SACO CONTROLS

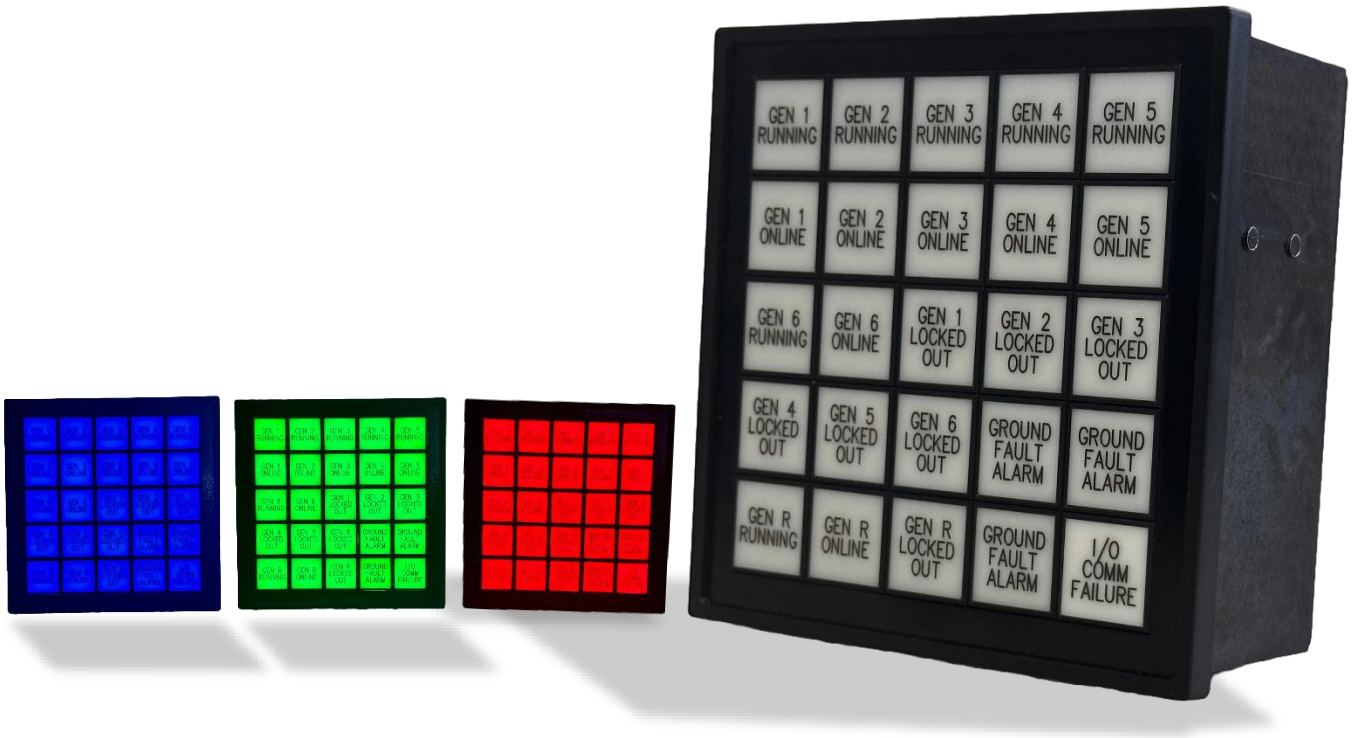


ABB-ANN-5X5

USER'S MANUAL

Important Information for the User

Please read this user manual carefully to ensure proper use of your ABB-ANN-5X5 Annunciator. Following the best practices outlined in this document will help extend the lifespan of your equipment.

Key Points:

- **Familiarity with Codes and Protocols**: Users should be familiar with the relevant codes, laws, and protocols necessary for the installation and proper functioning of the Annunciator.

- **Qualified Personnel**: Installation, adaptation, commissioning, assembly, or maintenance activities must be performed by personnel with the appropriate skills and experience in accordance with regional laws and codes.

- **Liability Disclaimer**: Saco Controls will not be held responsible for any damage to this equipment resulting from noncompliance with the recommendations provided in this manual.

By adhering to these guidelines, you can ensure the effective and safe operation of your ABB-ANN-5X5 Annunciator.

