names” for inputs and outputs.
Off Names	1 to 12 Characters	Not Used	Yes	The list of off state names, which will be available to choose from when configuring the “Off Names” for inputs and outputs.
Toggle Names	1 to 12 Characters	Not Used	Yes	The list of toggle names, which will be available to choose from when configuring the “Toggle Names” for inputs and outputs.
Battery Names	1 to 12 Characters	Not Used	Yes	The list of battery names, which will be available to choose from when configuring the “Battery Names” for GFT input channels.

4.6 DIGITAL INPUTS

The WI monitors the crossing using digital inputs. The application engineer can set each digital input to operate in the following modes: Discrete, GFT, MTSS, or Not Used. The mode is selected in the MCF Configuration Tool on the WI Editor page by setting the Channel Type field as shown in the following figure.

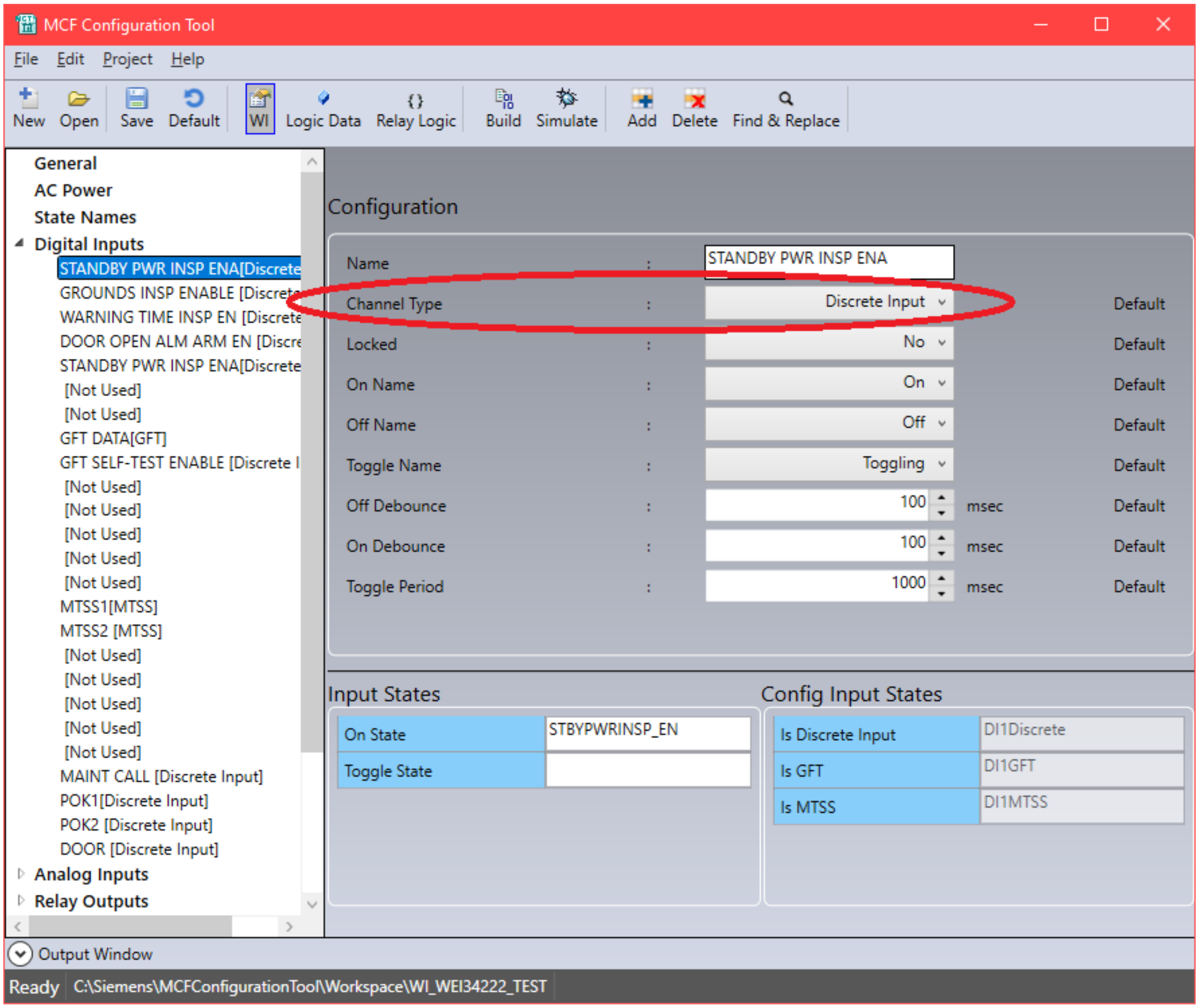

Figure 4-4 Digital Inputs Screen showing Channel Type

4.6.1 DISCRETE INPUTS

The WI declares discrete digital inputs to be in one of the following states: OFF, ON, or TOGGLING. When the WI detects a state change, the WI 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 executive 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 MCF 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 four 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 logic.

The application engineer configures the name of the discrete input channel, the state names, and the debounce settings through the WI Editor on the MCF Configuration Tool as shown in the following figure.

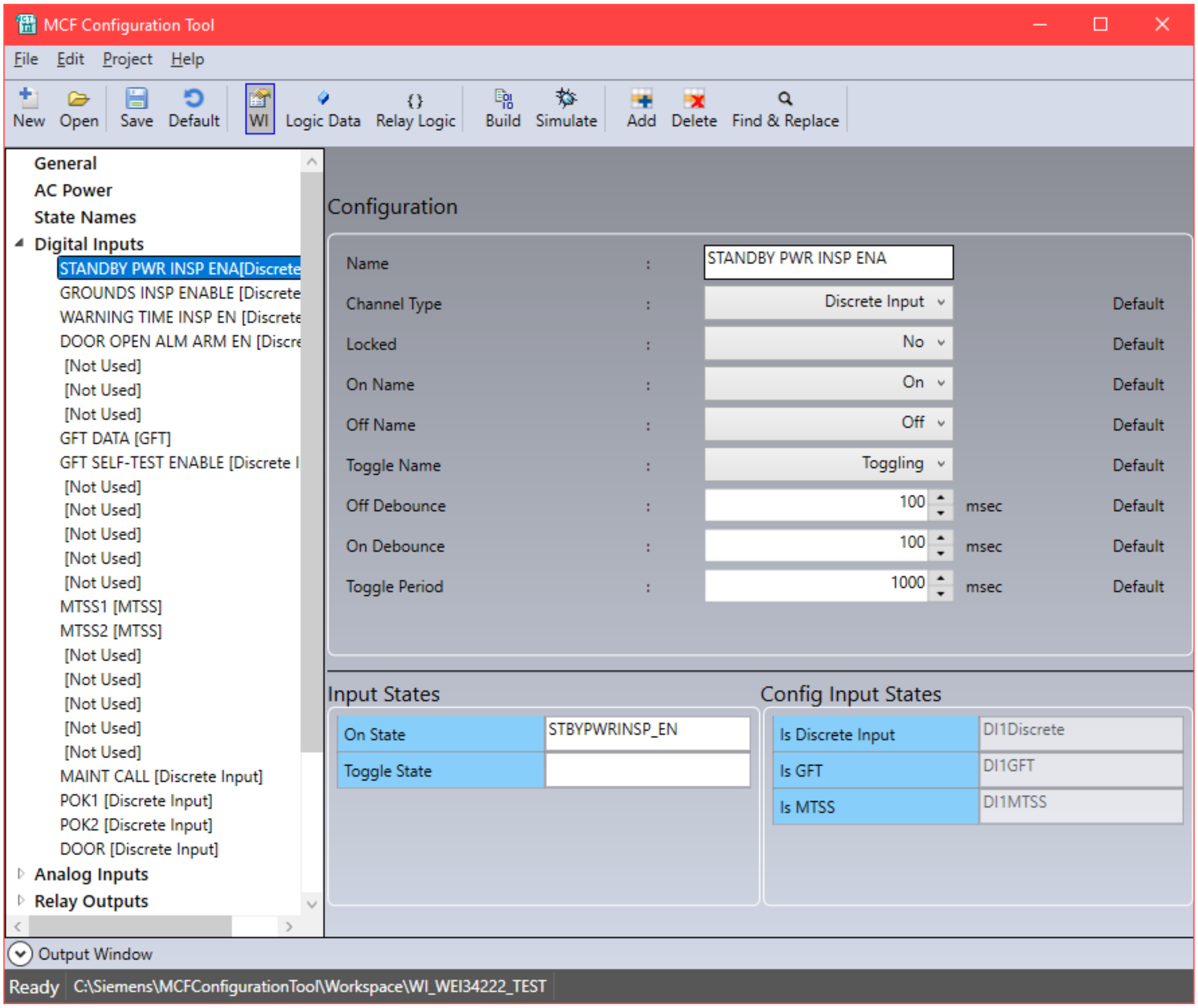

Figure 4-5 Discrete Input Configuration and Logic States

The following table provides a description for each discrete input parameter.

Table 4-10   Discrete Input Configuration Parameters

Parameter	***Range***	***Default***	***Web UI Editable***	***Description***
Name	20 characters	DI*xx*	Yes, unless Locked	Name used when logging state changes in the event log and included on the configuration report.
Channel Type	Discrete Input	Discrete Input	Yes, unless Locked	Selects the type of function the input used for. Must select “Discrete Input” for discrete inputs.
Locked	Yes or No	No	No	If set to Yes, the WebUI will not allow Field Personnel to change the channel name and state names of this channel.
On Name	On state name list	On	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	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	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	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	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.

The application engineer enters variable names for the discrete input logic states on the screen shown in Figure 4-5. The application engineer uses the logic state variable names in the relay logic. For a description of each discrete input logic state, see Table 4-11.

NOTE

NOTE

It is not necessary to use both the “On State” and the “Toggle State” logic states.

The “On State” logic state may be either set or clear and is not relevant if the “Toggle State” logic state is set.

Table 4-11 Digital Input Logic States

Logic State Label	***Functional Description***
Input Logic States	
On State	Set when the WI declares a digital input is on.
Toggle State	Set when the WI declares a digital input is TOGGLING.
Configuration Logic States	
Is Discrete Input	Set if the digital input channel is configured as a Discrete Input.
Is GFT	Set if the digital input channel is configured as a GFT input.
Is MTSS	Set if the digital input channel is configured as an MTSS input.

4.6.2 GFT INPUTS

The WI can process the pulsed data signal used by the A80297 GFT and the A81010 GFT2. There are 4 bits of data sent by the GFT: 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 also detects the “stuck low” and “stuck high” line status errors. The WI logs changes to each GFT status bit and the line status. The status bits and the line status are available to the MCF logic.

The application engineer configures the name of the GFT channel and the names of each battery bank monitored by the GFT on the screen shown in Figure 4-6. The WI will use the configured names in the logged events for the connected GFT.

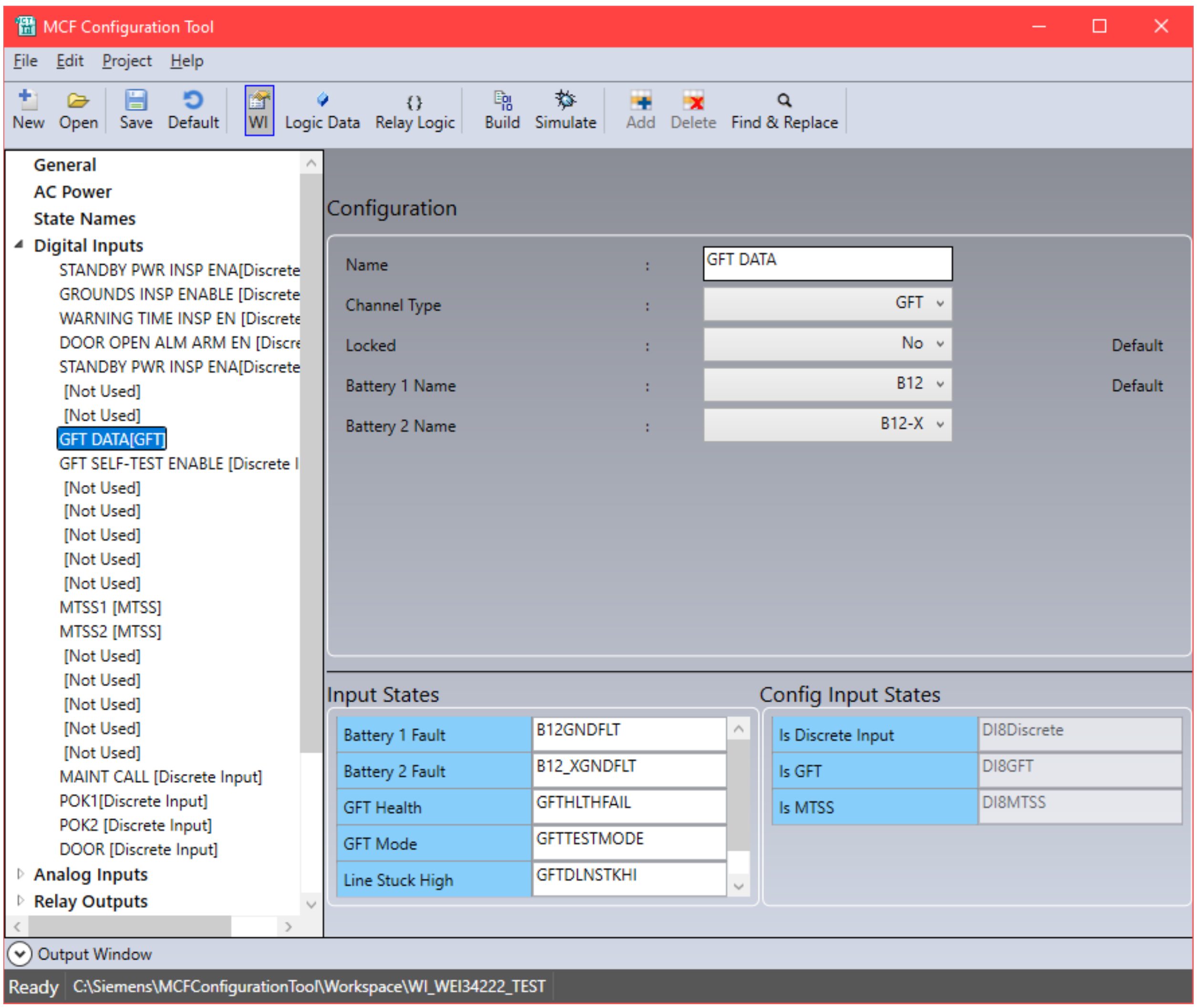

Figure 4-6 GFT Inputs

Table 4-12 describes each GFT input configuration parameter.

Table 4-12 GFT Configuration Parameters

Parameter	***Range***	***Default***	***Web UI Editable***	***Description***
Name	20 characters	DI*xx*	Yes, unless Locked	Name used when logging state changes in the event log and included on the configuration report.
Channel Type	GFT	Discrete Input	Yes, unless Locked	Selects the type of function the input used for. Must be selected as “GFT” for GFT inputs.
Locked	Yes or No	No	No	If set to Yes, the WebUI will not allow Field Personnel to change the channel name and state names of this channel.
Battery 1 Name	On state name list	On	Yes, unless Locked	Name used for the logging battery bank fault statuses for the battery 1 input of the connected GFT (refer to section 4.5).
Battery 2 Name	Off state name list	Off	Yes, unless Locked	Name used for the logging battery bank fault statuses for the battery 2 input of the connected GFT (refer to section 4.5).

The application engineer enters variable names for the GFT logic states on the screen shown in Figure 4-6: GFT Inputs. The application engineer uses the variable names in the relay logic. For a description of each GFT logic state, see Table 4-13.

Table 4-13 GFT Logic States

Logic State Label	*Functional Description*
Input Logic States	
Battery 1 Fault	Set if the GFT is reporting a ground fault on battery input 1.
Battery 2 Fault	Set if the GFT is reporting a ground fault on battery input 2.
GFT Health	Set if the GFT is not healthy. Clear if the GFT is healthy.
GFT Mode	Set if the GFT is in test mode. Clear if it is in normal mode.
Line Stuck High	Set if the GFT data signal is stuck high (energized continuously).
Line Stuck Low	Set if the GFT data signal is stuck low (no data signal present).
Configuration Logic States	
Is Discrete Input	Set if the digital input channel is configured as a Discrete Input.
Is GFT	Set if the digital input channel is configured as a GFT input.
Is MTSS	Set if the digital input channel is configured as an MTSS input.

