



ENGINEERED FOR MOTION



TCIB-UNI
TRAFFIC CABINET INTERFACE BOARD
FOR INTERSECTOR SENSORS

PRODUCT MANUAL

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1 INTRODUCTION

1.1 OVERVIEW

This installation manual is meant to provide descriptions of features available with the Traffic Cabinet Interface Board (TCIB) – Universal Switch (UNI) model, herein referred to as TCIB-UNI. The manual is divided into six sections: Introduction, Standard Features, Full-Feature Mode, Alternative Modes, Ethernet Networking Requirements, and Hardware Information.

1. The Introduction section provides an overview of the manual, as well as a high-level description of the TCIB-UNI.
2. The Standard Features section provides a description of all functions available to the TCIB-UNI independent of the mode it is placed in.
3. The Full-Feature Mode section provides descriptions of all functions available when the TCIB-UNI is placed in the full-featured mode.
4. The Alternative Modes section provides descriptions of the features available in the legacy TCIB mode, as well as describes Secondary TCIB-UNI operation.
5. The Ethernet Networking Requirements provides a detailed overview of the various Ethernet network considerations for proper and optimal use of the Intersector system with a focus on the TCIB-UNI.
6. The Hardware Information section provides detailed information about the TCIB-UNI hardware and associated certifications applicable to the product.

Throughout this manual, there will be references to various commands or entry fields that can be set. Commands that are shown with **bold text** are meant to be used verbatim. Commands that are shown with *italicized text* are meant to be variable.

1.2 PRODUCT DESCRIPTION

The TCIB-UNI functions similar to a standard TCIB, but now also provides a built-in 3-port unmanaged Ethernet switch.

The TCIB-UNI has two modes of operation: legacy and full-featured.

- Legacy mode is compatible with the previous generation of TC-CK1-SBE with software versions between 1.8M and 1.9U installed and has an operational mode similar to the previous generation of TCIB cards.
- Full-featured mode provides additional features previously not available to the TCIB to complement the latest version of TC-CK1-SBE code with software version 2.x, and the newest sensor to the Intersector product line, the TC-CK1-VMS.

When the TCIB-UNI is utilized with the TC-CK1-SBE-2.0 (2.x sensor software), the Intersector system becomes integrated through a connected Ethernet network. The TCIB-UNI provides a network portal page that provides a single page to view the Intersector system status, as well as builds in additional Intersector system tools that includes an IP Address Set program, firmware bootloader for the TCIB-UNI and TC-CK1, and now introduces an Ethernet cable testing feature called LinkMD.

2 STANDARD FEATURES

This section provides an overview of all features that are available on the TCIB-UNI in either legacy or full-featured mode.

2.1 ETHERNET SWITCH

The TCIB-UNI features a **built-in 3-port unmanaged Ethernet switch**. The figure below shows a Primary TCIB-UNI and a table summarizing the functionality of each port:



Figure 1: TCIB-UNI Front Plate

#	Top Marking	Bottom Marking	Use
1	* 24V *	Intersector	Power and network connection to a TC-CK1, Port 1
2	Network	Daisy In	Network connection into Intersector System, Port 2
3	Laptop/Diag	Daisy Out	Network connection into Intersector System, Port 3
4	Laptop/Diag	RS-232	Serial maintenance port or connection to secondary TCIB card

- **The first port of the TCIB-UNI (marked Intersector) is equivalent to the Operational and Setup ports of the previous version of the TCIB.** Like the Operational port, this Intersector port communicates the activation status to the TCIB directly, and like the Setup port, this port also connects the TC-CK1 to a Laptop port.
- The second and third ports of the TCIB-UNI (Daisy In/Daisy Out) are connected to each other and the Intersector port through an unmanaged Ethernet switch on-board the TCIB-UNI card. These ports are functionally the same in that they each network multiple TCIB-UNI cards and/or a maintenance laptop and/or peripheral networking equipment (i.e. DOT network switch or a DAT-PAC).
- The last port is an RS-232 port. This can be used to connect a Primary TCIB-UNI to a Secondary TCIB through a null-modem serial cable. This port can also be used for basic maintenance of the TCIB-UNI. These features are described in the remaining sub-sections of this manual

2.2 DIAGNOSTICS

Through the serial maintenance port, the user can read basic diagnostic information about the Intersector system. By entering the command **diag** into a serial terminal program running on a laptop, the TCIB-UNI will report the number of times the TCIB-UNI experienced a hardware reboot, the number of times the TC-CK1 and TCIB-UNI lost network connection from each other, and the number of times the TC-CK1 reported “Sensor Error”. To reset these counters, enter the command **clear** into the serial terminal session.

2.3 FAILSAFE TIMER

The TCIB-UNI has a failsafe safety feature that places the Intersector system into recall for a set amount of time after initial power-up or whenever the TCIB-UNI loses connection from the TC-CK1. This failsafe timer ensures that at least 1 cycle has protection prior to going back to controlling the detector outputs in real-time.

By default, this failsafe timer is set to 120 seconds. This time amount can be adjusted by entering the value **fs#**, where **#** is the amount of time, in seconds, for failsafe. For example, if you need to change the failsafe timer to 80 seconds, the user would enter **fs80** into the serial terminal window. The TCIB-UNI will confirm the change by replying with **FailSafe Timer = 80 Seconds**.

2.4 TOGGLING TCIB-UNI MODES

The default configuration mode for the TCIB-UNI is the full-feature mode unless otherwise configured upon request. Legacy mode is available to use with a TC-CK1-SBE sensor with a software version between 1.8M and 1.9U. This mode is required because these versions of software do not broadcast the messages required to operate the advanced features offered in the full-feature mode. Note that a TCIB-UNI not in legacy mode attempting to be used with an older version of TC-CK1-SBE will never come out of recall.

To put the TCIB-UNI into legacy mode, enter **legacy mode** into the serial terminal session. To revert to full-feature mode, enter **tcis mode** into the serial terminal session.

Note: There are several versions of serial terminal software available. A quick online search should provide a variety of options that work with different versions of Windows OS.

2.5 PASSWORD READ AND SET

The portal page accessible from the TCIB-UNI is password protected. In addition to being able to change the password from the portal page, the password can be read and reset from the serial maintenance port. To read the current password, enter **pwread** into the serial terminal session. To change the password, enter **pwset***password*, where the characters in italics are replaced with the desired password, into the serial terminal session.

The password requirements are provided in the “Password Set” subsection of the “Full-Featured Mode” section of this manual.

3 FULL-FEATURE MODE

This section provides description of features available when the TCIB-UNI is configured in the full-feature mode and is being used with a TC-CK1 sensor with 2.x software. The primary addition to this mode is the ability to access the TCIB-UNI Portal Page. **The default IP address for the Portal Page is 192.168.0.90.** The TCIB-UNI Portal Page provides a summary of the Intersector system from the perspective of the TCIB-UNI card being viewed. Each TCIB-UNI in full-feature mode provides this network summary and provides the same tools and features for viewing and maintaining the Intersector system. **The Portal Page displays the software version of the TCIB-UNI, the time and date set in the card, and a table that displays up to six TCIB-UNIs.** The following subsections provide a detailed summary of these features.