Table of Contents

Overview

The SANN-XX range of Annunciators from Saco Controls is designed for versatile equipment control management. Whether used individually or integrated into a central SCADA type system, these Annunciators offer flexibility and reliability. Specifically, the ABB-ANN-5X5 Annunciator model excels in adapting to various industrial processes and equipment management systems. Its scalability and robust performance make it an ideal choice for industries that prioritize performance, safety, and reliability.

The ABB-ANN-5X5 Annunciator controls a 5X5 grid of LED cells, each equipped with RGB Light Emitting Diodes (LEDs). The functionality of these LED cells is governed by values stored in Modbus holding registers, which can be accessed and modified by an external Modbus master via RS485 or RS-422 twisted pair communication.

Key Features:

Independent Control:

- Each LED cell can be turned on or off independently, set to Red, Green, Amber, Blue or White, and configured for either constant illumination or a variable blink rate.

- Typical Application: Commonly used in systems to display status indicators, the ABB-ANN-5X5 Annunciator responds to changes in system states and events by adjusting the on/off status, blink rates, and colors of the LED cells.

Modbus Communication:

- Typically, a Programmable Logic Controller (PLC) acts as the Modbus master.
- The master can issue Write Holding Register commands to modify the LED enable registers, controlling the on/off state of the LED cells.

To change an LED cell's color (e.g., from Amber to Red), the master sends a command to modify the corresponding LED color register. If the cell is currently on, the color change occurs immediately; if it is off, the next time it is activated, it will light up in the new color.

LED Cell Control

- The LED cells are numbered 1 through 25.
- The Modbus master can:
  - Enable or disable each LED cell.
  - Change the color of each cell.
  - Adjust the blink rate of each cell.

For more detailed operational instructions, please refer to the operation section of the manual.

Customization and Specifications of the ABB-SANN-5X5 Annunciator

Customization

The ABB-ANN-5X5 Annunciator 's appearance can be customized based on customer requests, allowing for the inclusion of text and graphics that clearly illustrate the system conditions represented by each LED. This personalization enhances clarity and communication within the system.

Specifications

Power Requirements

- Operating Voltage: 8.0V - 32V DC
- Operating Current: 2.5 Amps internal fuse

Environmental Conditions

- Operating Temperature: 32 to 122°F (0 to 50°C)
- Storage Temperature: -4 to 140°F (-20 to 60°C)
- Relative Humidity: 5% to 95%, non-condensing

Network Communications

- Protocols: RS485 or RS422

- Data Rates: 4800, 9600, 19200, or 28800 bps
- Parity Options: None, Even, or Odd
- Stop Bits: 0, 1 or 2
- Data Bits: 8 (RTU Protocol)

Electromagnetic Compliance (EMC)

- EN 55011: Radiated RF Emissions
- EN 61000-4-2: Electrostatic Discharge Immunity
- EN 61000-4-3: Radiated RF Immunity
- EN 61000-4-4: Electrical Fast Transient Immunity
- EN 61000-4-6: Conducted RF Immunity

Configuration and Communication

The ABB-ANN-5X5 Annunciator can be configured for communication at various baud rates (4.8k, 9.6k, 19.2k, 28.8k), with options for stop bits and parity settings set through Modbus holding registers. Only RTU mode is supported.

A six-position DIP switch on the rear panel allows for:

- Configuration of the Modbus address
- Resetting communication settings
- Activating test screens

Modbus Network

In a Modbus network, there is typically one master device and at least one slave device, daisy-chained using twisted pair cable (see Appendix B). Each Modbus slave device is assigned a unique address from 1 to 247. The ABB-ANN-5X5 Annunciator can be assigned an address from 1 to 15. This address allows the master to differentiate between slaves and send query commands.

Modbus Commands

The Modbus commands enable the master device to read from and write to specific holding registers, which are detailed in Appendix A. These registers facilitate manipulation of LED cell states, configuration of communication settings, and checking device status.

Modbus Command	Modbus Command Description
03h	Read Holding Register
06h	Write Single Holding Register
10h	Write Multiple Holding Registers

Figure 1: Supported Modbus Commands

1. Symbols used

Pictograms for Important Information

In this manual, we will use the following pictograms to highlight situations that require special attention from the reader:

1. Warning 

Indicates a potential hazard that could result in injury or damage if not observed.

2. Caution 

Alerts the reader to situations that may cause equipment malfunction or operational issues.

3. Note 

Provides additional information or helpful tips related to the content.

4. Important 

Signifies critical information that must be followed to ensure proper operation and maintenance.