4.6.3 MTSS INPUTS

The WI can process the pulsed data signal used by the MTSS. The MTSS sends 5 bits of data: Gate Up, Gate Down, Gate Level, Bell Power, and Bell Audio. Each data bit can be on or off. The WI logs changes to the MTSS status in the event log using fixed names for each status bit.

The WI can also detect the “stuck low” and “stuck high” line status errors. The WI will log changes to the line status.

The status bits and the line status are available to the MCF logic.

The application engineer configures the name of the MTSS channel on the screen shown in Figure 4-7. The WI uses the configured name in the logged events for the connected MTSS.

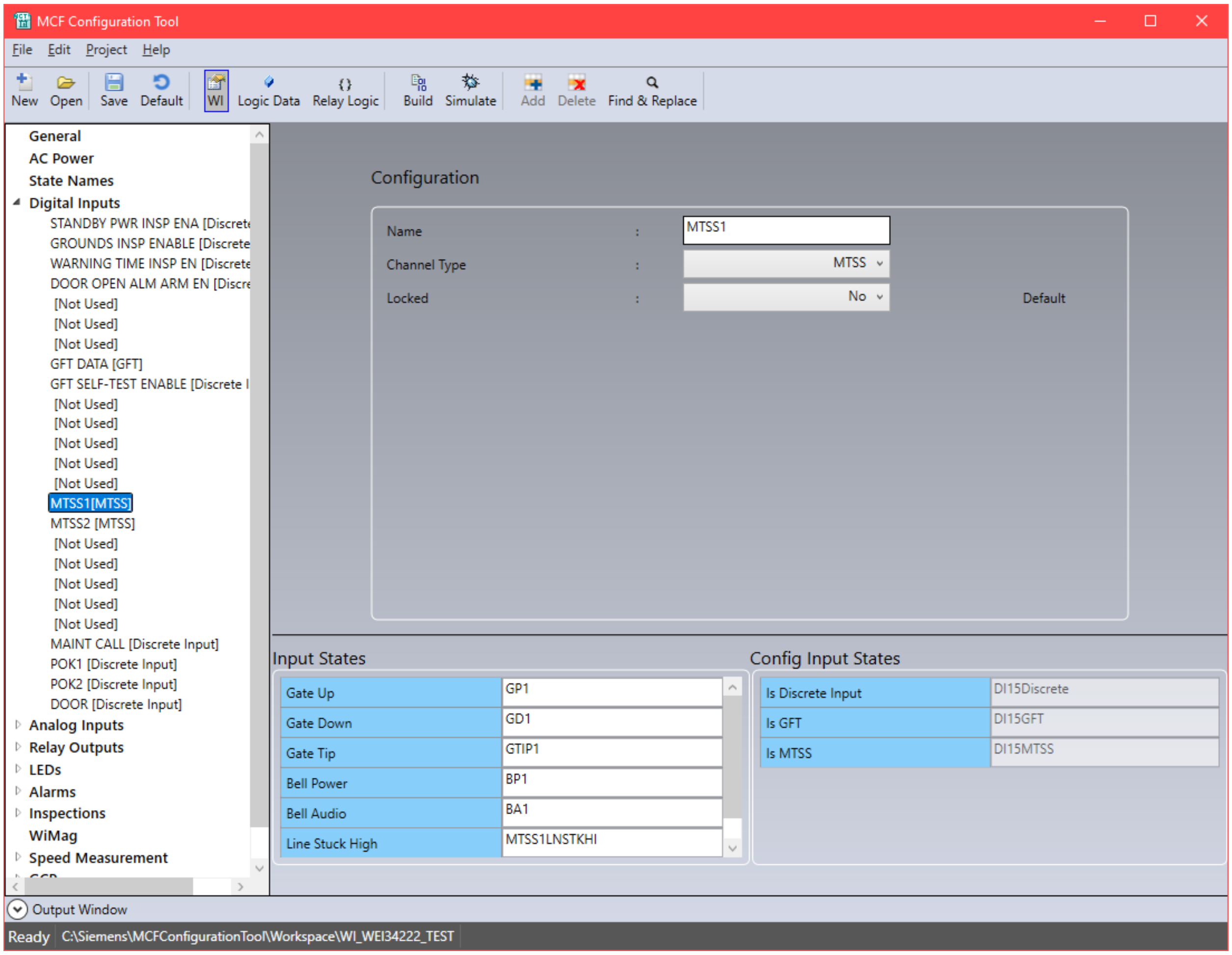

Figure 4-7 MTSS Inputs

Table 4-14 MTSS Configuration Parameters

Parameter	***Range***	***Default***	***Web UI Editable***	***Description***
Name	20 characters	DI*xx*	Yes, unless Locked	Name used when logging state changes in the event log and included on the configuration report.
Channel Type	MTSS	Discrete Input	Yes, unless Locked	Selects the type of function the input used for. Must be set to “MTSS” for MTSS inputs.
Locked	Yes or No	No	No	If set to Yes, the WebUI will not allow field personnel to change the channel name.

The application engineer enters variable names for the MTSS logic states on the screen shown in Figure 4-7. The application engineer uses the variable names in the MCF logic. Table 4-15 describes the available MTSS logic states.

Table 4-15 MTSS Logic States

Logic State Label	***Functional Description***
Input Logic States	
Gate Up	Set if the MTSS is reporting the monitored Gate Up input is on
Gate Down	Set if the MTSS is reporting the monitored Gate Down input is on
Gate Tip	Set if the MTSS is reporting the monitored Gate Tip input is on (gate is level)
Bell Power	Set if the MTSS is reporting the monitored Bell Power input is on (bell is powered)
Bell Audio	Set if the MTSS is reporting the monitored Bell Audio is on (bell is ringing)
Line Stuck High	Set if the MTSS data signal is stuck high (energized continuously).
Line Stuck Low	Set if the MTSS data signal is stuck low (no data signal present).
Configuration Logic States	
Is Discrete Input	Set if the digital input channel is configured as a Discrete Input.
Is GFT	Set if the digital input channel is configured as a GFT input.
Is MTSS	Set if the digital input channel is configured as an MTSS input.

4.6.4 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 Channel Type for an input to “Not Used” and the WI will ignore the input.

4.7 ANALOG INPUTS

The WI monitors battery banks at the crossing using the analog inputs. The executive software measures the voltage on the input by sampling the input at a user-configurable sample period. After sampling, the software averages the last user-configurable samples to determine the voltage. If the resulting voltage differs from the last logged voltage by a user-configurable resolution setting (or greater), the executive software logs a voltage change. The log entry includes the user-configured name of the battery bank and the voltage to the tenth of a volt (for example, OB 13.8V).

The software can compare the voltage to up to 4 voltage threshold values. If the voltage is greater than or equal to the threshold value, the software sets an MCF logic state. The MCF logic can use logic state for inspection or alarm logic.

The application engineer configures the settings for the analog inputs on the MCT screen shown in Figure 4-8.

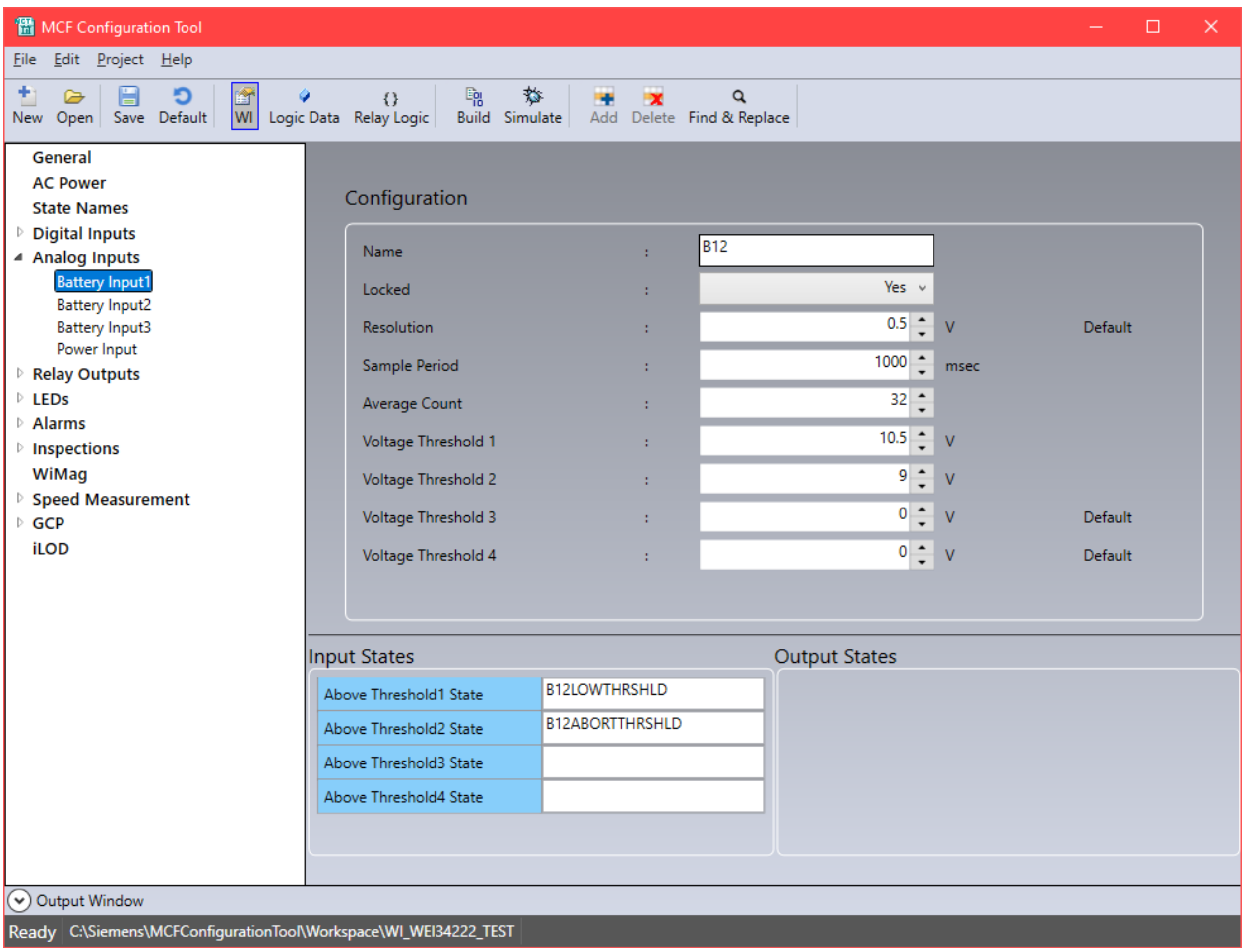

Figure 4-8 Analog Inputs

For a description of each analog input configuration parameter, see Table 4-16.

Table 4-16 Analog Input Configuration Parameters

Parameter Name	***Range***	***Default***	***Web UI Editable***	***Description***
Name	20 characters	BATT*x*	Yes, unless Locked	Name used when logging state changes in the event log and included on the configuration report.
Locked	Yes or No	No	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	Yes	Required change in voltage before the executive will log an entry.
Sample Period	100ms to 60,000ms	100ms	Yes	How often the executive will sample the input voltage.
Average Count	1 to 32	10	Yes	The number of consecutive samples the executive will average together to determine the input's voltage.
Voltage Threshold 1	0V to 36V	0V	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	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	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	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.

The application engineer enters variable names for the analog input logic states on the screen shown in Figure 4-7. The application engineer uses the variable names in the MCF logic. For a description of each analog input logic state, see Table 4-17.

Table 4-17 Analog Input Logic States

Logic State Label	***Functional Description***
Input Logic States	
Above Threshold1 State	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 1.
Above Threshold2 State	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 2.
Above Threshold3 State	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 3.
Above Threshold4 State	Set if the last logged voltage on the analog input channel is greater than or equal to the configured Voltage Threshold 4.

4.8 RELAY OUTPUTS

The WI sets the relay outputs to states as commanded by MCF logic. Each relay output has a channel name, OFF name, ON name and TOGGLE name. When the MCF logic commands relay outputs to change state, the executive software adds an entry to the event log showing the channel name and newly commanded state (e.g. TLITE FLASH).

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

The application engineer configures the settings for a relay output on the MCT screen shown in Figure 4-9: Relay Outputs.

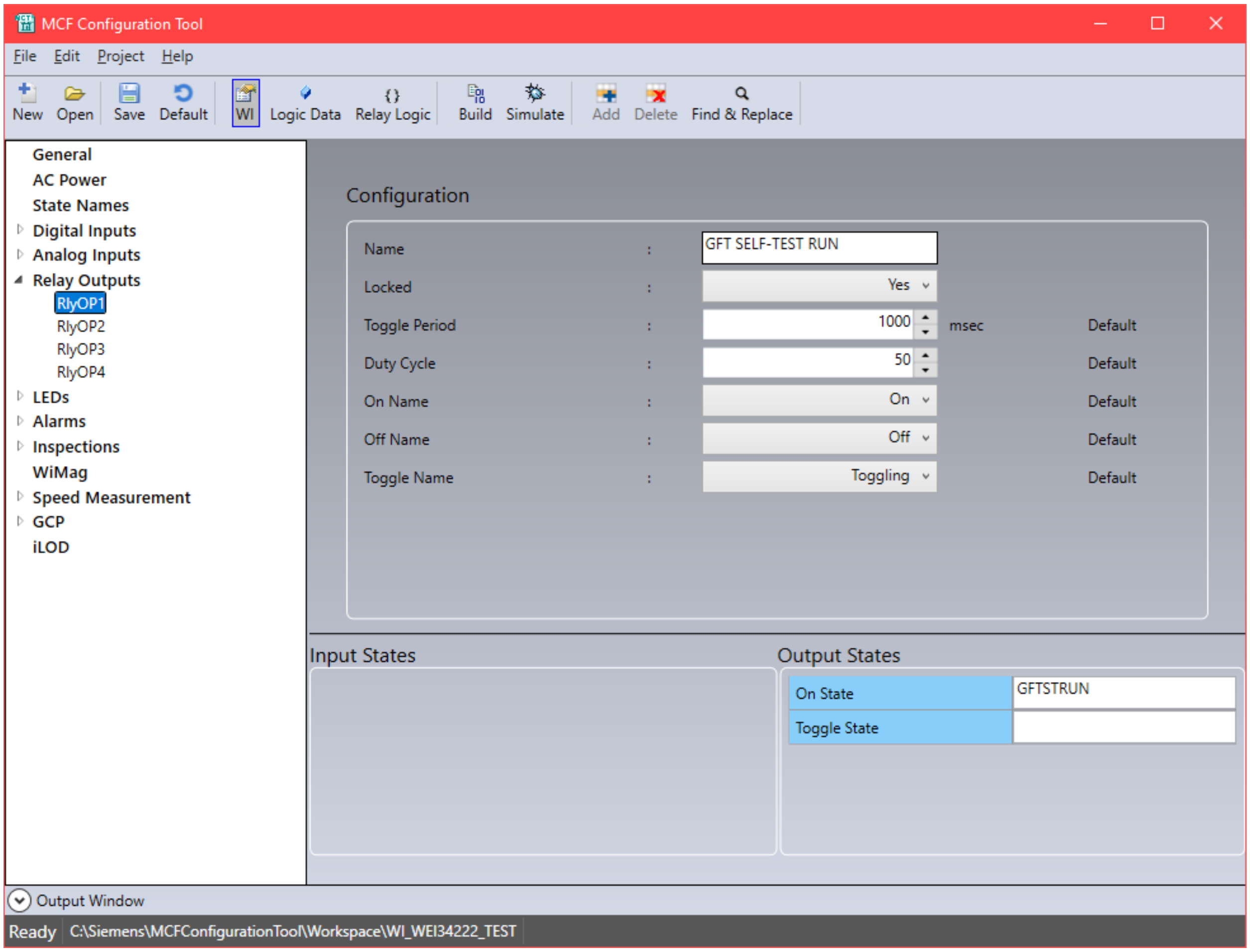

Figure 4-9 Relay Outputs

For a description of each relay output configuration parameter, see Table 4-18.

Table 4-18 Relay Output Configuration Parameters

Parameter Name	***Range***	***Default***	***Web UI Editable***	***Description***
Name	20 characters	RLY*x*	Yes, unless Locked	Name used when logging state changes in the event log and included on the configuration report.
Locked	Yes or No	No	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	Yes	If commanded to toggle, this is the period of time for each toggle cycle.
Duty Cycle	5% to 95%	50%	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	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	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	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.