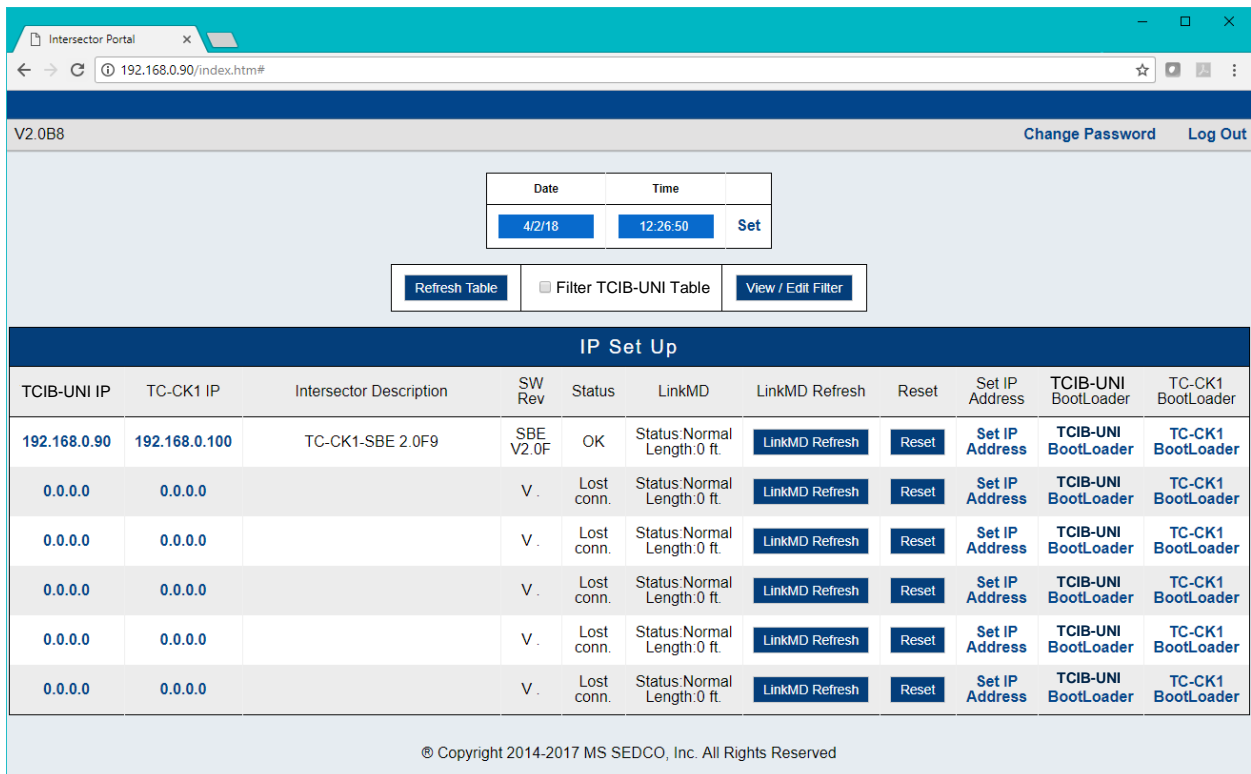


Figure 2: TCIB-UNI Portal Page

3.1 PASSWORD SET

A password is required to access the TCIB-UNI Portal Page, which is set to *password* by default. Depending on the computer’s web browser’s settings, the browser can save this password when it is entered successfully.

The password can be viewed and edited through the TCIB-UNI Portal Page. To view and edit the password from the Portal Page, click the “Change Password” button found in the upper right corner of the Portal Page after logging in to the page. Upon clicking this button, a pop-up

menu will appear with a user entry field that is pre-populated with the current password, as well as a box to “Change Password” once the field has been changed to the new password¹.

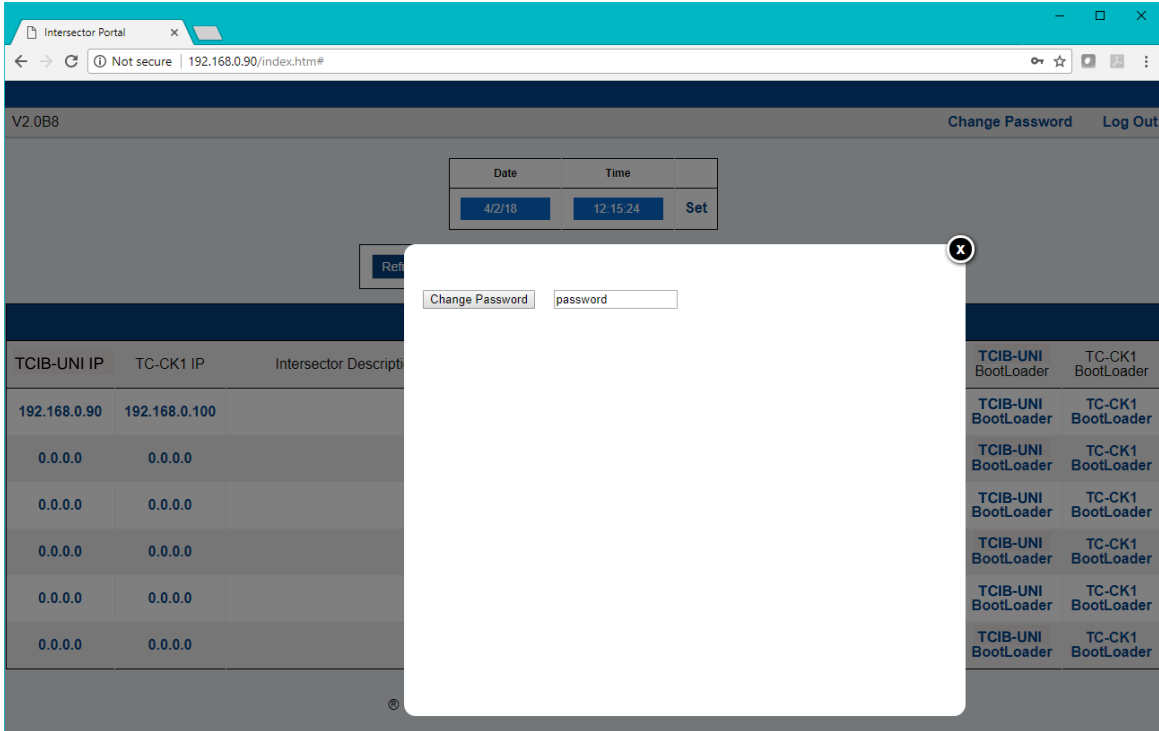


Figure 3: Change Password Pop-Up

Passwords can be up eight characters and can be a combination of upper and lower characters and/or numbers. Special characters are not allowed as they will automatically convert into their ASCII escape character, and any password entry above eight characters will be truncated to the first eight characters.

Once a new password is entered, click the “Change Password” button. The TCIB-UNI will display “Set Password Finished !!!” once the password entry is completed, which should take approximately 1 second. The user entry field will display the set password and can also be used to confirm the password if any truncation occurred as described above. To cancel changing a password without saving, click the “x” in the upper right corner of the pop-up without clicking the “Change Password” button.