5. Tip 

Offers practical suggestions to enhance performance or user experience.

Please pay close attention to these pictograms as you read through the manual to ensure safe and effective use of the **ABB-ANN-5X5 Annunciator.**

2. Safety standards

Warning: Please absolutely comply with these standards before, during and after using the ABB-ANN-5X5 Annunciator.

• Only qualified persons may install, start, and operate this device.

• For indoor use only

• Never handle when this device is energized

• Always follow the connection instructions to avoid any risk of electric shock

• Always respect the conditions indicated in this manual for the environment in which this device will be installed

• Do not change the fuse when this device is powered on

• Always turn off the equipment before making a connection

• When connecting the voltage source, always ensure that you respect the polarity indicated on the equipment

• Avoid close exposure to corrosive materials

3. Design

3.1. Front panel configuration

The front panel features 25 cells that are illuminated by high intensity LEDs, ensuring that alarms are highly visible even in challenging conditions. This design makes it easier for operators and personnel to quickly detect and respond to alerts, enhancing safety and operational efficiency.

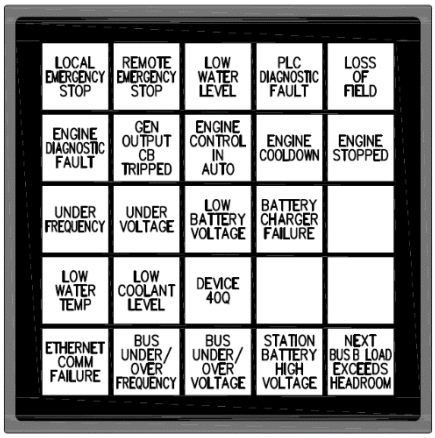


Figure 2: ABB-ANN-5X5 ANNUNCIATOR Front Panel

3.2. Back panel configuration

The ABB-ANN-5X5 Annunciator is designed for flexibility in industrial communication. Designed to fit into various industrial environments, making it a reliable choice for alarm signaling and communication needs.

Here's a summary of the key features:

Warning Lamp: Indicates when the unit is powered, providing a visual confirmation of voltage supply and provides vital feedback on the communication status with the Modbus master.

Communication Ports: RS485/RS422 Interface offers flexibility in connectivity, allowing the unit to be integrated with different control systems and communication setups.

DIP switch: Connect up to 15 ABB-ANN-5X5 Annunciator units to your network, each assigned a unique Modbus slave unit number. This is easily managed using the six-position DIP switch located on the rear panel of the device. This feature allows for organized and scalable alarm

management across your industrial site, ensuring that each unit can be individually addressed and control LED within the network.

This combination of features makes the ABB-ANN-5X5 Annunciator a robust and adaptable solution for maintaining efficient and reliable industrial operations.

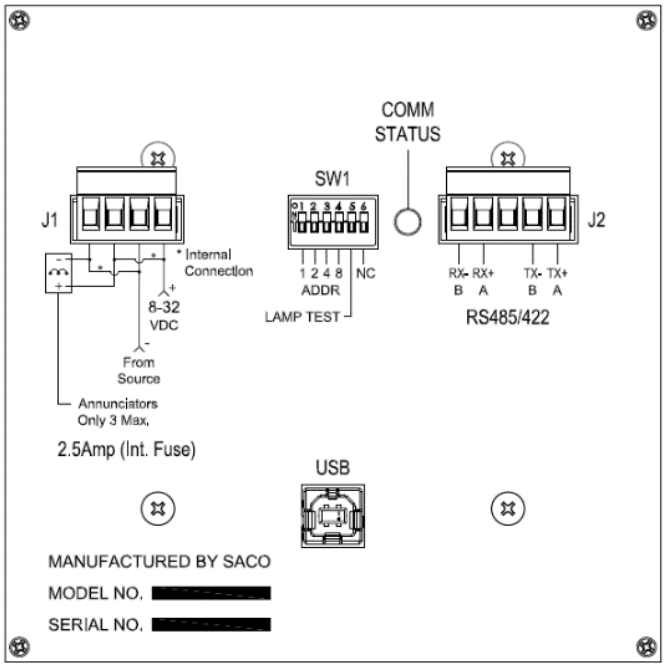


Figure 3: ABB-ANN-5X5 ANNUNCIATOR Back Panel configuration

4. Installation

4.1. Panel Installation

The ABB-ANN-5X5 Annunciator can be mounted in nearly any panel or door with a thickness of up to 0.9 inches. It fits into a square hole measuring 5.5 inches by 5.5 inches. Ensure that the ventilation openings on the bottom and rear of the Annunciator are not blocked during installation.