The application engineer enters variable names for the relay output logic states on the screen shown in Figure 4-9. The application engineer uses the variable names in the MCF logic. For a description of each relay output logic state, see Table 4-19.

Table 4-19 Relay Output Logic States

Logic State Label	***Functional Description***
Output Logic States	
On State	If set, the executive will turn ON the relay output channel.
Toggle State	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.

4.9 APPLICATION LEDS

The MCF logic controls 8 general purpose Application LEDs. The application engineer may use the LEDs for any 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 logic 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). The application engineer configures the name of an Application LED on the MCT screen shown in Figure 4-10.

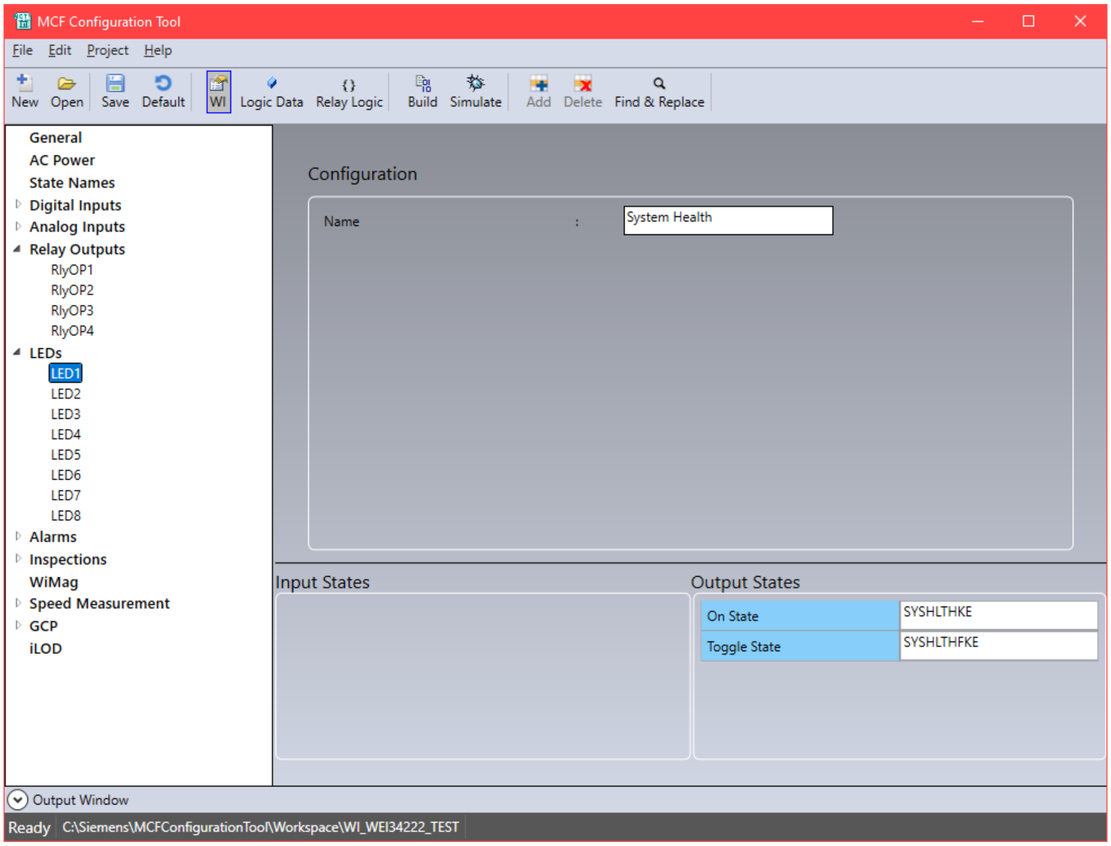

Figure 4-10 Application LEDs

Table 4-20 Application LED Configuration Parameters

Parameter Name	***Range***	***Default***	***Web UI Editable***	***Description***
Name	20 characters	LED*x*	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.

The application engineer enters variable names for the Application LED logic states on the screen shown in Figure 4-10. The application engineer uses the variable names in the relay logic. For a description of the Application LED logic states, see Table 4-21.

Table 4-21 LED Logic States

Logic State Label	***Functional Description***
Output Logic States	
On State	If set by the MCF logic, the WI will turn on the LED.
Toggle State	If set by the MCF logic, the WI will toggle the LED (the LED flashes). The WI will ignore the On State logic state if the MCF logic sets this logic state.

4.10 APPLICATION MESSAGES AND ALARMS

The application engineer may create messages, which can be added to the event log by MCF logic. The WI may optionally send the message to the office as a traditional WAMS alarm or as an alarm transmitted using the Siemens digitalization protocol through an ITCM system.

The WI considers each application message to be 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 as an “APPL” event type. The Set Text may include a data value (for example, a battery voltage). If a transmission method is enabled, the executive software will also send the message to the office, including the configured “Set Code”.

When the MCF logic clears the application message status, the executive software adds the “Clear Text” into the event log as an “APPL” event type. The Clear Text may include a data value. If a transmission method is enabled, the executive software will also send the message to the office, including the configured “Clear Code”.

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 blank.

The application engineer configures the settings for Application Messages and Alarms on the screen shown in Figure 4-11.

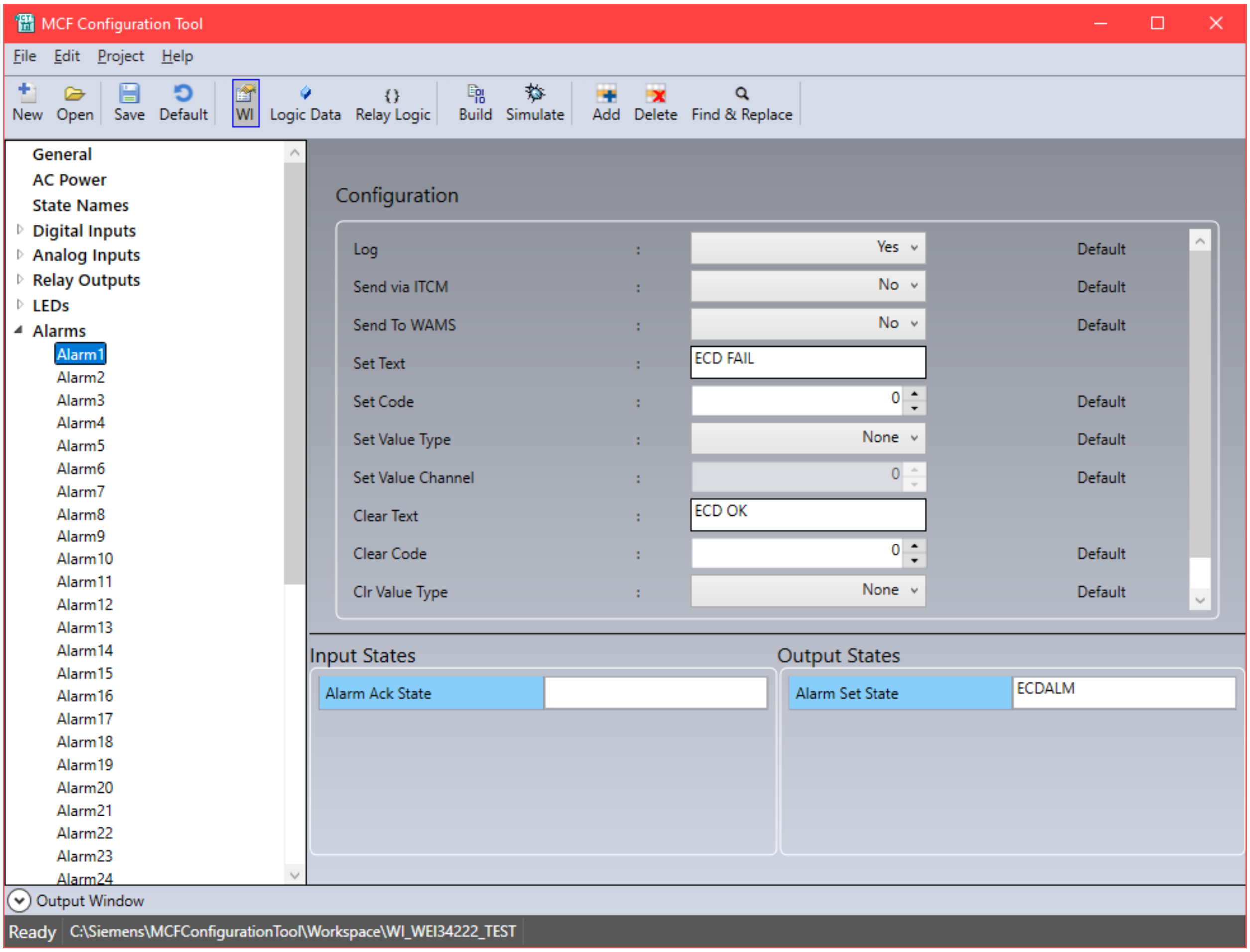

Figure 4-11 Application Message and Alarms

For a description of each Alarm configuration parameter, see Table 4-22.

Table 4-22 Alarm Configuration Parameters

Parameter Name	Range	Default	Web UI Editable	Description
Log	Yes or No	Yes	No	If yes, when the MCF 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 MCF 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 ITCM	Yes or No	No	No	If yes, when the MCF logic sets the alarm's logic state and if the Set Text is not blank, the executive will send a message to the office over the ITCM system using the Siemens digitalization protocol. The message includes the Set Text, Set Code, and Set Value. When the MCF logic clears the alarm's logic state and if the Clear Text is not blank, the executive will send a message to the office over the ITCM system. The message includes the Clear Text, Clear Code, and Clear Value.
Send to WAMS	Yes or No	No	No	If yes, when the MCF logic sets the alarm's logic state and if the Set Text is not blank, the executive will send a message to the office over using the Siemens WAMS protocol. The message includes the Set Text, Set Code, and Set Value. When the MCF logic clears the alarm's logic state and if the Clear Text is not blank, the executive will send a message to the office using the Siemens WAMS protocol. The message includes the Clear Text, Clear Code, and Clear Value.
Set Text	64 characters	<blank>	No	Text to include in log entries and alarm messages when the alarm is set.
Set Code	0 to 255	0	No	The code to use for this alarm in alarm messages when the alarm status is set.

Parameter Name	Range	Default	Web UI Editable	Description
Set Value Type	None, Battery Input Voltage, Timer, Digital Input, Relay Output, Logic Bit	None	No	The value to include in the log entry or alarm message when the alarm is set.
Set Value Channel	0 to 4000	0	No	The channel that determines where the executive will ready the Set Value from according to the Set Value Type. The "channel" corresponds to the type of value that is being included in the alarm. If the MCF is sending a "low battery" alarm and the "Set Value Type" is "Battery Input Voltage", then the "Set Value Channel" would be the battery input channel number to read the voltage from when the alarm is created. If the "Set Value Type" is a timer, then the "Set Value Channel" would be the timer number from the logic, and so on.
Clear Text	64 characters	<blank>	No	Text to include in log entries and alarm messages when the alarm is cleared.
Clear Code	0 to 255	0	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	No	The value to include in the log entry or alarm message when the alarm is cleared.
Clear Value Channel	0 to 4000	0	No	The channel that determines where the executive will ready the Clear Value from according to the Clear Value Type. The "channel" corresponds to the type of value that is being included in the alarm. If the MCF is sending a "low battery" alarm and the "Set Value Type" is "Battery Input Voltage", then the "Clear Value Channel" would be the battery input channel number to read the voltage from when the alarm is created. If the "Set Value Type" is a timer, then the "Clear Value Channel" would be the timer number from the logic, and so on.

The application engineer enters variable names for the Alarm logic states on this screen. The application engineer uses the variable names in the MCF logic. For a description of the Alarm logic states, see Table 4-23.

Table 4-23 Alarms Logic States

Logic State Label	*Functional Description*
Input Logic States	
Alarm ACK State	Reserved for future use.
Output Logic States	
Alarm Set State	When the MCF logic changes this logic state from clear to set, the WI will initiate the configured actions, unless the "Set Text" is blank. When the MCF logic changes this logic state from set to clear, the WI will initiate the configured actions, unless the "Clear Text" is blank.

4.11 INSPECTIONS

The WI can automatically perform periodic crossing inspections. The MCF logic determines when inspections pass. The executive software triggers the MCF logic to execute the inspections from an inspection schedule and by direct command from the web-browser user interface.

4.11.1 INSPECTION TYPES

The application engineer selects the type of inspection. The WI supports four types of inspections: Annual, Quarterly, Monthly, and Weekly. Annual inspections are intended to be run once per year. Quarterly inspections are intended to run once every three months, Monthly inspections are intended to run once per month, and weekly inspections are intended to run once per week. However, the frequency of running each inspection is determined by the inspection triggers as expected in section 4.11.3.

4.11.2 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.

4.11.3 INSPECTION TRIGGERS

The system may trigger inspections to run (change state to Pending, see section 4.11.2) using three methods: Inspection Schedule, User Interface, and Back-office Commands.

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 6).

The user may manually trigger inspections using the WebUI, via the Inspection Status screen.

4.11.4 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 triggered and the type of inspection.

4.11.5 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

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

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 Time (234.259)”, the measured warning time was 21 seconds, and this is an annual test.

4.11.6 INSPECTION PROGRAMMING USING MCT

The application engineer configures inspection on the Inspections screen shown in Figure 4-12.

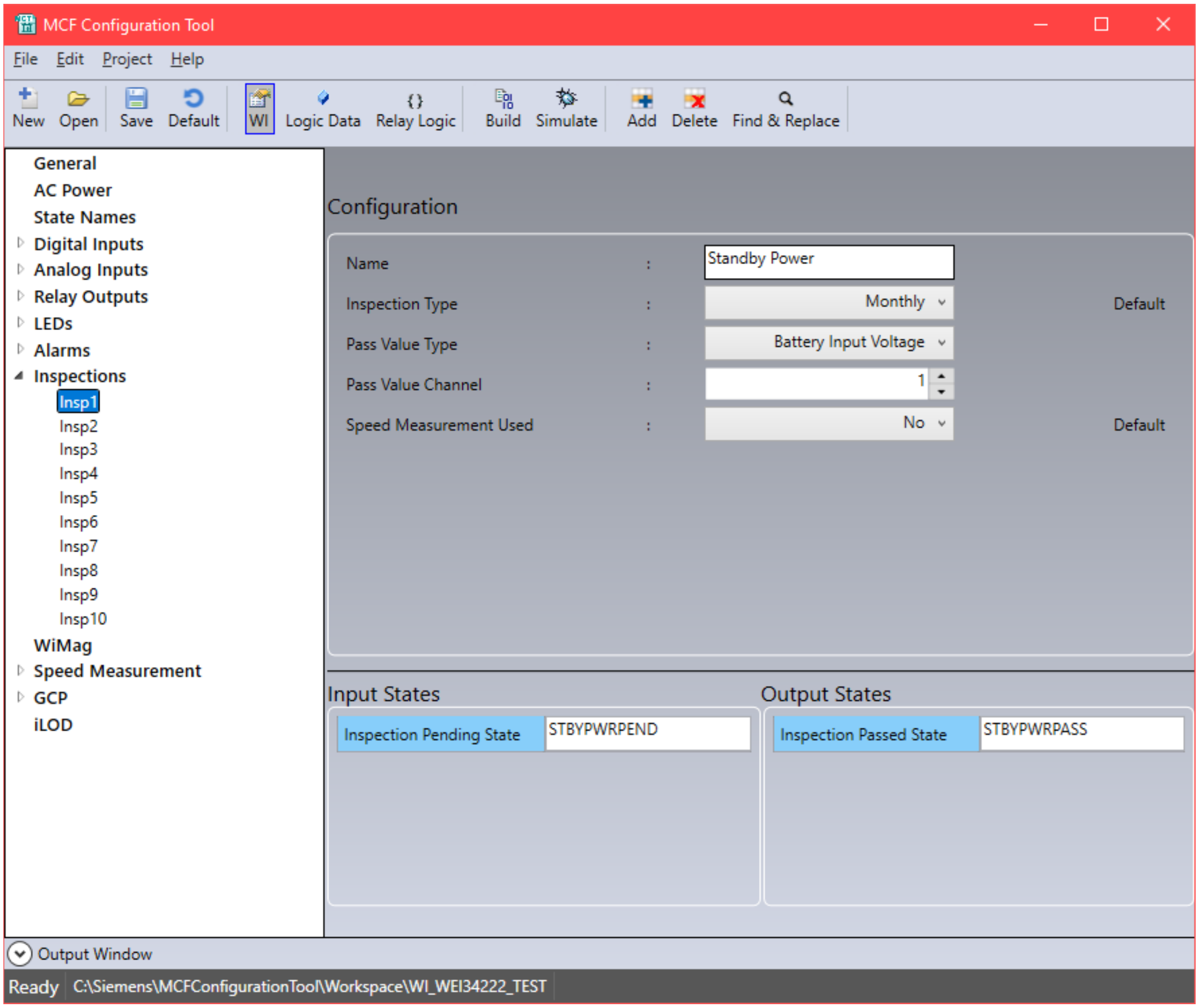

Figure 4-12 Inspections Screen

For a description of each inspection parameter, see Table 4-24.