Figure 4: Change Password Confirmation

¹ Google Chrome and Microsoft Edge web browsers only.

The user can choose to Log Out of the Portal Page once all setup is complete. The Log Out button is available at the upper right corner of the TCIB-UNI Portal Page. Note that any changes to passwords take effect immediately, so if the password has changed since the last time the user logged in to the TCIB-UNI Portal Page, the new password will need to be entered to access the page again. Should the password be forgotten, it can be accessed and/or changed from the serial maintenance page. See the “Password Read and Set” subsection of the “Standard Features” section of this manual.

3.2 REAL TIME CLOCK

The TCIB-UNI offers the ability to set a time and date viewable on the TCIB-UNI Portal Page. To configure these settings, press the “Set” button next to the date and time readouts on the TCIB-UNI Portal Page main page. Once this button is pressed, a pop-up will appear with the ability to edit the time and date.

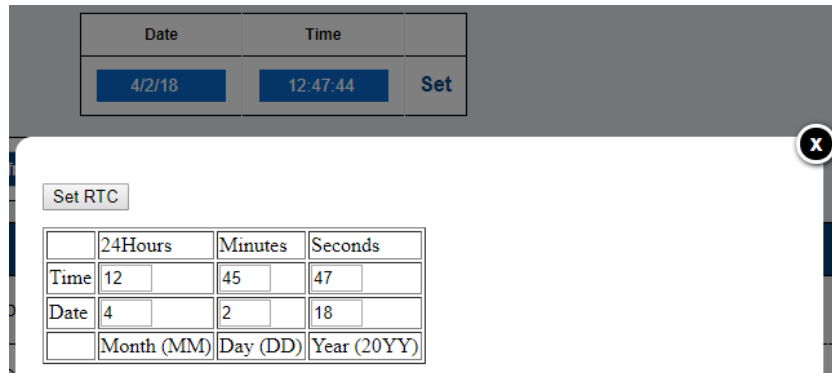


Figure 5: Set Time and Date Pop-Up

The time entry should be set using 24-hour notation (i.e. midnight = 0, 9AM = 9, 3PM = 15). The remaining fields should be modified following the instructions of the captions around them.

To save any changes, press the “Set RTC” button in the top left corner. When the change is saved successfully, the message “Set RTC Finished !!!” will be displayed below the user entry table. To cancel any changes, press the “x” in the upper right corner of the pop-up window without clicking the “Set RTC” button.

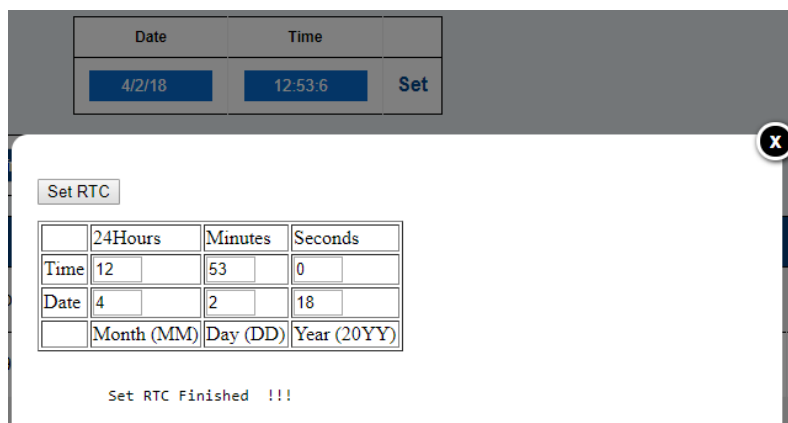


Figure 6: Save Time and Date Confirmation

A CR2032 battery can be installed on the TCIB-UNI card to save these settings over power cycles. Should the power be recycled on the board without a healthy battery, the TCIB-UNI defaults to midnight (0:0:0) on 1/1/2001.

3.3 IP SET UP TABLE

The TCIB-UNI Portal Page can display up to six TCIB-UNIs configured in full-feature mode in the “IP Set Up” table. The first card displayed is always the TCIB-UNI whose Portal Page is being viewed. The remaining five TCIB-UNIs displayed are the first five full-feature mode TCIB-UNIs to respond to the TCIB-UNI. If the TCIB-UNI does not detect any additional TCIB-UNI, the row will show IP Addresses of 0.0.0.0 to signify no card(s) were detected. If a TCIB-UNI was previously detected and displayed in the “IP Set Up” Table, but then loses communication, the TCIB-UNI will continue to display the TCIB-UNI card’s information with a status of “Lost conn.” to signify the degraded status.

3.3.1 Filter Table and Refresh Table Features

For TCIB-UNI cards that are on larger networks that span multiple connected intersections, the Filter Table feature provides the ability to filter the view of the TCIB-UNI to just the local TCIB-UNIs.

To fully use this feature, set up each TCIB-UNI card individually (i.e. set each Intersector systems’ IP Addresses and Description fields) and then network the local cards together using the Daisy In / Daisy Out Ethernet ports and straight-through Ethernet patch cables. On each TCIB-UNI, verify the “IP Set Up” table displays the expected TCIB-UNIs and then press the “View / Edit Filter” button. In the pop-up that appears, press the “Copy Filter” to copy the IP Addresses from the “IP Set Up” table to the Filter Table in the pop-up window. Edit the Filter Table if needed (i.e. add any TCIB-UNI IP Addresses that need to be added or remove any TCIB-UNI IP Addresses that are not part of the local TCIB-UNI network). Once the Filter Table has the correct TCIB-UNI IP Addresses, press the “Save Filter” button. If the user would like to cancel and/or leave the page without saving any further changes, either press the “Exit” button or the “x” in the upper right corner of the pop-up.

To enable the filter, check the box next to “Filter TCIB-UNI Table” on the main TCIB-UNI Portal Page. When the filter is enabled, the “IP Set Up” table will only display information for the TCIB-UNI cards that were included in the filter. The TCIB-UNI can still communicate and network to other TCIB-UNI cards on a larger network if the Ethernet connections permit, but they will not be displayed in the table unless the “Filter TCIB-UNI Table” checkbox becomes disabled.

In the event the user wants to refresh the “IP Set Up” table without having to reset or power cycle the TCIB-UNI card, they can press the “Refresh Table” button. The primary use case for this feature is the event that the TCIB-UNI is part of a larger, multiple-intersection network and a new local TCIB-UNI card is added to the local cabinet. To properly use this feature, connect all TCIB-UNI cards in the local cabinet and disconnect the port to the wider network, and then click the “Refresh Table” button. Ensure all local TCIB-UNI cards are visible and then repeat the Filter Table process to save this view.

Once the local TCIB-UNI filter is established, connect the local TCIB-UNI network to the wider Ethernet network.