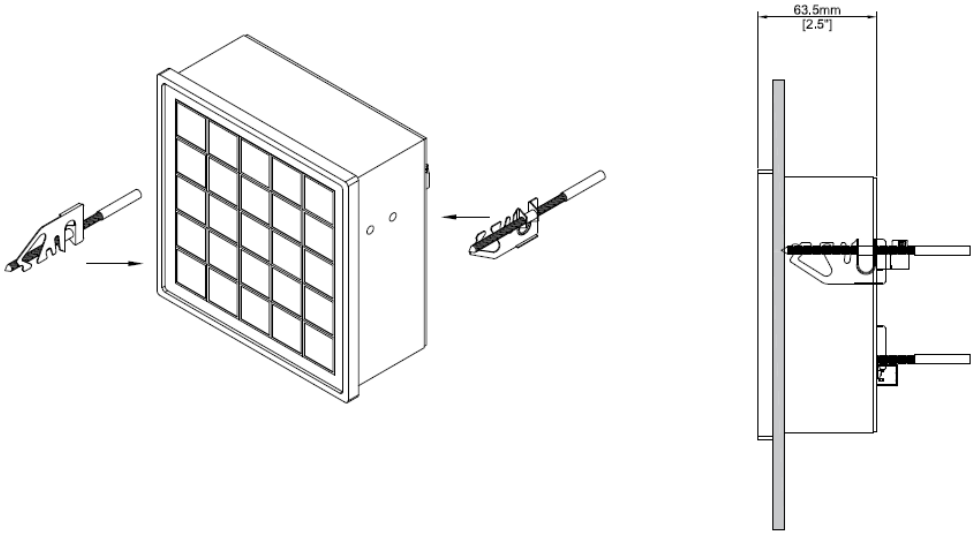


Figure 4: ABB-SANN-5X5

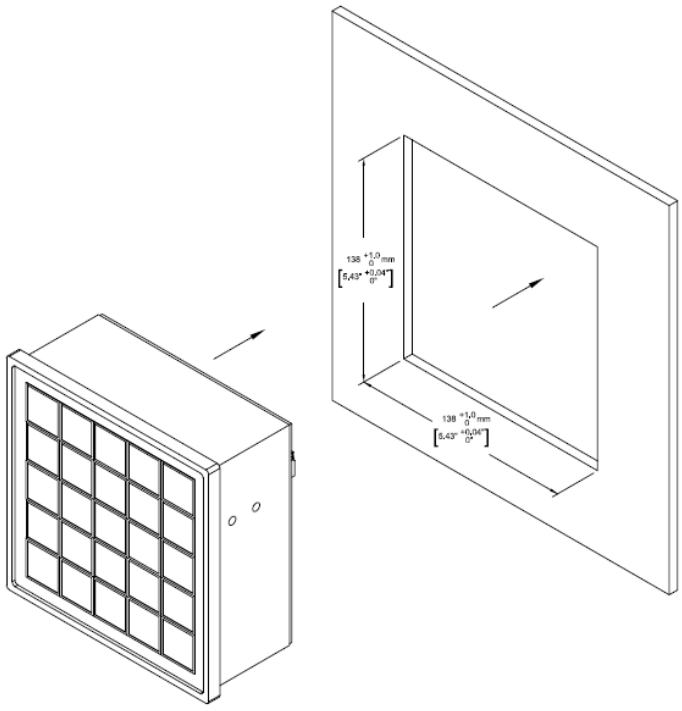


Figure 5: ABB-SANN-5X5

4.2. Power Wiring

DC power should be connected to J1 on the rear panel of the ABB-ANN-5X5 Annunciator. Connect the DC power source to pins 3 and 4 of J1. Pins 1 and 2 are designed for daisy-chaining power to additional Annunciators. You can Power-Up to four Annunciators from a single chain. For more detailed information, please refer to Section 8.3.