Table 4-24 Inspections Configuration Parameters

Parameter Name	Range	Default	Web UI Editable	Description
Name	64 characters	Inspection *x*	No	Name of the inspection, which will be used in the event log and reported inspection results.
Inspection Type	Annual, Quarterly, Monthly, Weekly	Quarterly	No	Defines whether the inspection should be performed once per year (annual), once every 3 months (quarterly), once per month (monthly), or once per week (weekly).
Pass Value Type	None, Battery Input Voltage, Timer, Digital Input, Relay Output, Logic Bit	None	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	No	This specifies the channel of the pass value type to include in the results (e.g. battery input 1). The “channel” corresponds to the type of value that is being included in the inspection. If the “Pass Value Type” is a timer, then the “Pass Value Channel” would be the timer number from the logic, and so on.
Speed Measurement Used	Yes or No	No	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	No	If Speed Measurement Used is Yes, this determines which entry in the Speed Measurement data to associate with this inspection.

The application engineer enters variable names for the Inspections logic states on this screen. The application engineer uses the variable names in the relay logic. For a description of the Inspections logic states, see Table 4-25.

Table 4-25 Inspections Logic States

Logic State Label	***Functional Description***
Input Logic States	
Inspection Pending State	The WI sets this logic state to trigger the MCF logic to run the inspection. The WI will set this logic state when the scheduled inspection date is reached, when manually triggered by a user, or by back-office command. The logic state will stay set until the MCF logic sets the Inspection Passed State or a user manually clears it via the web-browser user interface.
Output Logic States	
Inspection Passed State	The MCF 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.

4.12 GCP 4000, MS 4000, GCP 5000, AND GCP 3000+ INTERFACE

The WI receives I/O statuses and configuration data messages from a GCP over a network. The I/O statuses and the configuration data statuses are available to the MCF logic, which eliminates the need to wire physical I/O from the GCP to the WI. The WI supports an interface with all GCP 4000 models, MS 4000 models, GCP 5000 models and GCP 3000+ models.

The WI monitors the link health with the GCP. If the WI stops receiving status messages from the GCP, it will set the link health status to unhealthy. The application engineer can set the timeout for the link health in the MCF. The link health status is available to the MCF logic.

The WI receives the status of GCP I/O, which is available to the MCF logic. Since the GCP is highly configurable, not all I/O status are relevant in all conditions. The GCP reports the I/O statuses that are used in the GCP's current configuration. The "used" statuses are available to the MCF logic.

The WI will also log changes in the I/O statuses and configuration statuses, as reported from the GCP, into the event log.

4.12.1 GENERAL GCP INTERFACE CONFIGURATION

The application engineer configures the general GCP interface parameters on the General GCP Configuration screen shown in Figure 4-13.

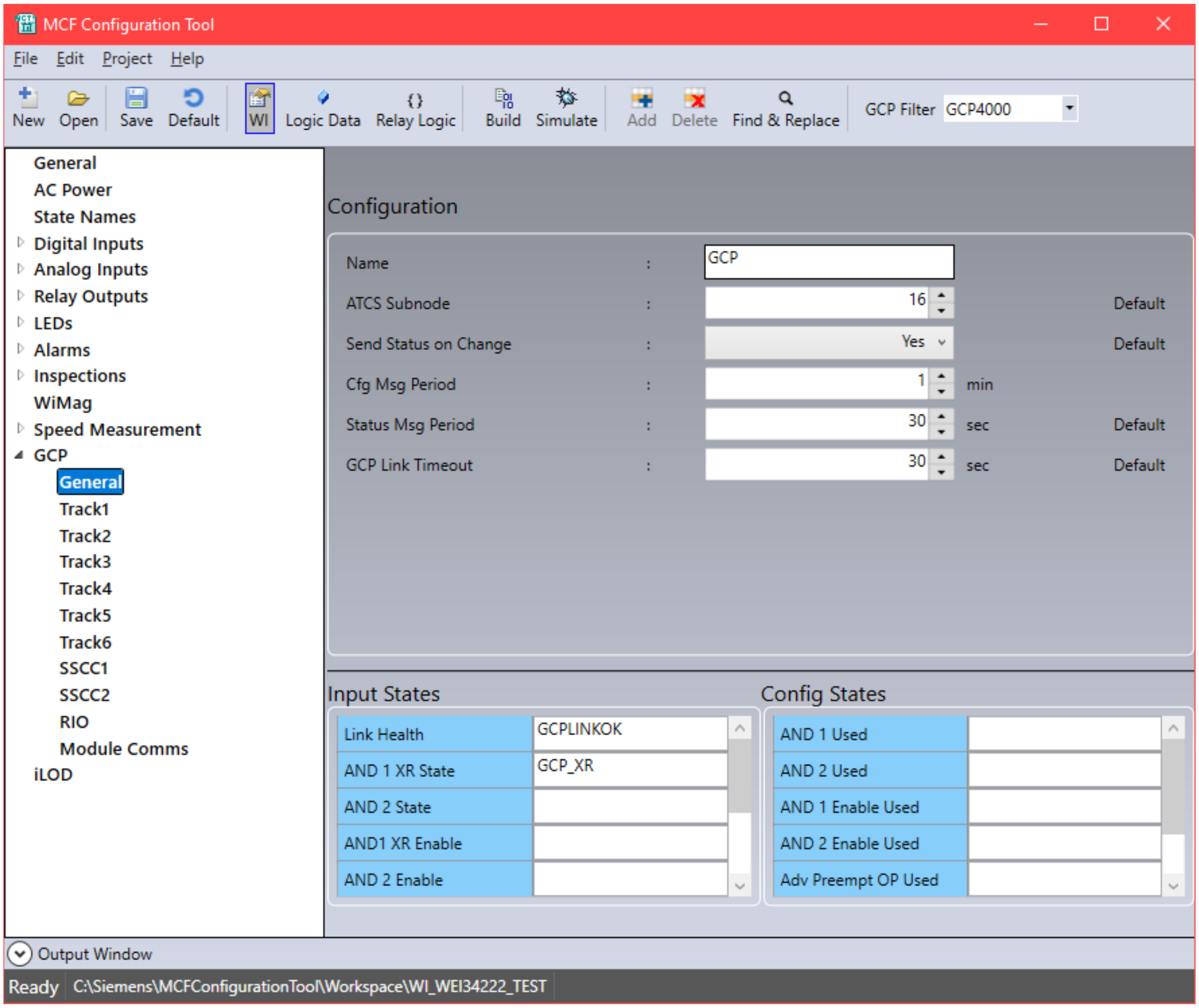

Figure 4-13 General GCP Configuration Screen

Table 4-26 describes each general GCP configuration parameter.

Table 4-26   General GCP Configuration Parameters

Parameter Name	Range	Default	Web UI Editable	Description
Name	20 characters	GCP IF	Yes	Name used for the GCP interface in logs and reports.
ATCS Subnode	0 to 99	16	Yes	The ATCS subnode of the GCP. *Note: The ATCS address of the WI and the GCP must have the same railroad, line, and group values.*
Send Status on Change	Yes or No	Yes	Yes	If Yes, the GCP will send status messages when any I/O status changes state, not just on the status message period.
Cfg Msg Period	0 to 60 minutes	0 minutes	Yes	Time period between configuration messages. If 0, the GCP will send configuration messages only on initiation of the link and on configuration data changes.
Status Msg Period	0 to 300 seconds	30 seconds	Yes	Period of status messages. If 0, the GCP will not send periodic status messages.
GCP Link Timeout	10 to 600 seconds	30 seconds	Yes	If the WI does not receive messages from the GCP for this length of time, it will clear the Link Health logic state and log the connection as unhealthy.

4.12.2 GCP FILTER

The WI supports an interface to the GCP 4000, the GCP 5000, and the GCP 3000+. The application engineer may filter the view in MCT to see only the logic states that apply to the type of GCP using the “GCP Filter” option. This is shown in the following figure.

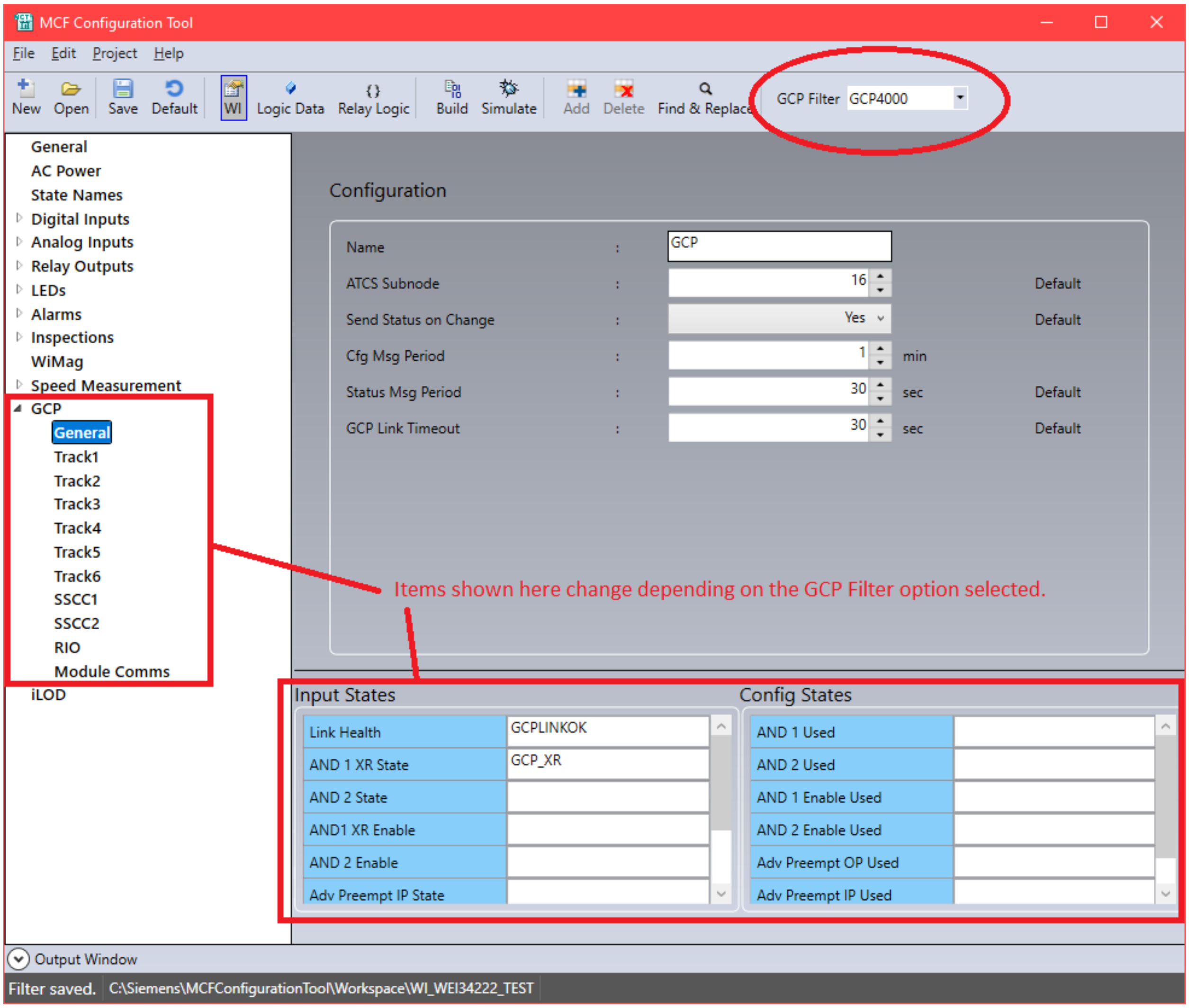

Figure 4-14 GCP Filter Option

With the GCP Filter selected only the GCP modules and logic states associated with the selected GCP model will be displayed. However, all the logic states are present and available for all models in the MCF. The GCP Filter just filters and organizes the view. The application engineer can design one MCF to handle more than one GCP model. The selected GCP Filter does not restrict the MCF to only that GCP model.

4.12.3 GCP GENERAL PURPOSE LOGIC STATES

The application engineer can name the general purpose logic states for a GCP 4000 as shown in Figure 4-14. Table 4-27 describes the available general purpose logic states for all GCP models. The table shows which logic states are displayed for the selected GCP Filter option.

Table 4-27 GCP General Purpose Logic States

Logic State Label	*GCP 4000 / 5000*	*GCP 3000+*	*MS 4000*	*Functional Description*
Input Logic States				
Link Health	Yes	Yes	Yes	Is set while the communication link to the GCP is healthy. Clears when it is unhealthy.
AND 1 XR State	Yes	Yes	Yes	Follows the AND 1 XR state in the GCP.
AND 2 State	Yes	No	No	Follows the AND 2 state
AND1 XR Enable	Yes	Yes	No	Follows the AND 1 XR Enable state in the GCP.
AND 2 Enable	Yes	No	No	Follows the AND 2 Enable state
Adv Preempt IP State	Yes	Yes	No	Set if the GCP advanced preempt input is energized.
Adv Preempt OP State	Yes	Yes	No	Set if the GCP advanced preempt output is energized.
GCP On Standby	Yes	Yes	Yes	Set if the GCP is running standby CPU and I/O modules instead of main CPU and I/O modules.
Maint Call	Yes	Yes	Yes	Set if the GCP maint call output is energized.
Configuration Logic States				
AND 1 Used	Yes	Yes	No	Set if AND1 is used in the GCP.
AND 2 Used	Yes	No	No	Set if AND 2 is used in the GCP.
AND 1 Enable Used	Yes	Yes	No	Set if AND 1 Enable is used in the GCP.
AND 2 Enable Used	Yes	No	No	Set if AND 2 Enable is used in the GCP.
Adv Preempt OP Used	Yes	Yes	No	Set if the Adv Preempt output is used in the GCP.
Adv Preempt IP Used	Yes	Yes	No	Set if the Adv Preempt input is used in the GCP.
GCP3000 Plus	No	Yes	No	Set if the connected GCP is a GCP 3000+.

4.12.4 GCP TRACK LOGIC STATES

Each GCP model supports a different number of track modules. Each track module is listed on the MCF Configuration Tool and each has input logic states and configuration logic states. The number of track modules listed and the logic states shown will change based on the GCP Filter selected as shown in Figure 4-14.

Figure 4-15 shows the MCF Configuration Tool screen to set the logic state names for a GCP 4000 and GCP 5000 track module. The GCP 4000 and the GCP 5000 support 6 track modules. The GCP 3000+ supports 2 track modules. The MS 4000 supports 1 track module.