3.3.2 Portal Page Navigation IP Addresses Columns

The TCIB-UNI Portal Page provides the ability to navigate to any portal page accessible from the TCIB-UNI. The first two columns in the “IP Set Up” table provide these links. When a user clicks on the IP Address from the 1st column, the webpage will be refreshed and changed to the applicable TCIB-UNI Portal Page if it was from a row other than Row 1. Clicking an IP Address from the 2nd column will display the TC-CK1’s Intersector Portal Page in a new tab. These links may be filtered depending on the TCIB-UNI Filter settings. See the “Filter Table and Refresh Table Features” subsection of this manual.

3.3.3 Intersector Information Columns

The TCIB-UNI displays the Intersector Description field and TC-CK1 Software version from the connected TC-CK1 sensor in the third and fourth columns respectively. The Intersector Description field can be customized on the TC-CK1 sensor’s Intersector Portal Page, which can be accessed by clicking the TC-CK1 IP Address in the 2nd column of that row. Note that changes to the Intersector Description field may require the web browser to be refreshed to display the latest information.

The software revision (SW Rev) is also displayed in the fourth column. The TCIB-UNI displays the sensor type (top line) and the software version (bottom line) for each sensor.

3.3.4 Troubleshooting Features

The TCIB-UNI offers expanded troubleshooting capabilities from its Portal Page. The first feature it offers is a read-out of its current status to the TC-CK1. If everything is operating normally, this status field will show “OK”. Any other status may require user intervention.

If the Status shows “Sensor err.”, the TCIB-UNI can communicate with the TC-CK1 sensor’s main processor, and it is reporting that there is a critical failure with its radar. When the TCIB-UNI has a sensor error on its connected TC-CK1, it automatically goes into recall and will periodically cycle power to the TC-CK1 to attempt to reset the sensor until the reported error resolves itself. If this sensor error does not resolve on its own after a few minutes, it is recommended to replace the TC-CK1 sensor.

Another potential failure-mode status “Lost conn.” is displayed when the TCIB-UNI cannot communicate to a TC-CK1 sensor. If the TCIB-UNI loses connection to its TC-CK1, perform the following troubleshooting steps:

- Verify the TC-CK1 IP Address associated with the TCIB-UNI is correct. If it is not, use the Set IP Address application and refresh the webpage.
- Verify all Ethernet cables between the TCIB-UNI and TC-CK1 are fully seated into the respective ports.
- Verify the Ethernet cable coming out of the TCIB-UNI does not have a short in the cable and verify that the distance between the TCIB-UNI and TC-CK1 or ECX is less than 300 feet. This can be done using the built-in LinkMD function on the TCIB-UNI and performing the following steps:

- Disconnect the Ethernet cable at the TC-CK1 end if an ECX is not in-line, or at the ECX if installed in-line between the TCIB-UNI and TC-CK1.
- Click the “LinkMD Refresh” button on the TCIB-UNI Portal Page on the row associated with the TC-CK1 with issues.
- Review the “LinkMD” entry after it updates. Note that LinkMD may take a few seconds before displaying the results.
 - “Status” can read “Normal”, “Open”, or “Short”. “Normal” is displayed when everything is connected and operating normally. “Open” will be displayed as long as the Ethernet cable is disconnect as previously instructed to do so. If “Short” appears, the Ethernet cable has a short that must be repaired before normal operation can resume.
 - “Length” is the relative distance to the error within $\pm 10\%$. If the status was “Open”, this value should correspond to the cable length between the TCIB-UNI and the ECX or TC-CK1. If the length is less than the cable run within tolerance, inspect the Ethernet cable in that region and make any necessary repairs. If the length is greater than 300 feet, install an ECX at a distance less than 300 feet from both the TCIB-UNI and TC-CK1, or move the ECX if one is already installed in the system.
 - Note that LinkMD is only performed on the first pair (pins 1 and 2) in the Ethernet cable. LinkMD cannot display failure notification if Ethernet cable damage exists solely on any of the other three pairs in the cable.

Finally, the TCIB-UNI allows the user to Reset the TCIB-UNI and TC-CK1 sensor remotely if needed. To reset, press the “Reset” button on the row corresponding to the Intersector system to be reset.

3.3.5 Set IP Address Application

The TCIB-UNI provides a Set IP Address Application so a standalone computer program version is not required to change Intersector’s IP Address. **By default, all TCIB-UNIs have an IP Address of 192.168.0.90, all TC-CK1 sensors have an IP Address of 192.168.0.100, a Subnet Mask of 255.255.255.0, and a Gateway of 192.168.0.1.**

Prior to changing any IP Addresses or networking TCIB-UNI, create an Ethernet network table to ensure each TCIB-UNI, TC-CK1, and any other networked devices have unique IP Addresses on the connected network. Information about the requirements for the Ethernet network for Intersector can be found in the “Ethernet Network Requirements” section of this manual.

To change the IP Address of either the TCIB-UNI and/or TC-CK1, press the “Set IP Address” button on the row with the units to be changed. Once that button is pressed, a pop-up window will appear with editable fields to customize the Intersector system’s Ethernet settings. See the figure below.

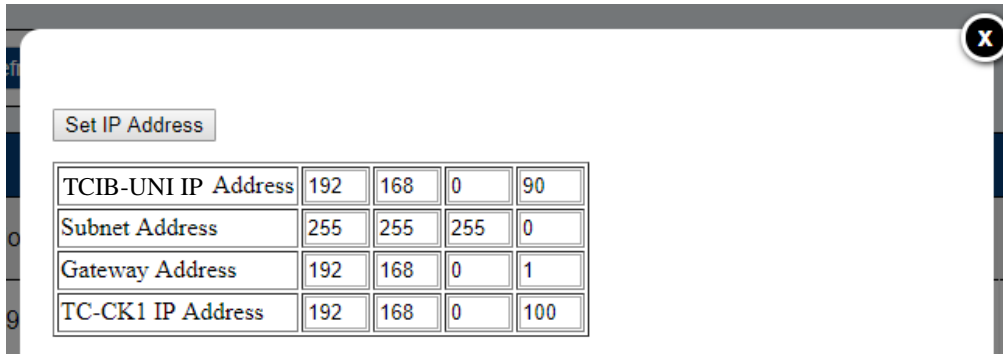


Figure 7: Set IP Address Application Pop-Up

Once the user finishes customizing the Ethernet settings, press the “Set IP Address” button at the top of the pop-up to save the changes. Within a few seconds, the TCIB-UNI will report the change was successful by showing the text “Set IP Address Finished !!!” at the bottom of the table.