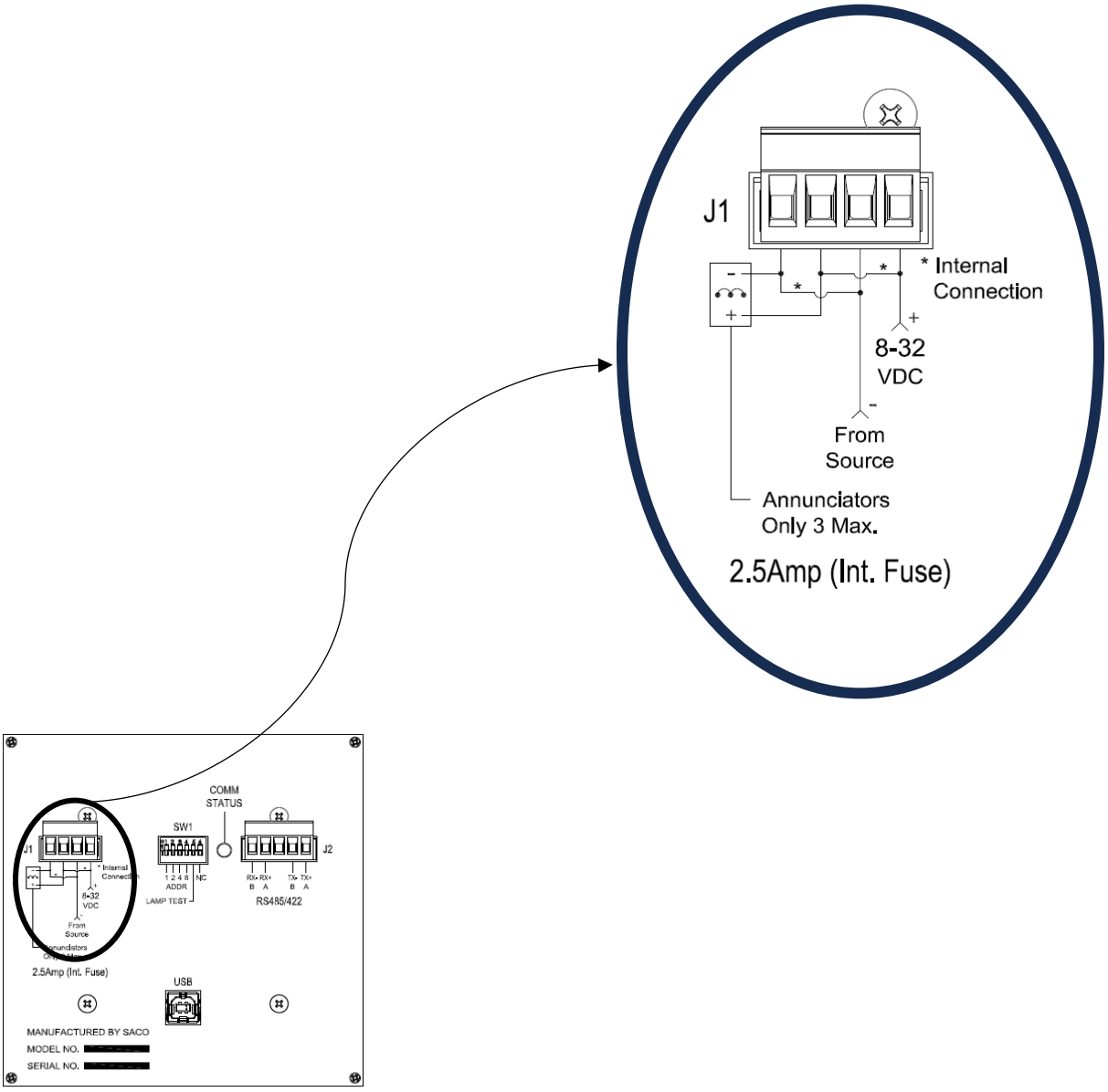


Figure 6: DC power connection

4.3. Network Wiring

The ABB-ANN-5X5 Annunciator supports both RS485 (two-wire) and RS422 (four-wire) connections. The network connector is J2, located on the right side of the rear panel. For more detailed information, please refer to Section 8.3.