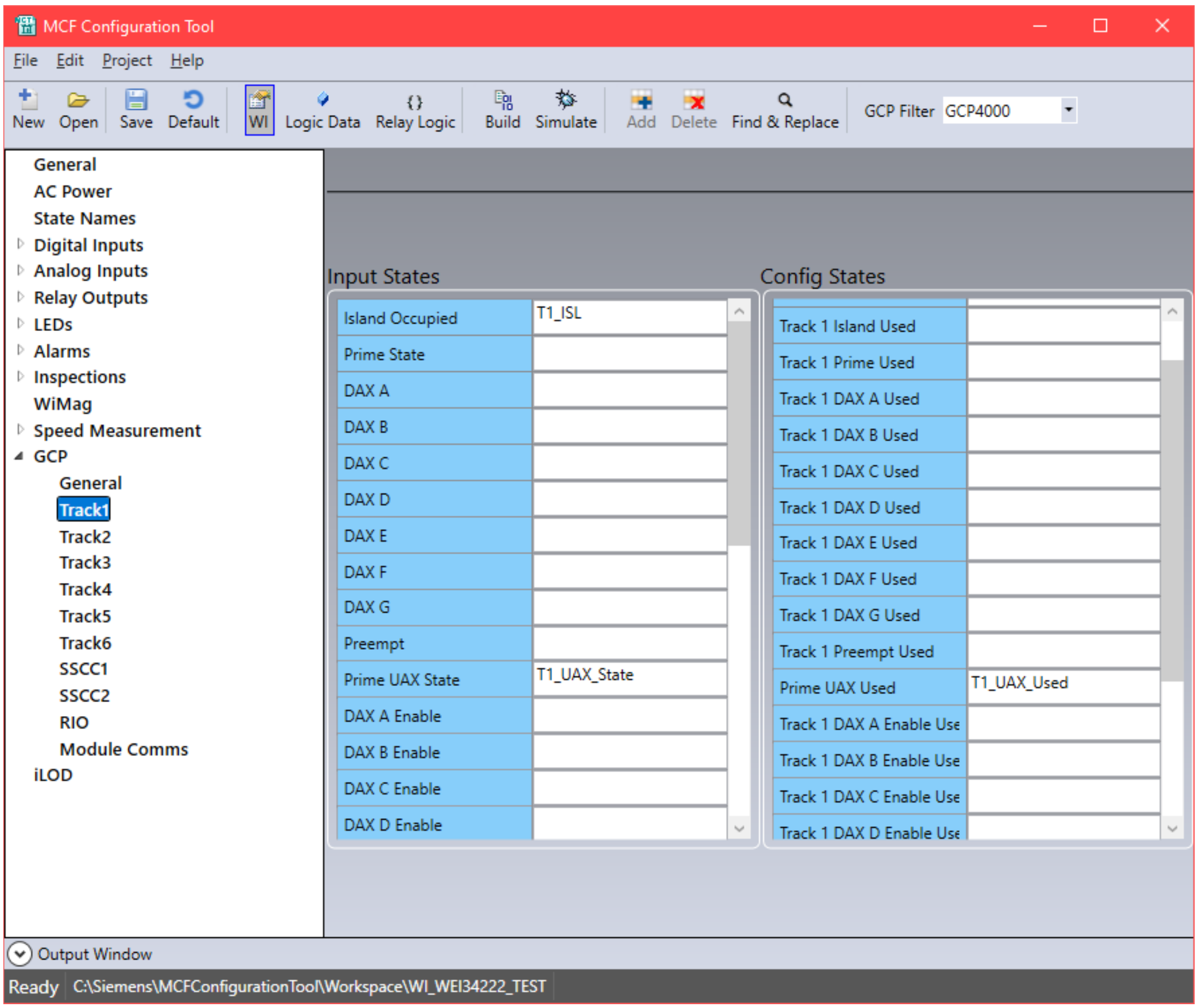

Figure 4-15 GCP Track Module Logic States

Table 4-28 describes each track module logic state and shows which logic states the MCF Configuration Tool will show for each GCP Filter option.

Table 4-28 GCP Track Module Input Logic States

Logic State Label	***GCP 4000 / 5000***	***GCP 3000+***	***MS 4000***	***Functional Description***
Island Occupied	Yes	Yes	Yes	Set – Island occupied Clear – Island unoccupied
Prime State	Yes	Yes	Yes	Set – Prime predictor not predicted Clear – Prime predictor predicting arriving train
DAX A	Yes	Yes	No	Set – DAX not predicted Clear – DAX predicts arriving train
DAX B	Yes	Yes	No	
DAX C	Yes	Yes	No	
DAX D	Yes	Yes	No	
DAX E	Yes	No	No	
DAX F	Yes	No	No	
DAX G	Yes	No	No	
Preempt	Yes	No	No	Set – Preempt predictor not predicted Clears – Preempt predictor predicts arriving train
Prime UAX State	Yes	Yes	Yes	Set – UAX input is energized Clear – UAX input is de-energized
DAX A Enable	Yes	No	No	Set – DAX Enable input is energized Clear – DAX Enable input is de-energized
DAX B Enable	Yes	No	No	
DAX C Enable	Yes	No	No	
DAX D Enable	Yes	No	No	
DAX E Enable	Yes	No	No	
DAX F Enable	Yes	No	No	
DAX G Enable	Yes	No	No	
Preempt Enable	Yes	No	No	Set – Preempt Enable input is energized Clear – Preempt Enable input is de-energized
GCP Card Health	Yes	Yes	Yes	Set if the track module is healthy.

GCP OOS	Yes	Yes	Yes	Set if the track module has been taken out of service.
Island OOS	Yes	Yes	Yes	Set if the island circuit of the track module has been taken out of service.
IN 1.1	Yes	Yes	Yes	Set if input 1 on the track card is energized.
IN 1.2	Yes	Yes	Yes	Set if input 2 on the track card is energized.
VRO 1 State	Yes	Yes	Yes	Set if vital relay output 1 is energized on the track card.
VRO 2 State	Yes	Yes	Yes	Set if vital relay output 2 is energized on the track card.
Train On Approach	Yes	Yes	Yes	Clears when a train is on the approach.
Train Inbound	Yes	Yes	Yes	Clears when there is an inbound train (train moving toward the island).
Trk Wrapped	Yes	No	No	Set if the track circuit is wrapped.
Direction Isl Tx to Rx	Yes	No	No	Set if the direction of the train is from the transmitter towards the receiver as measured on the inbound move. The MCF logic should ensure the “Direction Available” logic state is set before using this logic state.
Direction Isl Rx to Tx	Yes	No	No	Set if the direction of the train is from the receiver towards the transmitter as measured on the inbound move. The MCF logic should ensure the “Direction Available” logic state is set before using this logic state.
Outbound RX	Yes	No	No	Set if there is an outbound train that is moving from the transmitter towards the receiver.
Outbound TX	Yes	No	No	Set if there is an outbound train moving from the receiver towards the transmitter.

Table 4-29 GCP Track Module Configuration Logic States

Logic State Label	***GCP 4000 / 5000***	***GCP 3000+***	***MS 4000***	***Functional Description***
Track *x* Used	Yes	Yes	Yes	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.
Track *x* GCP Used	Yes	No	No	Set if the approach track circuit on the track module is used.
Track *x* Island Used	Yes	Yes	Yes	Set if the island track circuit on the track module is used.
Track *x* Prime Used	Yes	Yes	Yes	Set if the prime predictor on the track module is used.
Track *x* DAX A Used	Yes	Yes	No	Set if the DAX predictor on the track module is used.
Track *x* DAX B Used	Yes	Yes	No	
Track *x* DAX C Used	Yes	Yes	No	
Track *x* DAX D Used	Yes	Yes	No	
Track *x* DAX E Used	Yes	No	No	
Track *x* DAX F Used	Yes	No	No	
Track *x* DAX G Used	Yes	No	No	
Track *x* Preempt Used	Yes	No	No	Set if the preempt predictor on the track module is used.
Prime UAX Used	Yes	Yes	Yes	Set if the Prime UAX has been enabled.
Track *x* DAX A Enable Used	Yes	No	No	Set if the DAX Enable has been enabled.
Track *x* DAX B Enable Used	Yes	No	No	
Track *x* DAX C Enable Used	Yes	No	No	
Track *x* DAX D Enable Used	Yes	No	No	
Track *x* DAX E Enable Used	Yes	No	No	Set if the DAX Enable has been enabled.
Track *x* DAX F Enable Used	Yes	No	No	
Track *x* DAX G Enable Used	Yes	No	No	

Track *x* Wrap Used	Yes	No	No	Set if the track wrap input of the track module has been enabled.
Direction Available	Yes	No	No	Set if direction statuses are valid and can be used in logic.

4.12.5 GCP SSCC MODULE LOGIC STATES

The GCP 4000 and GCP 5000 support integrated solid state crossing controllers (SSCC) modules. The GCP 3000+ and the MS 4000 do not support the SSCC modules. If the GCP 3000+ or the MS 4000 is selected in the GCP Filter option, the SSCC module logic states will not be displayed. Figure 4-16 shows the MCF Configuration Tool screen where the application engineer can name the logic states.

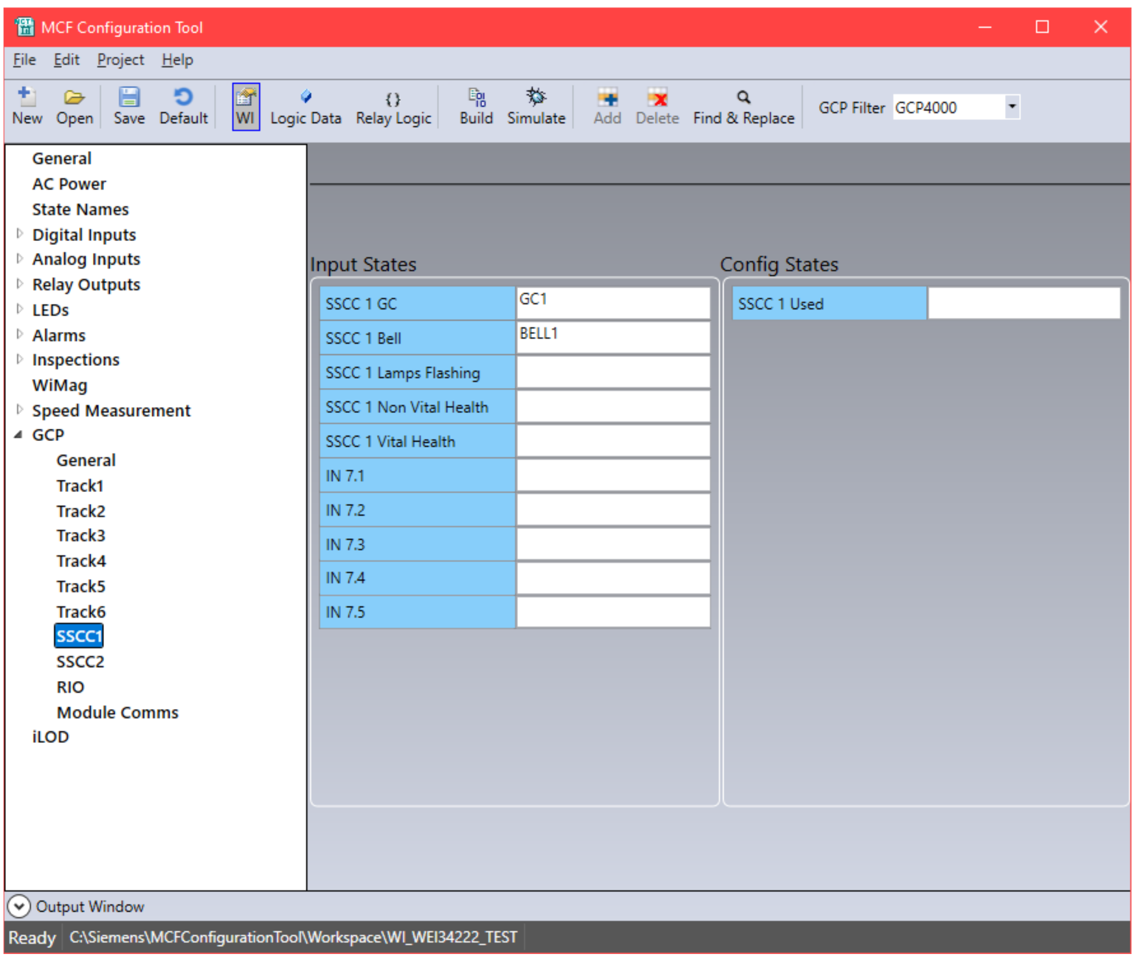

Figure 4-16 GCP SSCC Module Logic States Screen

Table 4-30 describes each logic state.

Table 4-30 GCP SSCC Module Logic States

Logic State Label	***Functional Description***
Input Logic States	
SSCC x GC	Set if the gate control output of the SSCC is energized. Clear if the gate control output of the SSCC module is de-energized.
SSCC x Bell	Set if the bell output of the SSCC module is energized. Clear if the bell output of the SSCC module is de-energized.
SSCC x Lamps Flashing	Set if the lamp output of the SSCC module is flashing. Clear if the lamp output of the SSCC module is not flashing.
SSCC x Non Vital Health	Set if the non-vital health of the SSCC module is good.
SSCC x Vital Health	Set if the vital health of the SSCC module is good.
Logic State Label	***Functional Description***
IN x.1	Set if the SSCC Module input used and is energized.
IN x.2	
IN x.3	
IN x.4	
IN x.5	
Configuration Logic States	
SSCC 1 Used	Set if the SSCC module is used in the GCP configuration.

4.12.6 GCP RIO MODULE LOGIC STATES

The GCP 4000 and GCP 5000 support up to 3 RIO modules. The GCP 3000+ supports one RIO module. The MS 4000 does not support a RIO module. The MCF Configuration Tool screen to name the GCP RIO module logic states is shown in Figure 4-17.

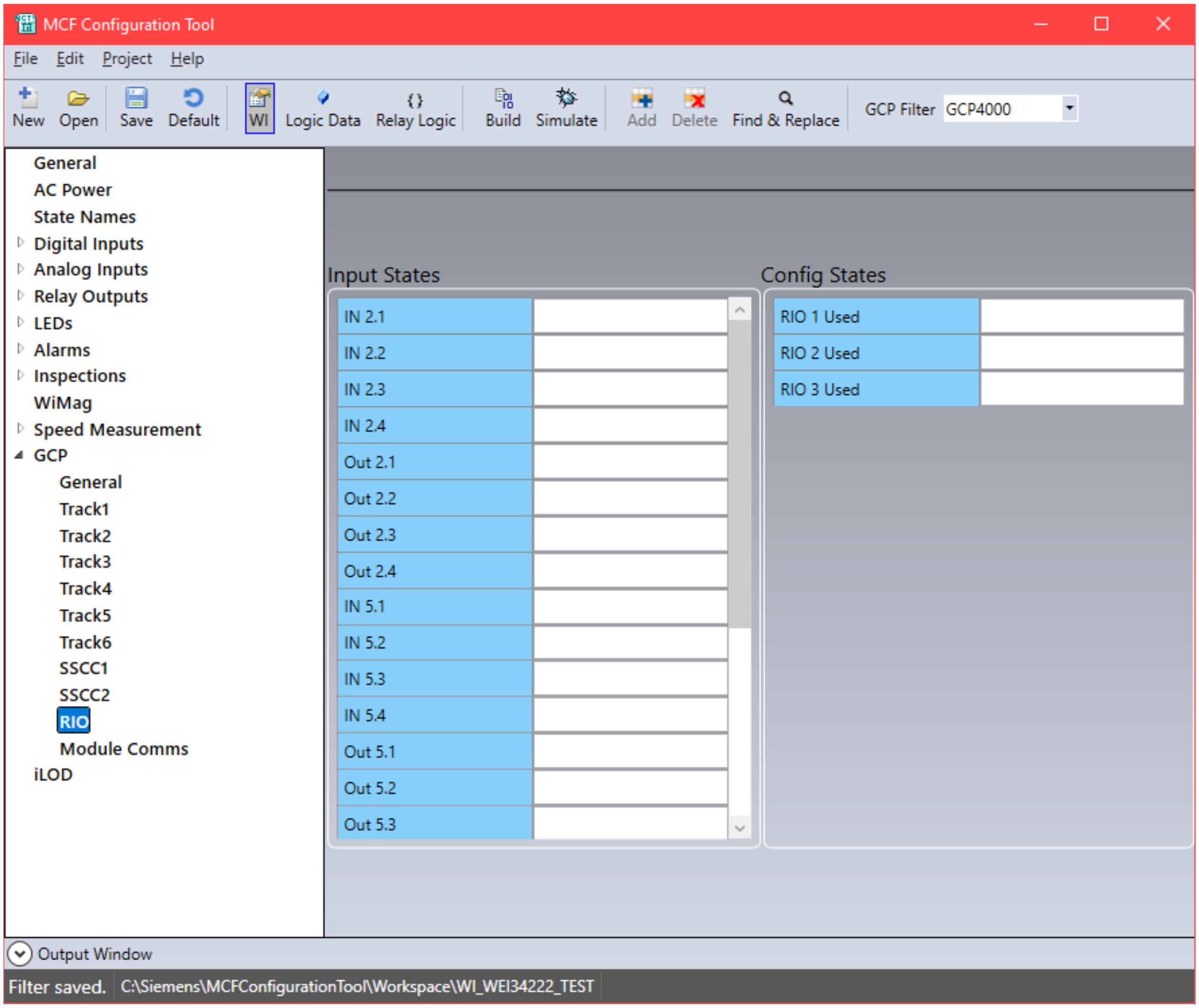

Figure 4-17   GCP RIO Module Logic States Screen

Table 4-31 describes the GCP RIO module logic states and shows which logic states the MCF Configuration Tool will show for each GCP Filter option. The label of the logic states is different depending on the GCP Filter option selected.