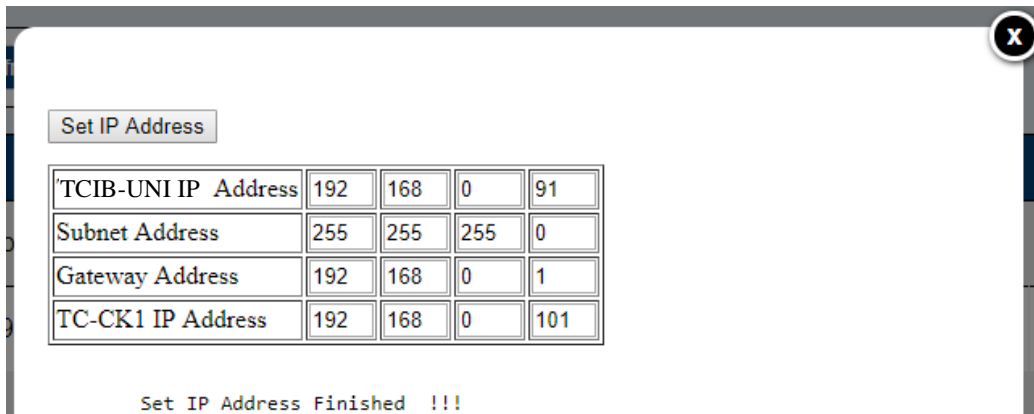


Figure 8: Set IP Address Confirmation

Note that any field can be changed to any valid Ethernet settings value. If the TCIB-UNI IP Address was changed, the user will need to re-enter the new IP Address into the URL of the web browser and log in to the unit if a password was not already previously saved for that IP Address. If the Subnet Address and/or Gateway Address are changed, the user’s laptop Ethernet settings should be changed to a unique IP Address on the new Subnet Address. Note that the TCIB-UNI changes the TC-CK1’s Ethernet information on the Data Link Layer, meaning that the TCIB-UNI can change a TC-CK1’s IP, Subnet, and Gateway Addresses even when the TC-CK1 is on a different IP Address scheme and/or Subnet.

3.3.6 TCIB-UNI Firmware Uploading Application

The TCIB-UNI offers the ability to update its software through its webpage. For further instructions on this feature, please **contact MS Sedco at (317) 842-2545**.

3.3.7 TC-CK1 Firmware Uploading Application

The TCIB-UNI also provides the capability to update TC-CK1-SBE and TC-CK1-VMS main board software files. For further instructions on this feature, please **contact MS Sedco**.

4 ALTERNATIVE MODES

4.1 LEGACY MODE

Legacy mode provides basic legacy TCIB functionality that is compatible with TC-CK1-SBE software versions between 1.8M and 1.9U. This is required because older versions of TC-CK1 software do not provide the proper messages to the TCIB-UNI that it needs in order to provide full functionality and come out of recall. See the “Toggling TCIB-UNI Modes” subsection for instructions of converting between “legacy” and “full-featured” mode.

When the TCIB-UNI is placed into “legacy” mode, it removes access to the TCIB-UNI Portal Page, while also removing its ability to be displayed on other networked TCIB-UNI cards’ portal pages that are in “full-feature” mode. While the TCIB-UNI does not display a portal page, it still requires a unique IP Address on the network it is connected to, and it must be told its TC-CK1 sensor’s IP Address if it differs from the default (192.168.0.100). To modify the IP Address of a TCIB-UNI in Legacy mode, use the standalone IP Address Set program that was used to set the IP Addresses of legacy TCIB cards and TC-CK1-SBE units with older software versions. A standalone bootloader program also exists to update the software of TCIB-UNI cards if requested. Please contact the MS Sedco engineering department for further details.

4.1.1 TC-CK1-SBE Sensors with 1.8 Version of Software

TC-CK1-SBE sensors with a software version of 1.8 will need additional support to properly function in legacy mode with the TCIB-UNI hardware. To use a TCIB-UNI in legacy mode with sensors that have the 1.8 version of software, the TC-CK1-SBE will require a separate power injector (i.e. TCIP1-4) inline between the TCIB-UNI and the TC-CK1-SBE.

4.2 SECONDARY MODE

The TCIB-UNI is set to “Primary” by default unless “Secondary” mode is specifically requested. The Primary TCIB-UNI provides the electrical activation outputs for up to Opto-Outputs 1 through 4 and the Secondary TCIB-UNI provides the electrical outputs for up to Opto-Outputs 5 through 8. The table below provides the matrix of Opto-Outputs based on card configuration.

Table 1: TCIB-UNI Output Mapping Matrix

Configuration	Primary	Secondary
<i>TCIB-UNI-2.1</i>	1 – 2	5 – 6
<i>TCIB-UNI-4.x</i>	1 – 4	5 – 8

The Secondary TCIB communicates to a Primary TCIB-UNI through a null-modem RS-232 cable connected between each card’s RS-232 ports. The Secondary TCIB activates based on input from this serial port and cannot power or communicate to a TC-CK1 sensor or an Ethernet port of a Primary TCIB-UNI.

Secondary TCIB cards are available from MS Sedco where the software is pre-set to Secondary mode and the Ethernet portions of the circuit are removed. If a Primary TCIB-UNI needs to be converted to a Secondary TCIB card in the field, initiate a serial terminal session between a computer and the TCIB-UNI to be converted. Enter the command **secondary** to the

card into a serial terminal session. The TCIB-UNI will reset and display the change in operation mode in the serial terminal session. To convert a full TCIB-UNI card from a Secondary card back to a Primary, enter the command **primary** into the serial terminal session. The card will automatically reset and display “Primary” next to the software version number.

5 ETHERNET NETWORKING REQUIREMENTS

With the TCIB-UNI’s built-in Ethernet switch, the Intersector system now provides easier methods to put the Intersector system onto an Ethernet network. When networked properly, this makes the Intersector system easier to set up and allows for possible viewing from a central office. As user’s Ethernet networks become larger and more complex, proper Ethernet network management become critical to the operation of the Intersector system. This section provides information regarding Ethernet networking requirements and topologies required to ensure proper Intersector operation when it is attached to an Ethernet network.

There are three main issues commonly found in Ethernet networks. These include IP Address Conflicts, Denial of Service Attacks, and Broadcast Storms. All Ethernet devices are susceptible in some way to each of these network issues. MS Sedco has put measures in place to mitigate as many negative effects as possible on the Ethernet network. By following the recommendations in each of the following subsections, these network issues can be avoided during long-term operation.

5.1 IP ADDRESS CONFLICTS

Almost all Ethernet-enabled devices use an IP Address to communicate on the Ethernet network. IP Addresses can be assigned either automatically using DHCP or manually by assigning a static IP Address. If a static IP Address is assigned, care must be taken to ensure there is not another device on the network with the same IP Address. In general, if an IP Address Conflict occurs, the resulting behavior is undefined. Generally, connectivity to either, or both, devices is lost as the host device does not know how to route to the intended device.