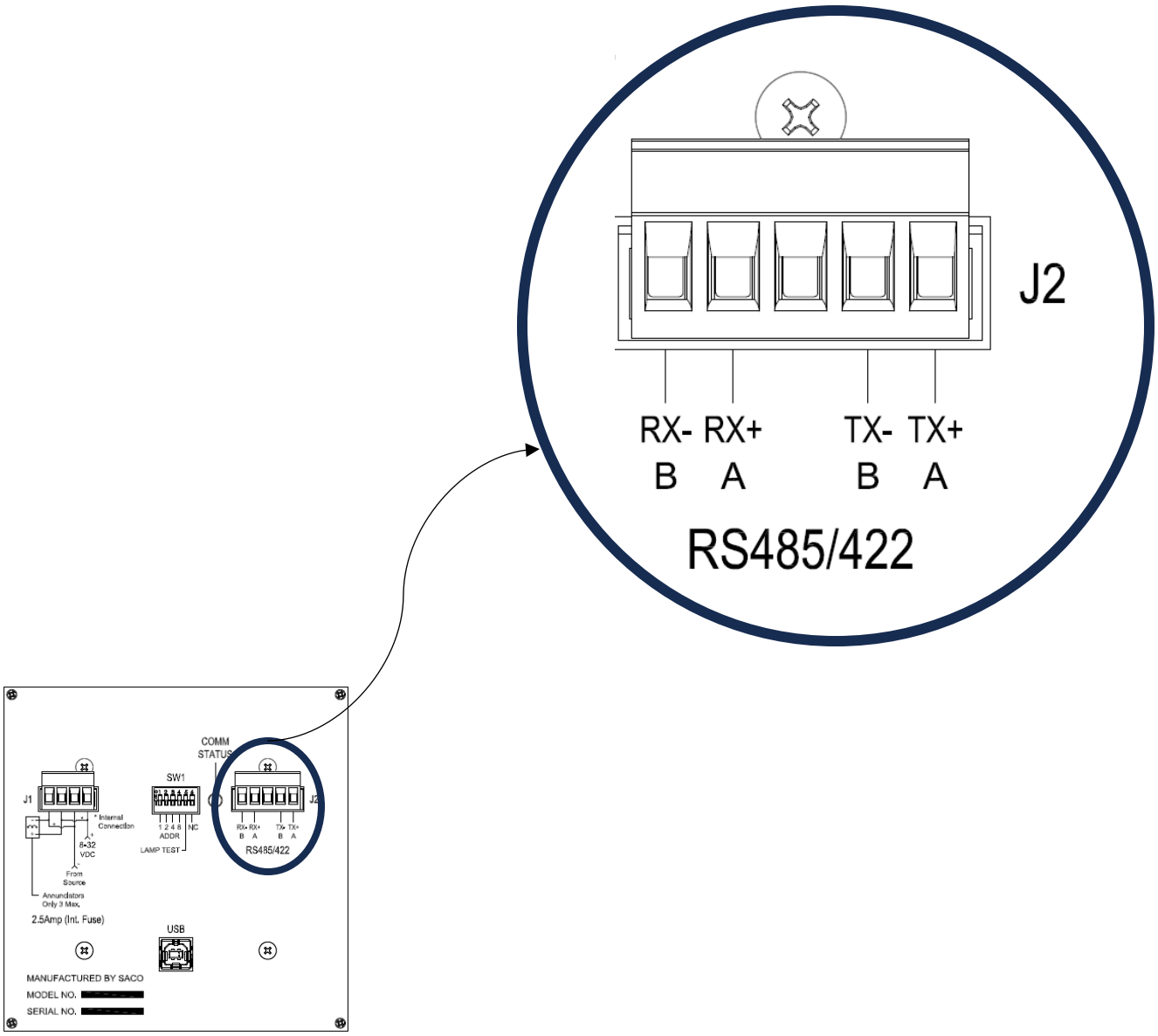


Figure 7: RS485/422 connection

5. Configuration

The ABB-ANN-5X5 Annunciator can be assigned a Modbus slave address ranging from 1 to 15. This address is configured using switches 1 through 4 on the six position DIP switch (SW1) located on the rear panel. These four switches correspond to the four bits of a binary address:

Position	
1	2^0
2	2^1
3	2^2
4	2^3

Table 1: DIP switch position

A switch set to the UP position represents a 1 in the four-bit address, while a switch in the DOWN position represents a 0. The new address configuration will be applied after the ABB-ANN-5X5 ANNUNCIATOR is powered off and then back on.