The MS 4000 does not include a RIO module; therefore, the MCF Configuration Tool hides the RIO module logic states when the MS 4000 filter is selected.

Table 4-31 GCP RIO Module Logic States

GCP 4000 / 5000 Logic State Label	*GCP 3000+ Logic State Label*	*Functional Description*
Input Logic States		
IN 2.1	IN 3.1	Set if the RIO module input is energized and clear otherwise (input de-energized or failed).
IN 2.2	IN 3.2	
IN 2.3	IN 3.3	
IN 2.4	IN 3.4	
Out 2.1	Out 3.1	Set if the RIO module output is energized and clear otherwise (output de-energized or failed).
Out 2.2	Out 3.2	
Out 2.3	Out 3.3	
Out 2.4	Out 3.4	
IN 5.1	N/A	Set if the RIO module input is energized and clear otherwise (input de-energized or failed).
IN 5.2	N/A	
IN 5.3	N/A	
IN 5.4	N/A	
Out 5.1	N/A	Set if the RIO module output is energized and clear otherwise (output de-energized or failed).
Out 5.2	N/A	
Out 5.3	N/A	
Out 5.4	N/A	
IN 6.1	N/A	Set if the RIO module input is energized and clear otherwise (input de-energized or failed).
IN 6.2	N/A	
IN 6.3	N/A	
IN 6.4	N/A	
Out 6.1	N/A	Set if the RIO module output is energized and clear otherwise (output de-energized or failed).
Out 6.2	N/A	
Out 6.3	N/A	
Out 6.4	N/A	

Configuration Logic States		
RIO 1 Used	RIO 1 Used	Set if the RIO module is used in the GCP configuration. Clear if the RIO module is not used.
RIO 2 Used	N/A	
RIO 3 Used	N/A	

4.12.7 GCP MODULE COMMS LOGIC STATES

The GCP reports the status of the communication with the I/O modules to the WI. Figure 4-18 shows the MCF Configuration Tool screen to name the Module Comms logic states.

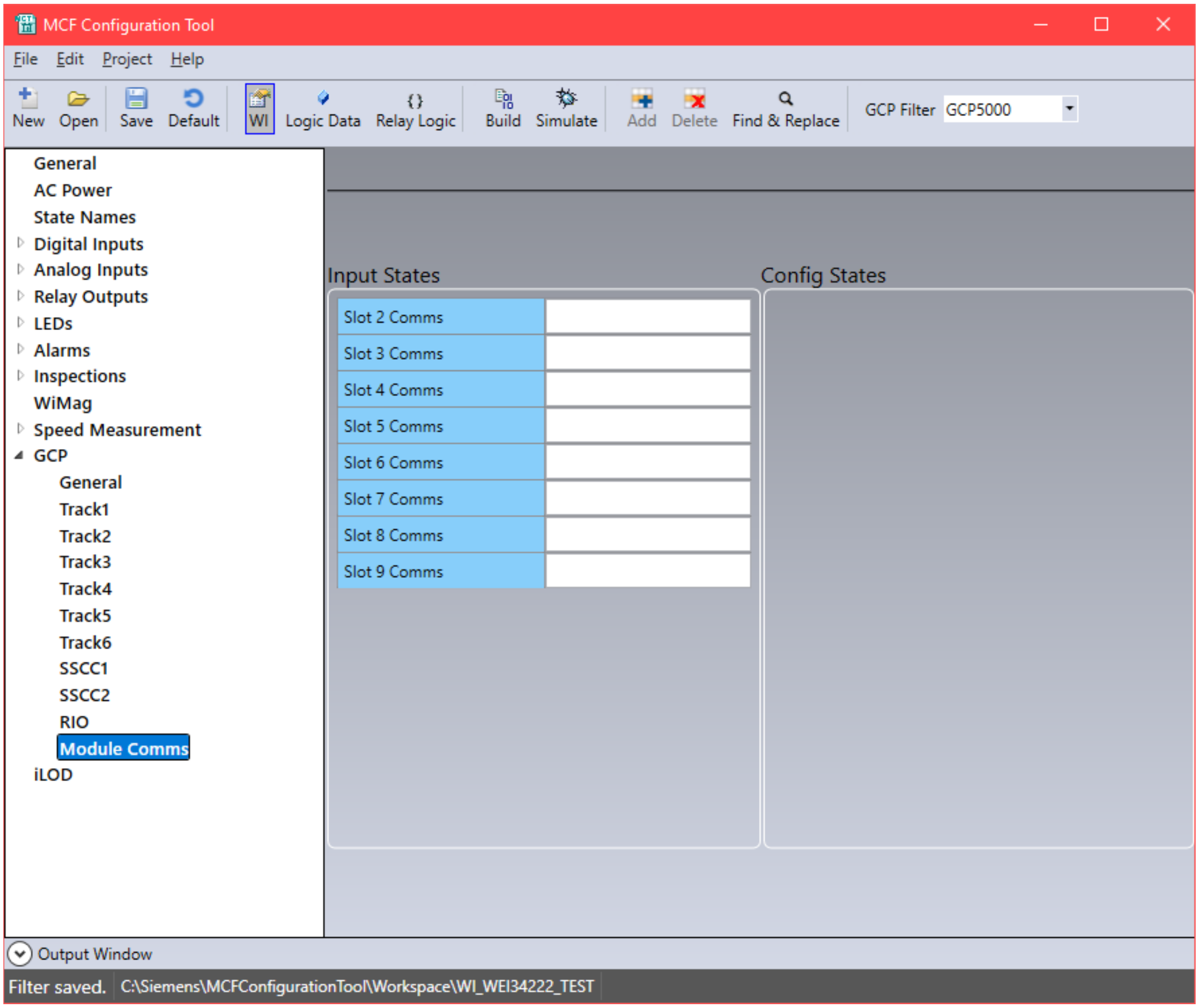

Figure 4-18 GCP Module Comms Logic States Screen

Table 4-32 describes the GCP Module Comms logic states and indicates which states are shown based on the GCP Filter selection.

Table 4-32 GCP Module Comms Logic States

Logic State Label	*GCP 4000/5000*	*GCP 3000+*	*MS 4000*	*Functional Description*
Input Logic States				
Slot 2 Comms	Yes	Yes	Yes	Set if the communication between the GCP CPU and the I/O module in the indicated slot is good.
Slot 3 Comms	Yes	Yes	No	
Slot 4 Comms	Yes	Yes	No	
Slot 5 Comms	Yes	No	No	
Slot 6 Comms	Yes	No	No	
Slot 7 Comms	Yes	No	No	
Slot 8 Comms	Yes	No	No	
Slot 9 Comms	Yes	No	No	

4.13 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 the speed or receive the speed from a GCP.

The WI determines the train speed and informs the MCF logic through logic states. The MCF configuration data includes a "Speed Measurement Entry" for each speed the executive needs to check. The WI supports up to 64 speed measurement entries.

Figure 4-19 shows the MCF Configuration Tool screen to configure a speed measurement and name the available logic states when receiving the speed from a connected GCP.

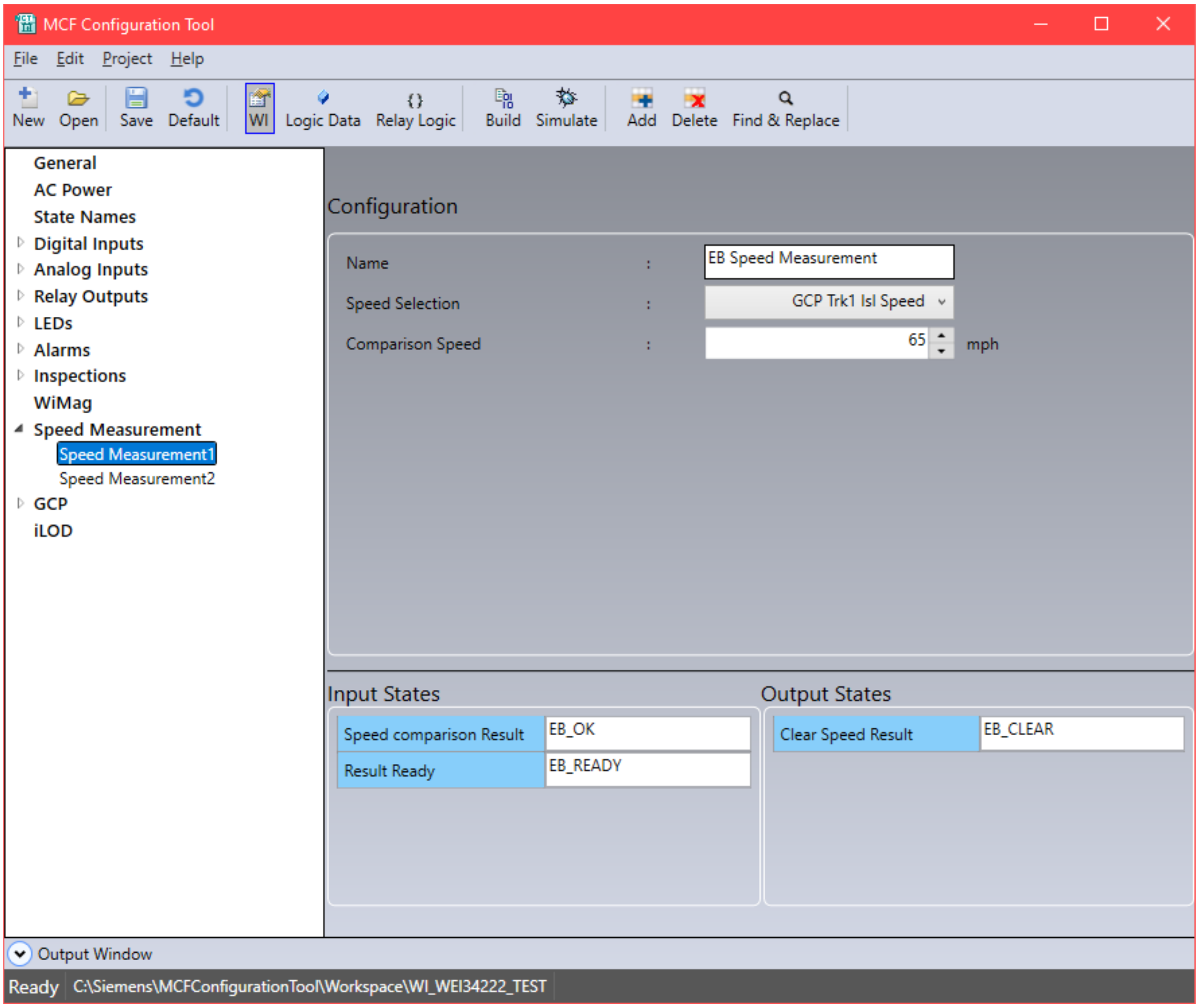

Figure 4-19 Speed Measurement for Receiving Speed from GCP

Figure 4-20 shows the MCF Configuration Tool screen when the WI calculates the train speed using I/O state changes.

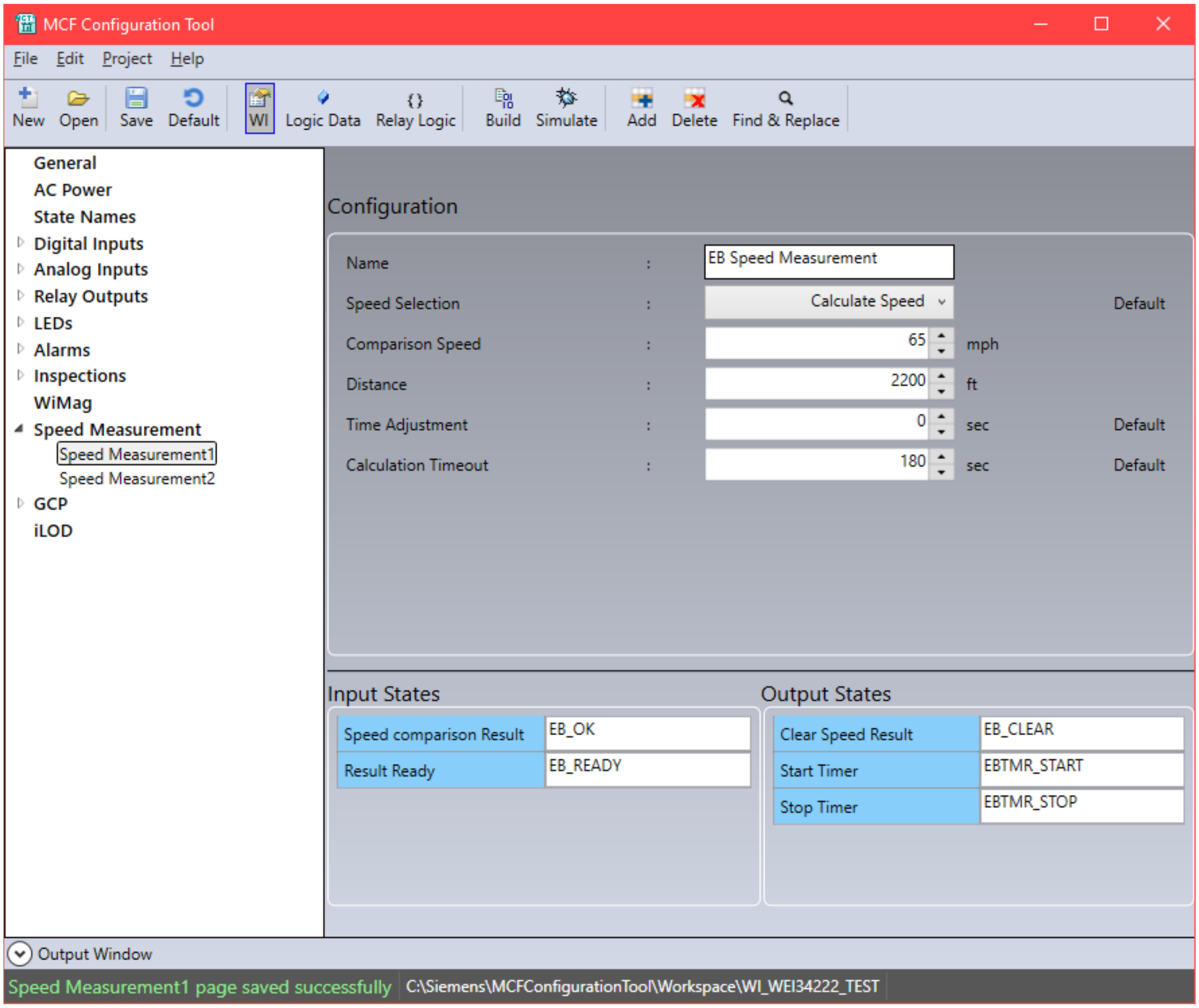

Figure 4-20 Speed Measurement for Speed Calculations from I/O Changes

Table 4-33 describes the speed measurement configuration parameters.

Table 4-33 Speed Measurements Configuration Parameters

Parameter Name	Range	Default	Web UI Editable	Description
Name	20 characters	Speed Measurem ent	No	The name used for the speed measurement entry in logs and reports.
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	No	Selects the method of determining speed.
Comparison Speed	0 to 255 mph	0 mph	Yes	If the calculated speed or reported speed from the GCP is greater than or equal to this value, the WI will set the “Speed Comparison Result” logic state.
Distance	0 to 65535 ft.	0 ft.	Yes	The distance to use in the speed calculation, which should be set to the distance the train travels between activations of Start Timer and Stop Timer. *Only shown if Speed Selection is Calculate Speed.*
Time Adjustment	-12.8 to 12.7 seconds	0 seconds	Yes	Time value used to adjust the speed calculation to account for de-bounce or other system delays. The Time Adjustment should be calculated as the delay on Start Timer clearing minus the delay on Stop Timer clearing (see section 4.13.2.3 for an example). *Only shown if Speed Selection is Calculate Speed.*
Calculation Timeout	0 to 65535 seconds	180 seconds	Yes	Time limit on a complete speed calculation. If both speed measurement inputs do not change state within this length of time, the WI will abandon the speed calculation. *Only shown if Speed Selection is Calculate Speed.*

4.13.1 SPEED CALCULATIONS FROM I/O CHANGES

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

The MCF logic drives the speed calculation process. The WI performs the speed calculation, compares the calculated speed to the configured Comparison speed, and sets the Speed Comparison Result and Result Ready logic states for the result. The MCF logic uses those logic states in the warning time inspection logic. Table 4-34 describes the logic states available to the MCF logic.