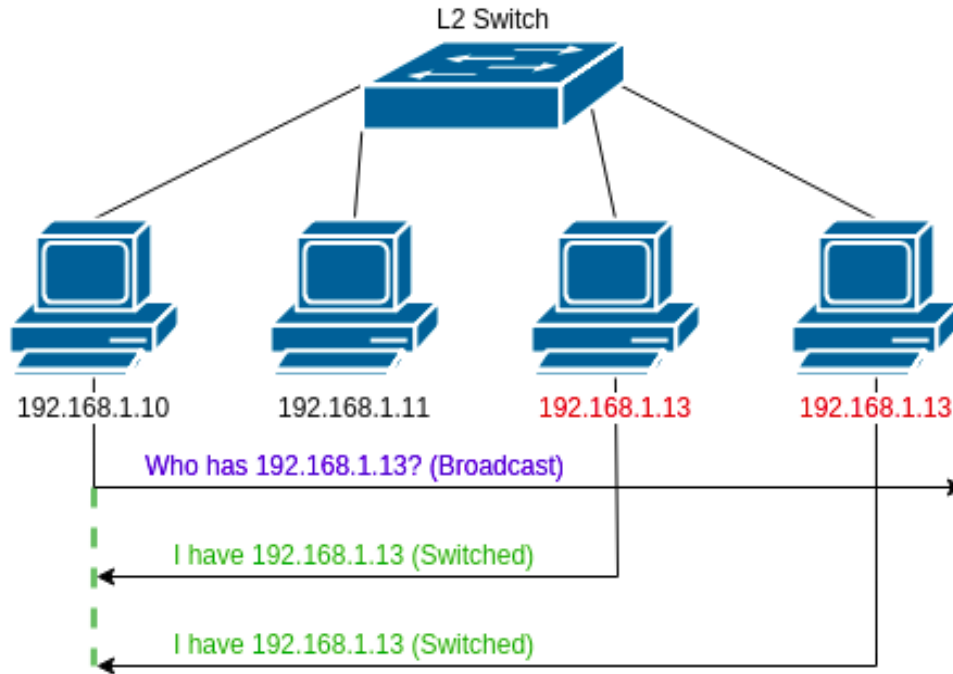


Figure 9: IP Address Conflict

Both the TCIB-UNI and TC-CK1 devices are required to be placed on the Ethernet network to view and/or edit them remotely. The TCIB-UNI and TC-CK1 products each have implemented features that mitigate issues from IP Address conflicts to ensure proper output activation operation continues normally, even if a conflict does occur.

It should be noted that if an IP Address conflict is left on the wide-area Ethernet network between TCIB-UNIs or TC-CK1s, the user will not be able to reach the portal page for any products in IP Address conflict. Typical behavior when the user attempts to access the Portal Page of an Intersector device in IP Address conflict, is that one of the device's Portal Page's will be displayed, although it may not be the intended device. Any attempt to edit the customizable parameters on the Portal Page may result in the wrong device receiving the update, one or both units restarting automatically, and/or one or both devices remaining in recall until the IP Address conflict is removed by disconnecting it or the other device from the network.

To avoid IP Address Conflicts, the following steps should be taken during setup:

- Ensure that only 1 TCIB-UNI / TC-CK1 pair is configured at a time during initial setup. This should be performed by directly connecting the laptop to the TCIB-UNI, and not through an external Ethernet switch or at a different node of the Ethernet network.
- Create and maintain a list of static IP Addresses to reference when adding or modifying Ethernet-enabled devices onto the network. Reference this list before setting the TCIB-UNI / TC-CK1's IP Address and update it to reflect the new devices on the network once the IP Addresses are decided.
- Prior to placing the TCIB-UNI / TC-CK1 pair onto an Ethernet network, perform a ping test for each device's IP Address on the main Ethernet network. If a different device

responds to the ping test, do not connect the Intersector system, find a different IP Address that is not in use, and repeat the test. Note that ping testing may not always find an IP Address conflict as some devices may not respond to a ping.

- Utilize VLANs to minimize the number of devices on the network that could conflict the Intersector system devices.
- After placing the Intersector system on the network and before leaving the cabinet, verify each unit's Portal Page can be accessed with no noticeable issues.

5.2 DENIAL OF SERVICE

Denial of Service is a type of “attack” against a single device on a network, and is characterized by causing the device to be unavailable for other use. Generally, this occurs by over-extending network infrastructure or the end devices by spamming them with data packets, HTTP requests, etc. Denial of Service can occur both on a piece of network equipment servicing the devices (example: an Ethernet switch), or the end device itself (example: TC-CK1 sensor).

Typically, Denial of Service on the Intersector system are done inadvertently. The two common ways an inadvertent Denial of Service occurs are as follows:

1. Too many computers are connected, and an attempt is made to edit to the Intersector Portal Page. This overloads the ability for the Intersector system to serve all incoming requests and may result in the user becoming unable to view and/or edit the webpage properly. The Intersector system should continue to operate normally with whatever settings were saved prior to the Denial of Service attack.
2. If another “high-speed” device on the network, such as an IP Camera / DVR system, is configured to the wrong IP Address (example: a video system's DVR IP Address is mistyped as either the TC-CK1 or the TCIB-UNI). This can overload the Intersector system's ability to send and receive Ethernet traffic to properly operate.

To prevent either of these scenarios, the following Ethernet best-practices are required:

- Close all Intersector and TCIB-UNI Portal Pages when not actively in use.
- Prior to editing any pages, ensure no one else on the Ethernet network is actively viewing the Portal Page being worked on (i.e. an engineer in the central office should ensure that a technician in the field is not actively working on the TC-CK1 before opening the Portal Page from the central office).
- It is recommended to place the Intersector devices (TC-CK1s, TCIB-UNIs, DAT-PACS, etc.) on their own VLAN network so that other Ethernet-enabled traffic devices, such as IP traffic camera systems, cannot interfere with Intersector communications.

5.3 BROADCAST STORM

A Broadcast Storm is a runaway effect on a network in which a broadcast message is responded to by multiple other devices repeating the broadcast message, which in further causes more messages to be broadcast. Typically, this is caused by a “ring” in a switched network. Once a broadcast message is sent out, it continues to be duplicated on this “ring”

path and to all other ports on all switches in the loop, eventually consuming all available bandwidth.

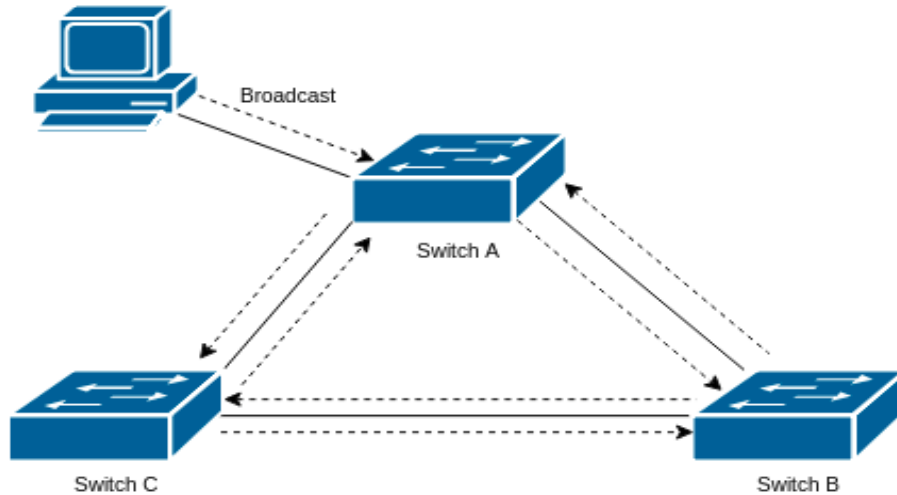


Figure 10: Broadcast Storm

If the Ethernet network has a Broadcast Storm occur, especially if Spanning Tree Protocol is not enabled on ALL switches across the network, this will cause the internal Ethernet Switch on the TCIB-UNI to become overloaded with traffic. The TCIB-UNI and TC-CK1 have features enabled in order to mitigate the effects of short exposures to Broadcast Storms. If a short Broadcast Storm occurs, the TCIB-UNI throttles its bandwidth to the wide-area network port and puts higher priority to processing communications to and from the TC-CK1 to continue normal operation. If a Broadcast Storm lasts over a long period of time, the Intersector devices will eventually be unable to communicate between the TCIB-UNI and TC-CK1. When this communication path is disrupted, the TCIB-UNI will put its outputs into recall, then restart, and re-establish communication to its TC-CK1. With the communication re-established, the Intersector system will operate normally again until the TCIB-UNI becomes overwhelmed with incoming messages again. This cycle will continue until the Broadcast Storm network issue is resolved, and the Intersector system will automatically resume normal operation.