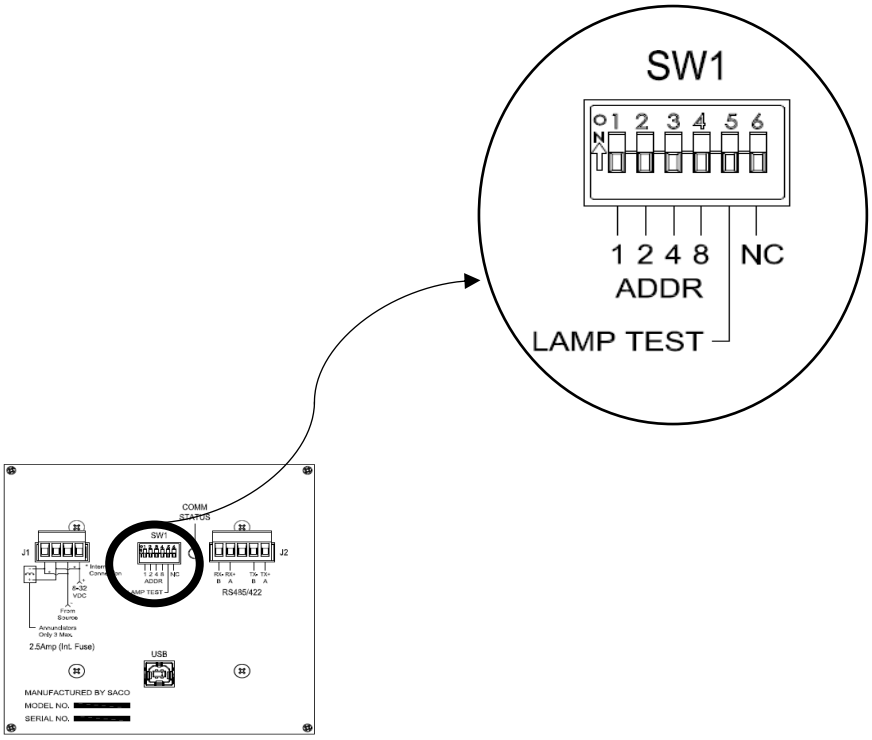


Figure 8: DIP switch

5.1. Modbus slave address

To set the Modbus slave address of the ABB-ANN-5X5 ANNUNCIATOR to address 7 (binary 0111), follow these steps:

1. Disconnect the power.

2. Configure the DIP switches (SW1) as follows:

   Switch 4: DOWN (0)

   Switch 3: UP (1)

   Switch 2: UP (1)

   Switch 1: UP (1)