Table 4-34 Speed Calculation Logic States

Logic State	***Description***
Input Logic States	
Speed Comparison Result	The value of this logic state is only valid when the Result Ready logic state is set. The WI will set this logic state if the calculated speed is greater than or equal to the Comparison Speed value. Once set, this logic state remains set until the MCF logic sets the Clear Speed Result logic state.
Result Ready	The WI sets this logic state when the WI completes a calculation and comparison. This logic state signals the MCF logic that the Speed Comparison Result is now valid. Once set, this logic state remains set until the MCF logic sets the Clear Speed Result logic state.
Output Logic States	
Clear Speed Result	Once the MCF logic has used the speed result, it sets this logic state to clear the results in preparation for the next calculation.
Start Timer	When Start Timer clears (changes from 1 to 0), the executive software will start an internal timer.
Stop Timer	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.

The WI uses Equation 4-1 to calculate train speed:

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

Equation 4-1 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 Comparison Result logic state. After the comparison, the executive sets Result Ready to inform the MCF logic the result is available.

4.13.2 SPEED CALCULATION EXAMPLE

To illustrate speed calculations from I/O state changes, consider the following example crossing. The crossing has a single bidirectional track circuit and an island circuit.

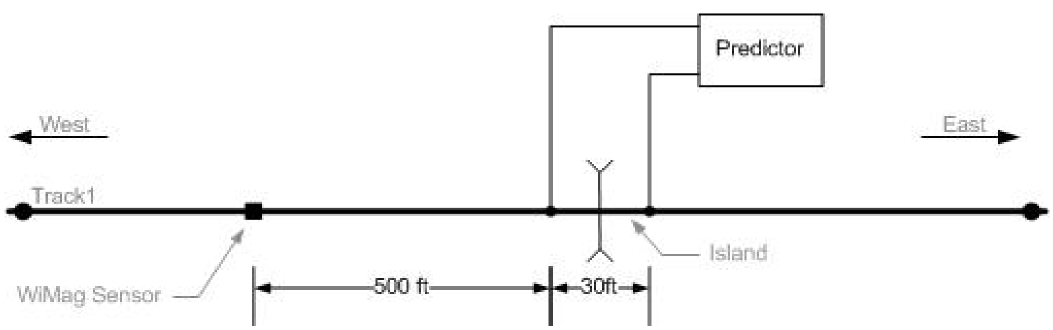

Figure 4-21 Example Bidirectional Crossing

For this crossing, assume a non-Siemens predictor, which does not have a messaging interface with the WI.

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.

4.13.2.1 *COMPARISON SPEED*

For this fictional crossing location, the maximum permissible speed is 55 mph. The MCF logic will consider trains traveling 50 mph or greater as “fast enough” to use for the warning time test; therefore, the Comparison Speed is set to 50 mph for both Entry 1 and Entry 2.

4.13.2.2 *DISTANCES*

For eastbound trains, the train will activate the WiMag sensor first, then the near side of the island circuit. Therefore, the Distance value 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 value for Entry 2 is 530 feet.

4.13.2.3 *TIME ADJUSTMENT*

The application engineer will determine the time adjustment values specific to the application. 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 this example, 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.

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

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

4.13.2.4 *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 the 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 as shown below:

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

Equation 4-2   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 4-3   Example Westbound Speed Calculation

4.13.2.5 *EXAMPLE LOGIC*

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

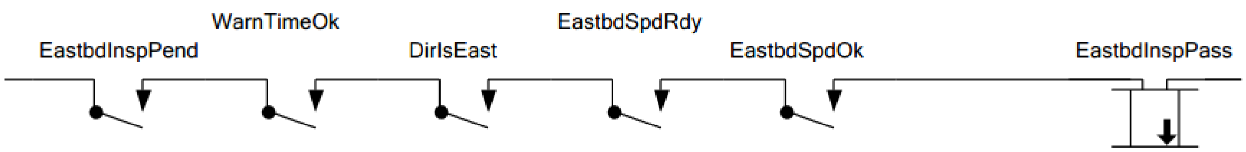

Figure 4-22   Warning Time Inspection Relay Logic

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 circuit for the Entry 1 Start and Stop Timer might look something like the following:

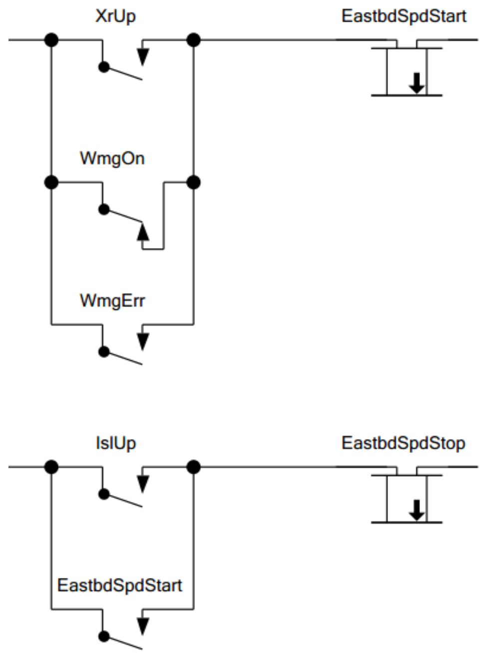

Figure 4-23 Start and Stop Timer Logic Rungs

EastbdSpdStart is Entry 1 Start Timer (variable name is assigned in the MCF Configuration Tool). The WI 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 a speed calculation is not started when there is no crossing activation (e.g. WiMag sensor incorrectly reports active).

EastbdSpdStop is Entry 1 Stop Timer. The WI stops the speed calculation timer and calculates speed when EastbdSpdStop clears. The circuit 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 Recommendation

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.

4.13.3 GCP-REPORTED SPEEDS

At crossings using the Siemens GCP models, the WI does not need to calculate the speed. The GCP reports the speed to the WI. 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 Comparison Result logic state and Result Ready after the WI receives the island speed from the GCP.

4.14 ILOD

The WI can receive current measurements from an A80271 iLOD. It can communicate with a maximum of four concurrent iLOD units.

4.14.1 ILOD GENERAL CONFIGURATION PARAMETERS AND LOGIC STATES

Figure 4-24 shows the MCF Configuration Tool screen to configure the iLOD settings and name the iLOD logic states.

The echelon node is determined automatically by the MCF Configuration Tool. The user does not enter it. It is shown for informational purposes only.

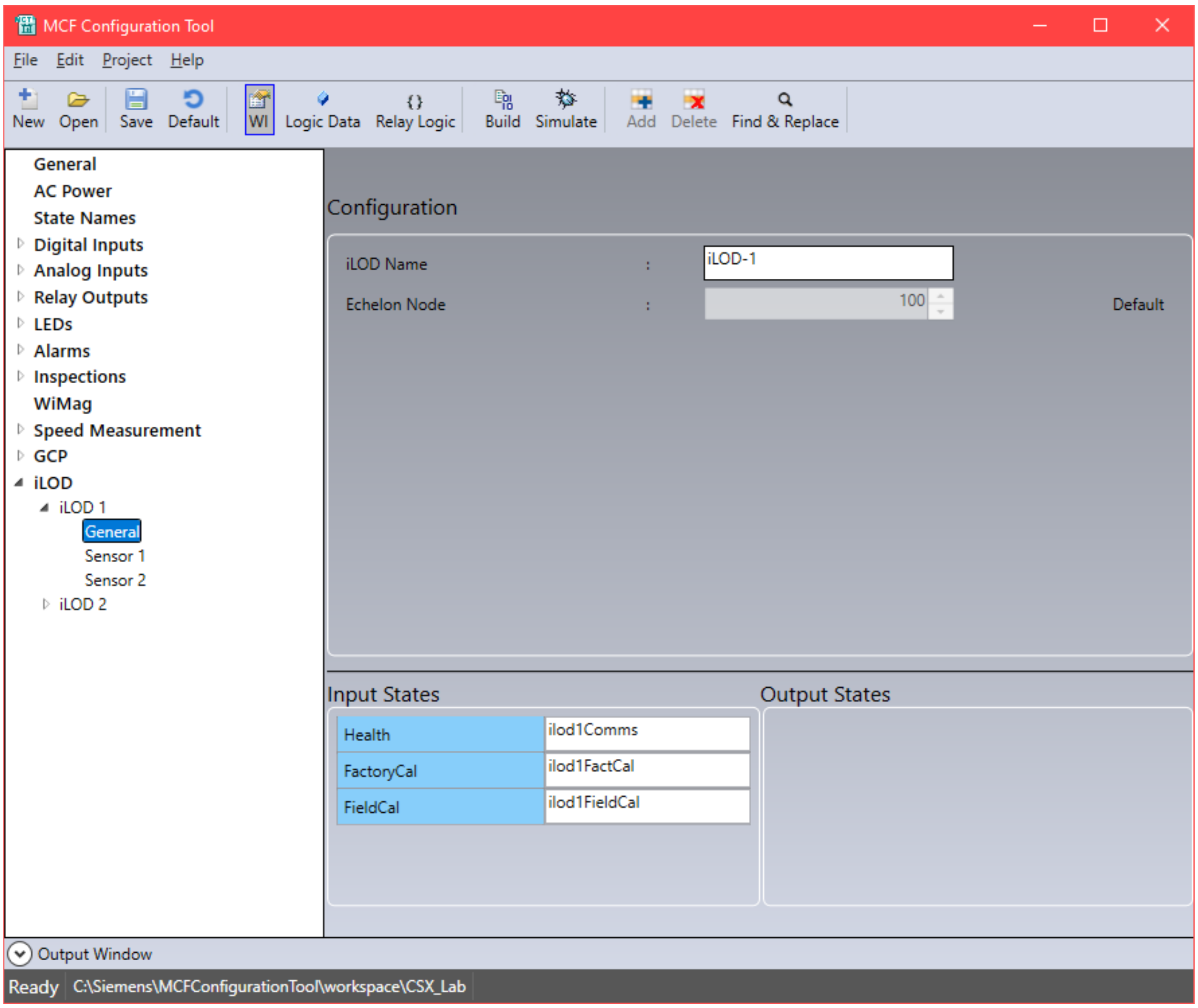

Figure 4-24 iLOD General Configuration Screen

Table 4-35 describes the iLOD configuration parameters.

Table 4-35 iLOD General Configuration Parameters

Parameter Name	*Range*	*Default*	*Web UI Editable*	*Description*
iLOD Name	0 - 20 characters	iLODx	Yes	The name of the iLOD module to use in logging and reports.

Table 4-36 describes the iLOD general logic states available to the MCF logic.

Table 4-36 iLOD General Logic States

Logic State Label	*Functional Description*
Input Logic States	
Health	Set when the iLOD communications is healthy.
FactoryCal	Set when factory calibration has been performed.
FieldCal	Set when field calibration has been performed.

4.14.2 ILOD SENSOR CONFIGURATION PARAMETERS AND LOGIC STATES

Each iLOD unit has two current sensors. Figure 4-25 shows the MCF Configuration Tool screen to configure an iLOD sensor and to name the iLOD logic states.

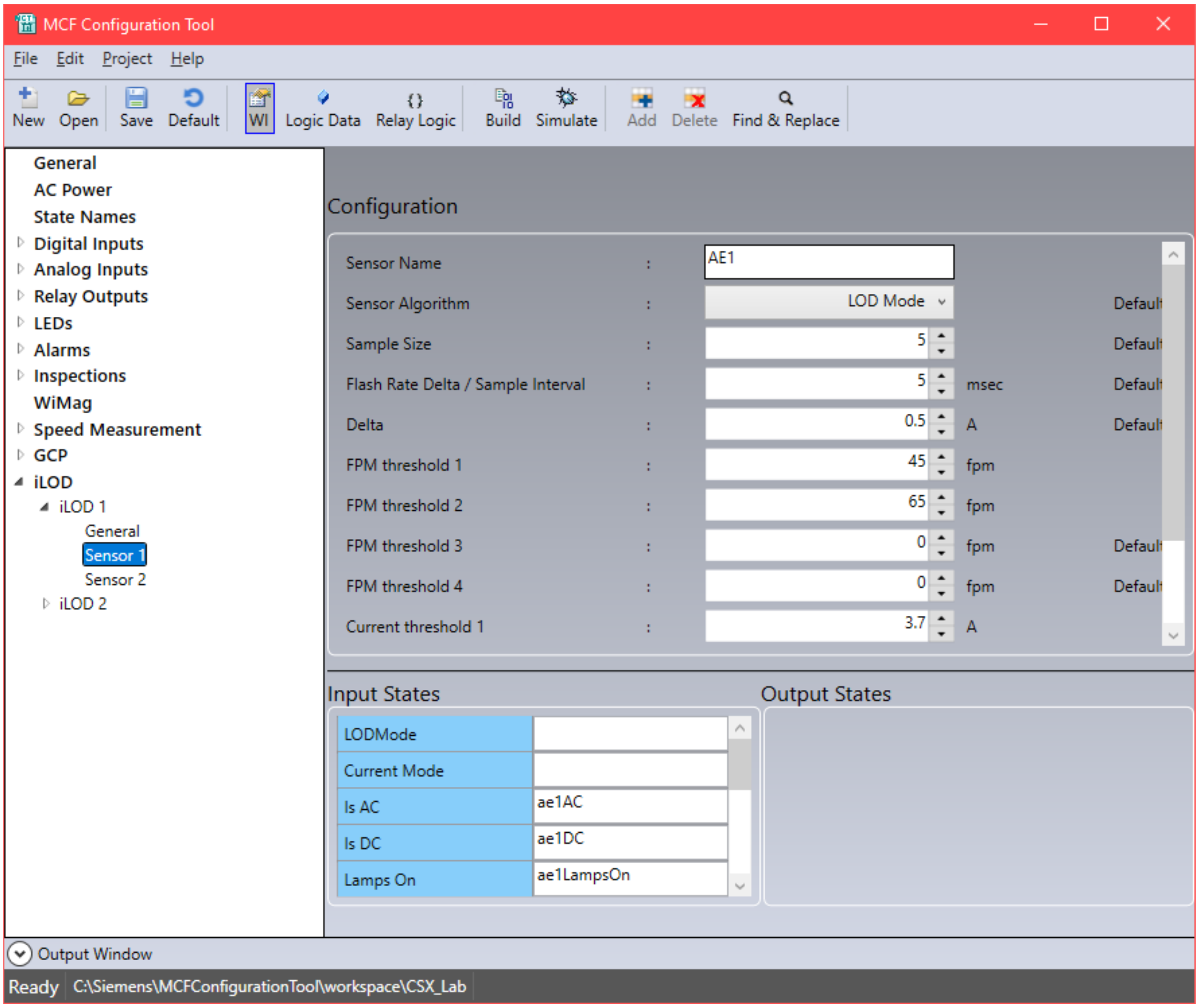

Figure 4-25 iLOD Sensor Configuration Screen

Table 4-37 describes the iLOD sensor configuration parameters.