To prevent broadcast storms from occurring on the network and degrading Intersector system performance, the following are required:

- Ensure the “Daisy In” and “Daisy Out” Ethernet ports on the TCIB-UNI are never looped together. Do NOT connect both ends of the daisy to the TCIB-UNI or into the Ethernet network.
- Enable Spanning Tree Protocol on ALL Ethernet Switches on the Ethernet network.

5.4 OTHER ETHERNET NETWORK BEST PRACTICES

In addition to the setup considerations described above to avoid common Ethernet network failures, there are a few Intersector-specific considerations to keep in mind when setting up an Intersector system on an Ethernet network. These best practices are described in the section below.

5.4.1 Cabinet Installation Topologies

There are two distinct topologies for connecting the TCIB-UNI to an external Ethernet network: Daisy-Chain and Flat.

The Daisy-Chain topology is where each TCIB-UNI card is daisy-chained to the next, with one of the last TCIB-UNI cards connected to the external Ethernet switch in the traffic cabinet (see the figure below). This is a simpler, and generally less expensive way to connect the Intersector system to the external network; however, this method is less fault tolerant. An issue with one TCIB-UNI can result in a loss of remote Portal Page access for the remaining, healthy TCIB-UNIs and TC-CK1s downstream of that device. Note that the degradation would be isolated to viewing the Portal Page remotely and the single approach having issues. The other approaches downstream would continue to function normally with respect to activating outputs to the controller.

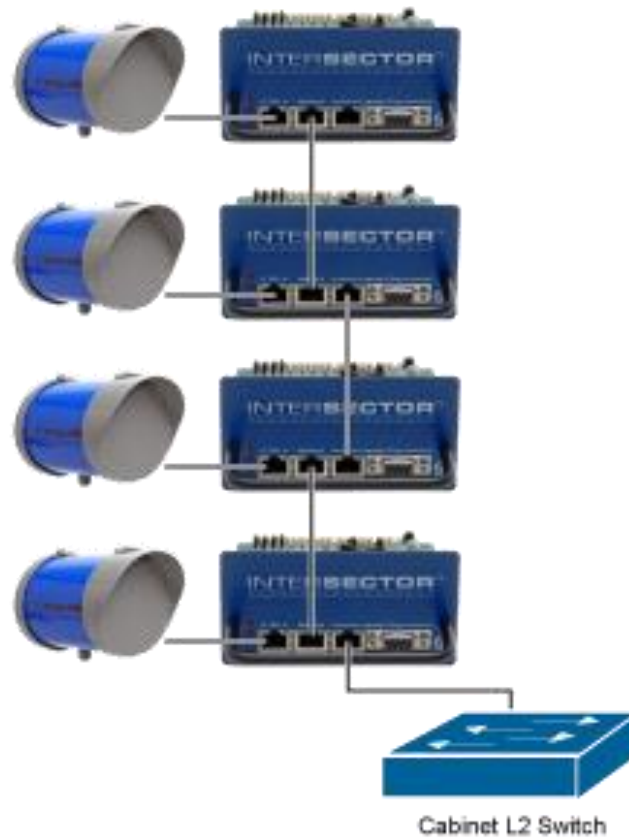


Figure 11: Daisy-Chain Ethernet Connection Topology

An alternative to the Daisy-Chain topology is the Flat Ethernet network topology. In this topology, each TCIB-UNI card is connected directly to the Ethernet switch in the traffic cabinet (see the figure below). While this topology is slightly more complex in that it requires 1 port in the Ethernet Switch per TCIB-UNI, it is more fault tolerant. An issue in a single TCIB-UNI has no noticeable effect on the other TCIB-UNIs on the network.

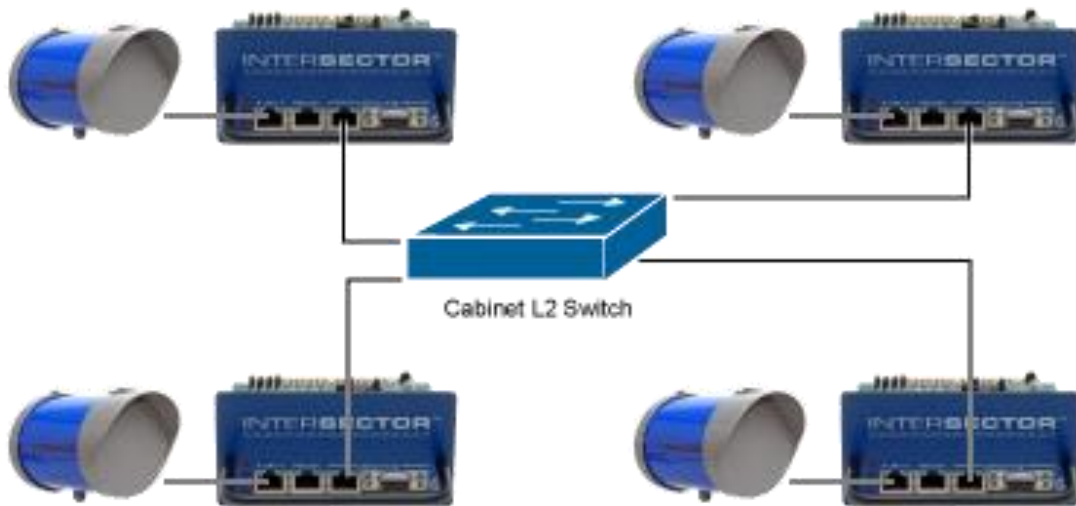


Figure 12: Flat Ethernet Connection Topology

5.4.2 Minimize Latency During Initial Setup and Maintenance

As advancements in point-to-point radio and cellular technology become more readily available and affordable, more Ethernet network topologies are including these wireless transmission paths to supplement return paths to a central office when wired fiber runs cannot be made. Also, as Ethernet-enabled devices become more prevalent, the bandwidth allowances on these wired and/or wireless transmission paths becomes less as the network becomes more congested with Ethernet traffic.

Viewing and editing the Portal Pages of either the TCIB-UNI or TC-CK1 requires having the lowest latency possible. It is recommended that any changes to the Intersector settings be made through a wired-only connection, ideally at the cabinet itself. Higher latency network topologies, especially with cellular back-end devices and/or high-resolution IP cameras being on the same network, may affect an installer or maintainer's ability to update Intersector settings remotely. A typical failure mode that can occur when attempting to make modifications in high-latency routes is that changes are not saved properly.

6 HARDWARE INFORMATION

The TCIB-UNI is designed to be pin-for-pin compatible with the legacy TCIB card.

6.1 PHYSICAL DIMENSIONS

The subsections below provide the physical dimensions of the TCIB-UNI card.

6.1.1 Card Dimensions

The dimensions of the circuit board and handle are provided in the figure below. The TCIB-UNI complies with NEMA-TS2:2006 specifications for Detector Rack cards.

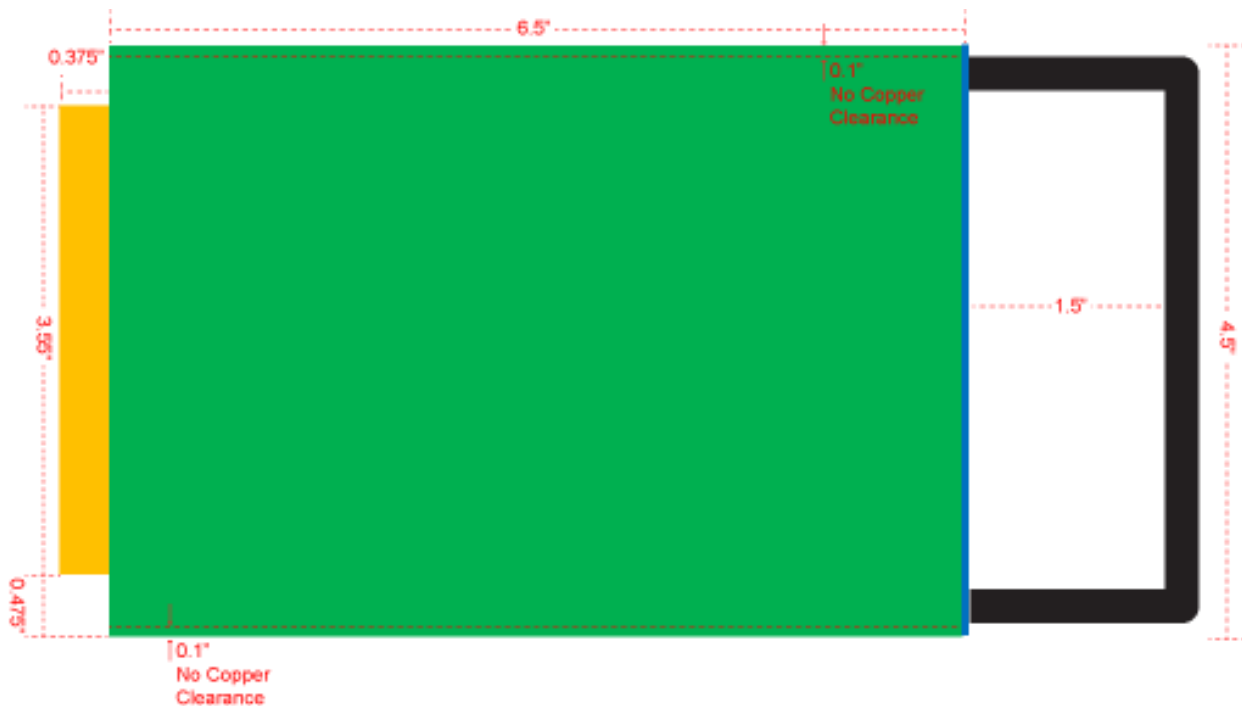


Figure 13: TCIB-UNI Circuit Board Dimensions

6.1.2 Face Plate Options

There are four possible faceplates for a TCIB-UNI. Two are “1-Position” that are designed to cover a single slot in a standard Detector Rack. The other two are “2-Position” that are designed to cover two slots in a standard Detector Rack. For each size of faceplate, one has openings for “Primary” configuration and another faceplate for the “Secondary” configuration that only exposes the RS-232 port.



Figure 14: TCIB-UNI Faceplate Dimensions

6.2 PRODUCT INTERFACES

6.2.1 Power

The TCIB-UNI operates on 12 to 24 Volts-DC. The current draw is dependent on the version of sensor being used. For TC-CK1-SBE sensors with 1.9U software and older, the TCIB-UNI complies with the power specifications of the regular TCIB.

For the TC-CK1-VMS and TC-CK1-SBE with 2.x software versions, the TCIB-UNI has lower power requirements. The table below provides the minimum current supply based on input voltage. Note that “4-Unit System” is 4 TCIB-UNIs powering 4 TC-CK1 sensors directly, and a “1-Unit System” is a single TCIB-UNI powering a single TC-CK1 sensor directly.

Table 2: Intersector System Power Consumption

Current Draw	12 VDC Input	24 VDC Input
4-Unit System	5 A	3 A
1-Unit System	1.25 A	0.75 A

6.2.2 Ethernet

The TCIB-UNI's primary communication path is in the

Table 3: Ethernet Connector Pinout

Pin	Intersector	Daisy In/Out	RJ45 Color
1	TX+	TX+	ORG/WHT
2	TX-	TX-	ORG
3	RX+	RX+	GRN/WHT
4	GND	NC	BLU
5	GND	NC	BLU/WHT
6	RX-	RX-	GRN
7	+24VDC	NC	BRN/WHT
8	+24VDC	NC	BRN

6.2.3 Serial

The TCIB-UNI provides an RS-232 serial maintenance port. The table below provides a pinout for this serial port.

Table 4: Serial Maintenance Port Pinout

Pin	Function
1	NC
2	TX1
3	RX1
4	NC
5	GND
6	NC
7	RX2
8	TX2
9	NC

The table below provides the parameters needed to configure a serial terminal session to access the serial maintenance port.

Table 5: Serial Port Settings

Port Setting	Value
Bits per second	115200
Data bits	8
Parity	None
Stop bits	1
Flow Control	Hardware

6.2.4 Edge Connector

The TCIB-UNI complies with NEMA TS2:2006 Detector Rack Card specifications. The TCIB-UNI card operates on 12 to 24-volts-DC power input, and all output signals comply to the signal levels specified in the NEMA standard. The table below provides the pinout for the edge connector.

Table 6: Edge Connector Pinout

Pin	Function	Pin	Function
A	Logic Ground (DC-)	1	Reserved
B	Detector Unit DC Supply	2	Reserved
C	NC	3	Reserved
D	NC	4	NC
E	NC	5	NC
F	Channel 1 Output (+)	6	NC
H	Channel 1 Output (-)	7	Channel 1 Status Output
J	NC	8	NC
K	NC	9	NC
L	Chassis Ground	10	Reserved
M	NC	11	NC
N	NC	12	NC
P	NC	13	NC
R	NC	14	NC
S	Channel 3 Output (+) *	15	NC
T	Channel 3 Output (-) *	16	Channel 3 Status Output *
U	NC	17	NC
V	NC	18	NC
W	Channel 2 Output (+)	19	NC
X	Channel 2 Output (-)	20	Channel 2 Status Output
Y	Channel 4 Output (+) *	21	NC
Z	Channel 4 Output (-) *	22	Channel 4 Status Output *

* Not Connected in TCIB-UNI-2.1 card configuration.