Table 4-37 iLOD Sensor Configuration Parameters

Parameter Name	***Range***	***Default***	***Web UI Editable***	***Description***
Sensor Name	0 - 12 characters	iLODxSensY	No	The name to use for the iLOD sensor in logging and reports.
Sensor Algorithm	Unused, LOD Mode, Steady Current Mode	LOD Mode	Yes	If Unused is selected, the sensor will be ignored. If LOD Mode is selected, the iLOD sensor will measure current and flash rate for flashing lamps. If Steady Current Mode is selected, the iLOD sensor will measure steady current only.
Sample Size	5 to 32	16	Yes	If the selected sensor algorithm is “LOD Mode,” this parameter is not used. If the selected sensor algorithm is “Steady Current Mode” this parameter specifies the number of samples to average together to determine the measured current.
Flash Rate Delta / Sample Interval	10 to 200 ms	10	Yes	If the selected sensor algorithm is “LOD Mode,” this parameter specifies the change in the measured flash rate necessary to trigger a new flash rate event from the iLOD. If the selected sensor algorithm is “Steady Current Mode” this parameter specifies how often the iLOD should sample the current being measured.
Delta (A)	0.0 to 9.9 amps	0.5	Yes	Specifies the change in measured current necessary to trigger a new current measurement event from the iLOD.
FPM threshold 1 - 4	0 to 255 f/m	0	Yes	Specifies threshold values to trigger logic state changes in the MCF logic. If the reported flash rate for this sensor is greater than or equal to the threshold value, the executive software will set the corresponding logic state input to the MCF to TRUE.
Current threshold 1-2	0.0 to 30.0 amps	0	Yes	Specifies the threshold values to trigger logic state changes in the MCF logic. If the reported current for this sensor is greater than or equal to the threshold value, the executive software will set the corresponding logic state input to the MCF to TRUE.

Table 4-38 describes the iLOD sensor logic states.

Table 4-38 iLOD Sensor Logic States

Logic State Label	***Functional Description***
Input Logic States	
LODMode	Set when the iLOD sensor is configured in LOD mode (measures current for flashing crossing lamps).
Current Mode	Set when the iLOD sensor is configured in steady current mode.
Is AC	Set when the measured sensor current is AC current. This logic state is mutually exclusive to the “Is DC” logic state. If neither “Is AC” nor “Is DC” are set, there is no measured current (lamps are off or current not reported yet).
Is DC	Set when the measured sensor current is DC current. This logic state is mutually exclusive to the “Is AC” logic state. If neither “Is AC” nor “Is DC” are set, there is no measured current (lamps are off or current not reported yet).
Lamps On	Set when the iLOD detects the Lamps are on for this channel.
OverFlash Rate1 – OverFlash Rate4	Set when the last reported flash rate is greater than or equal to the corresponding FPM Threshold value.
OverCurrent1 - OverCurrent4	Set when the last reported current is greater than or equal to the corresponding Current Threshold value.

For further information relating to the iLOD, refer to the ***iLOD (A80271) User Guide, SIG-00-03-05-005***.

4.15 MAINTAINER ON-SITE MODE

Maintainer on Site mode allows field personnel to test and modify the crossing without sending 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. The application engineer can modify the default Maintainer on Site Time in the MCT on the General settings page as shown in the following figure. Field personnel may change the Maintainer on Site Time from the WI web UI.

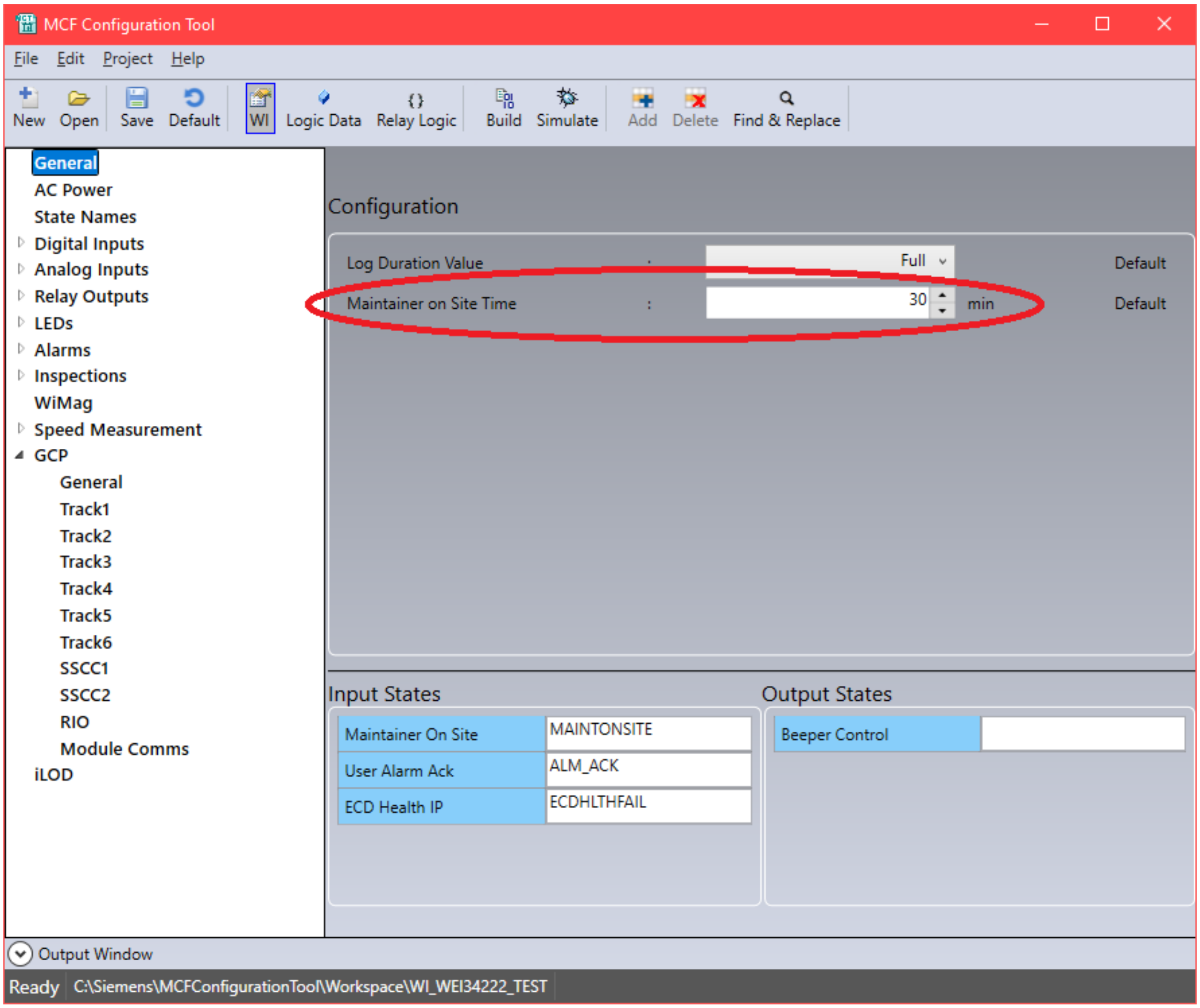

Figure 4-26 General Screen showing Maintainer on Site Time

4.16 WIMAG SENSORS

The WI can receive on/off status from a wireless magnetometer (WiMag) sensor system. The WiMag sensors detect changes in the magnetic field above the sensor. The sensors can be used for non-vital train detection to aid in determine the direction or the route or a train through a crossing. The WI connects to the WiMag sensor system over the Ethernet network.

Table 4-39 WiMag Base Parameter Values

Parameter Name	***Range***	***Default***	***Web UI Editable***	***Description***
UDP Listen Port	1 to 65535	7253	Yes	The UDP port the WI will listen on for WiMag sensor status messages.
Base Status Timeout	0s to 255s	10s	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 4-40 WiMag Sensors Parameter Values

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

Table 4-41 WiMag Logic States

Logic State Label	***Functional Description***
Base Comms Status	Set by the executive while the communication link with the WiMag Access Point (base station) is good.
Sensor Detected State	Set by the executive when the WiMag sensor is detecting a train over it and clear otherwise.
Sensor Error State	Set if there is a problem with the sensor (sensor h/w failure or comms timeout with this sensor).

CHAPTER 5 PER-UNIT CONFIGURATION PARAMETERS

This chapter provides a reference to the per-unit configuration parameters of the WI. These configuration parameters are not shown or editable in the MCF Configuration Tool. These configuration parameters are only available through the web-browser user interface of the WI and must be set by field personnel at the time the WI is installed. See the ***Wayside Inspector Installation & Instruction manual, SIG 00-16-03***, for the web-browser user interface screens for these settings.

5.1 SITE INFORMATION

Table 5-1 Site Information Configuration Parameters

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

5.2 NETWORKING

Table 5-2 Networking: Comms Interface Configuration Parameters

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
Networking: Comms Interface	DHCP Mode	Disabled or Client	Disabled	If set to Client, the WI will request the network settings using the DHCP protocol. If set to Disabled, the interface uses static settings.
	IP Address	IPv4 Address	192.168.2.100	The IPv4 address of the Network Ethernet interface. *Only visible if DHCP Mode is Disabled.*
	Network Mask	IPv4 Address	255.255.255.0	The network mask of the Network Ethernet interface. *Only visible if DHCP Mode is Disabled.*
	Default Gateway	IPv4 Address or Blank	Blank	The default gateway of the Network Ethernet interface. Leaving the field blank means no default gateway used. *Only visible if DHCP Mode is Disabled.*

Table 5-3 Networking: Domain Name System Configuration Parameters

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
Networking: Domain Name System	Name Server 1	IPv4 Address or Blank	Blank	IP address of the primary name server for use with name resolution.
	Name Server 2	IPv4 Address or Blank	Blank	IP address of the secondary name server for use with name resolution.

Table 5-4 Networking: ATCS/IP Field Protocol Parameter Values

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

Table 5-5 Networking: ATCS/IP Office Protocol Configuration Parameters

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
Networking: ATCS/IP Office Protocol	Circuit ID Line	0 - 999	000	The circuit ID is a unique ID of the WI used by OCG and Packet Switches.
	Circuit ID Port	0 - 2	0	
	Circuit ID Poll	0 - 15	00	
	Routing Region One	0.0.0.0 - 255.255.255.255 or Symbolic Name	192.168.X.2 where X is replaced with the Port Number plus one.	This can be either a subnet broadcast or unicast IP address associated with office OCG or packet switch.
	Routing Region Two	0.0.0.0 - 255.255.255.255 or Symbolic Name	192.168.X.3 where X is replaced with the Port Number plus one.	This can be either a subnet broadcast or unicast IP address associated with office OCG or packet switch.
	UDP Port	0 - 65535	5361	Specifies the port number used to listen for messages. Specifies the UDP port number used to listen for messages.
	Path Value	0 - 255	72	This is information used by packet switch/OCG to specify inbound path options such as main/standby, field device operation, etc. The path value is determined by the application engineer or the railroad communication personnel. In most cases, the default need not be changed.
	Route Search Time	0 - 65535 seconds	15 Seconds	Route request is sent per this time interval until a route update response is received.
	Route Refresh Time	0 - 65535 Minutes	5 Minutes	Once a route update response is received, a route request is periodically sent per this time interval to refresh the route table.
	Route Search Tries	0 - 255	4	The number of times the WI will retry a route search if a response is not received.

5.3 WAMS/RAILFUSION

Table 5-6 WAMS / RailFusion Configuration Parameters

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
WAMS / RailFusion	WAMS/RailFusion Messaging Enabled	Yes, No	No	Allows the WI to interface with WAMS and RailFusion systems.
	ATCS Address	2.000.00.0000 to 2.999.99.9999	2.620.01.9100	The ATCS Address of the Target System, padded out to 6 bytes. If it is a type 7 ATCS Address, it does not include the DD field (7.RRR.LLL.GGG.SS)
	Alarm Retry Time (sec)	0 to 65535 seconds	75	A value of 0 means alarms will not be retried.

5.4 SERIAL PORT

Table 5-7 Serial Port Parameter Values

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
Serial Port Parameters	Baud Rate	1200 - 115200	9600	Sets the serial port's baud rate in bits per second.
	Data Bits	7, 8	8	Sets the number of data bits to use in each character transmitted.
	Parity	None, Odd, Even	None	Sets the parity bit mode.
	Stop Bits	1, 2	1	Sets the number of stop bits to use in each character transmitted.
	Flow Ctrl	None, Hardware, Radio/Modem	None	Select the flow control method to use for the serial port. "Hardware" selects the typical CTS/RTS handshake method. "Radio/Modem" is not currently supported.
	Protocol	None, Gen/ATCS Field, Genisys Field, GCP 3000	None	At this time, the WI only supports the GCP 3000 protocol. If "GCP 3000" is selected, the WI will poll an external legacy 3000 Grade Crossing Predictor for its configuration and event information. For further information, refer to the ***Wayside Inspector Installation & Instruction Manual, SIG-00-16-03***. Support for the "Gen/ATCS Field" protocol and the "Genisys Field" protocol may be added in a future release.

5.5 LOGGING

Table 5-8 Log Setup: Diagnostic Logging Parameter Values

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

5.6 ATCS MESSAGE ROUTING

Table 5-9 ATCS Message Routing Parameter Values

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

5.7 TIME MANAGEMENT

Table 5-10 Time Management Screen

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
Time Management	Time Source	Manual Only	Manual Only	**Manual Only is currently the only supported option**. The user can set the time from the web browser user interface and the WI will set the time when a message is received on the WAMS interface or the SDP interface.
	Minimum Time Difference	0 – 60 sec	2	Minimum amount of time difference between received time and system time before the WI will set the time from the time source.

5.8 SECURITY

Table 5-11 Security: Password Configuration Parameters

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

Table 5-12 Security: WebUI Configuration Parameters

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
Security: WebUI Configuration	Browser Access	Secure (https) or Non-Secure (http)	Secure (https)	Whether the web browser is accessed using http or https.

5.9 WAYSIDE MESSAGING SERVER AND SIEMENS DIGITALIZATION INTERFACE

Table 5-13 WMS Interface Configuration Parameters

Web UI Screen	*Parameter Name*	*Range*	*Default*	*Description*
Digi Intf Settings	Digitalization Interface Enabled	Yes, No	No	The digitalization interface may be enabled or disabled with this setting.
	Encryption Enabled	Yes, No	Yes	If set to Yes, the WI will encrypt digitalization messages using the specified encryption key.
	Encryption Key	1 to 20 characters	Encryptkey#1	If encryption is enabled, this key will be used.
	Message Authentication Key	1 to 20 characters	MacKey#1	Each digitalization message is authenticated using a message authentication code (MAC). This field specifies the key to use in the message authentication process.

Table 5-14 WMS Class D Configuration Parameters

Web UI Screen	*Parameter Name*	*Range*	*Default*	*Description*
Class D Settings	Application Gateway IP Address	0 to 64 characters	10.255.255.210	Specifies the IP address of the application gateway service to use for communication.
	Application Gateway Port	1024 to 65535	3001	Specifies the TCP port number to use for the Class D connection to the application gateway.
	Keep Alive Interval	0 to 60000 ms	30000	Specifies the interval between Class D keep alive ack messages.
	Keep Alive Ack Timeout	0 to 60000 ms	30000	Specifies the timeout for Class D keep alive ack messages.
	Ack Timeout	0 to 60000 ms	15000	Specifies the timeout for Class D ack messages.
	Connect Attempt Timeout	1 to 60000 ms	30000	Specifies the connection timeout for Class D connections.
	Connect Attempt Delay	1 to 60000 ms	60000	Specifies the delay between attempts to connect.
	Connect Attempt Retry Count	-1 to 10000	-1	Specifies the limit on connection attempts. A value of -1 means the WI will attempt to connect indefinitely.
	Reconn. Attempt Retry Limit	-1 to 10000	-1	Specifies the limit on reconnection attempts. A value of -1 means the WI will attempt to re-connect indefinitely.
	Data ACK Enable	Yes, No	Yes	Enables or disables data ack messages.
	Data Ack Timeout	1 to 60000 ms	15000	Sets the time for data ACKs.

Table 5-15 WMS EMP Parameter Values

Web UI Screen	***Parameter Name***	***Range***	***Default***	***Description***
EMP Settings	Wayside Inspector EMP Addr	0 – 64 characters	wi.w:1	The EMP address used for the WI unit.
	MindConnect Rail EMP Addr	0 – 64 characters	mcr.o:1	The EMP address used for the MindConnect Rail server, which is the digitalization gateway system for the WI.
	EMP TTL	0 to 65535	1	Specifies the EMP TTL value to use in digitalization messages.
	EMP QOS	0 to 65535	1	Specifies the EMP QOS value to use in digitalization messages.

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CHAPTER 6 – INSPECTION SCHEDULE TEXT FILE FORMAT

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

```
# Lines starting with a pound (#) sign are ignored and
# used for comments. Blanks lines are also ignored.

# Inspection schedule xxx; version 1.0; June 3, 2015
Q  01-JAN-2015 00:00

A  03-APR-2016 23:30  Text following the date/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, 'M' for monthly inspections, and 'W' for weekly inspections.
- At least one whitespace is required between the data fields in each schedule entry. A whitespace is defined as a space or tab character. Multiple whitespaces are 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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