3. Reconnect the power and power cycle the unit to apply the new address setting.

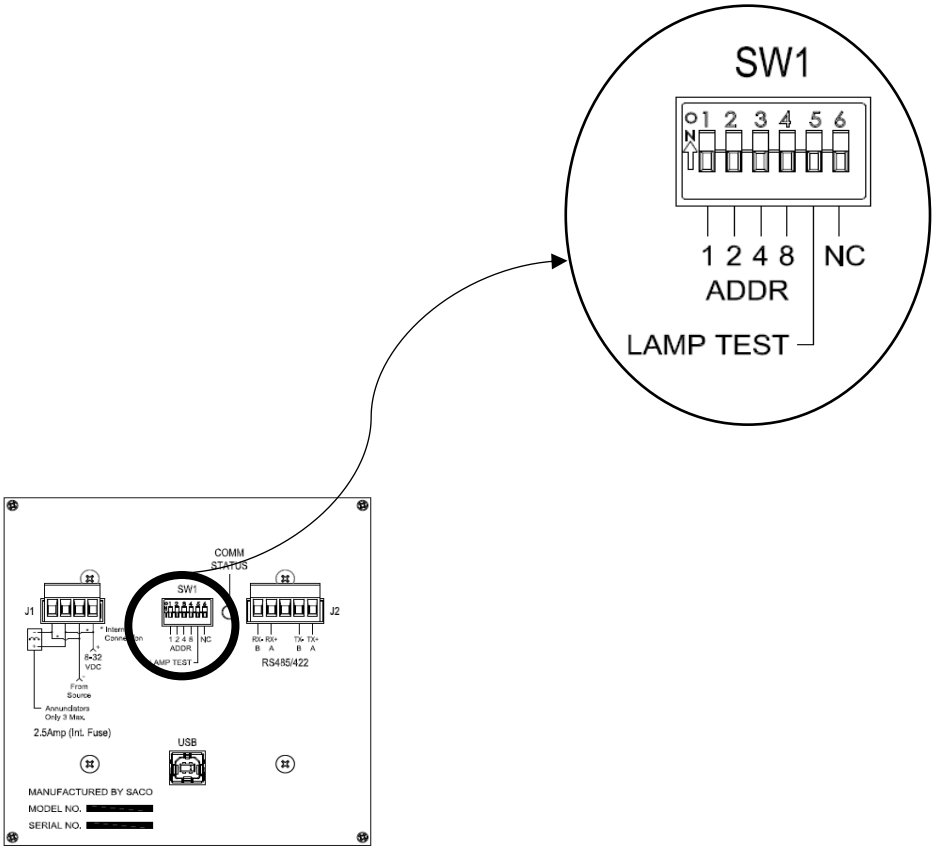


Figure 9: DIP switch

5.2. Communication settings

The ABB-ANN-5X5 ANNUNCIATOR can be configured with any combination of the following settings:

- **Baud Rate:** 4.8k, 9.6k, 19.2k or 28.8k
- **Stop Bits:** 1 or 2
- **Parity:** None, Even or Odd

To change these settings, write to the respective Modbus holding registers that control UART settings. Reconnect the power and power cycle the unit to apply the new communication settings. For more detailed information, please refer to Section 8.1.

Holding registers	Description	Value	Read Only or RW
40011	UART Baud Rate		Read-Write
		0 = 19.2k	
		1 = 4.8k	
		2 = 9.6k	
		3 = 19.2k	
		4 = 28.8k	
		>4 = 19.2k	

Table 2: Baud Rate settings

Holding registers	Description	Value	Read Only or RW
40012	UART Stop Bits		Read-Write
		0 = 1 Stop Bit	
		1 = 1 Stop Bit	
		2 = 2 Stop Bit	
		>2 = 1 Stop Bit	

Table 3: UART Stop Bits

Holding registers	Description	Value	Read Only or RW
40013	UART Parity Bits		Read-Write
		0 = No Parity	
		1 = No Parity	
		2 = Even Parity	
		3 = Odd Parity	
		>3 = No Parity	

Table 4: UART Parity Bits

Retrieving Lost or Unknown Communication Settings

If you need to retrieve lost or unknown communication settings for the ABB-ANN-5X5 Annunciator, follow these steps:

1. Run the Power-Up Lamp Test:

   This test will display the current communication settings directly on the front panel of the Annunciator.

2. Refer to the Manual:

   For detailed instructions on how to perform the Power-Up Lamp Test, consult the operation section of this manual. This will guide you through the steps to access and view the communication settings effectively.

By following these steps, you can easily recover the necessary communication settings for your ABB-ANN-5X5 Annunciator.

5.3. Reply delay

Configuring the Reply Delay for the ABB-ANN-5X5 Annunciator

To set a delay between receiving a Modbus query and sending a response, follow these steps:

1. Write the Desired Value:

   Enter a value between 0 and 255 milliseconds into the Reply Delay Register (Modbus holding register 40014).

2. Power Cycle the Unit:

   Disconnect and then reconnect the power to the unit to apply the new communication settings.

This adjustment helps prevent communication errors by allowing the Modbus Master time to deactivate its RS485 line drivers, thereby reducing bus contention issues.

Holding registers	Description	Value	Read-Only or RW
40014	Reply Delay		Read-Write
		0 255 = 0255 msec	
		>255 = 255 msec	

Table 5: Reply Delay register

5.4. Factory default

The factory default communication settings for the ABB-ANN-5X5 Annunciator are:

Baud Rate	19.2k
Stop Bit	1
Parity Bit	No Parity
Reply delay	50 ms

Table 6: Factory default communication settings

To restore these settings, follow these steps:

1. Disconnect the power
2. Set All positions of the DIP switch SW1, to the Down position (0)
3. Restore power. All LED cells will turn red and flash at a 500 msec blink rate.
4. Disconnect the power
5. Set DIP switch SW1, positions 14, to the desired Modbus slave address
6. Restore power

The communication settings are now restored to their factory original settings of:

- Baud Rate: 19.2k
- Stop Bits: 1
- Parity: None
- 50 ms Reply Delay

6. Operation

Each LED cell on the ABB-ANN-5X5 Annunciator has three major control functions:

1. **Enable**: Turns the LED cell on or off.

2. **Color**: Defines the color of the LED cell.

3. **Blink Rate**: Adjusts the frequency at which the LED cell blinks.

The LED cells are numbered from 1 to 25, progressing from left to right and top to bottom.

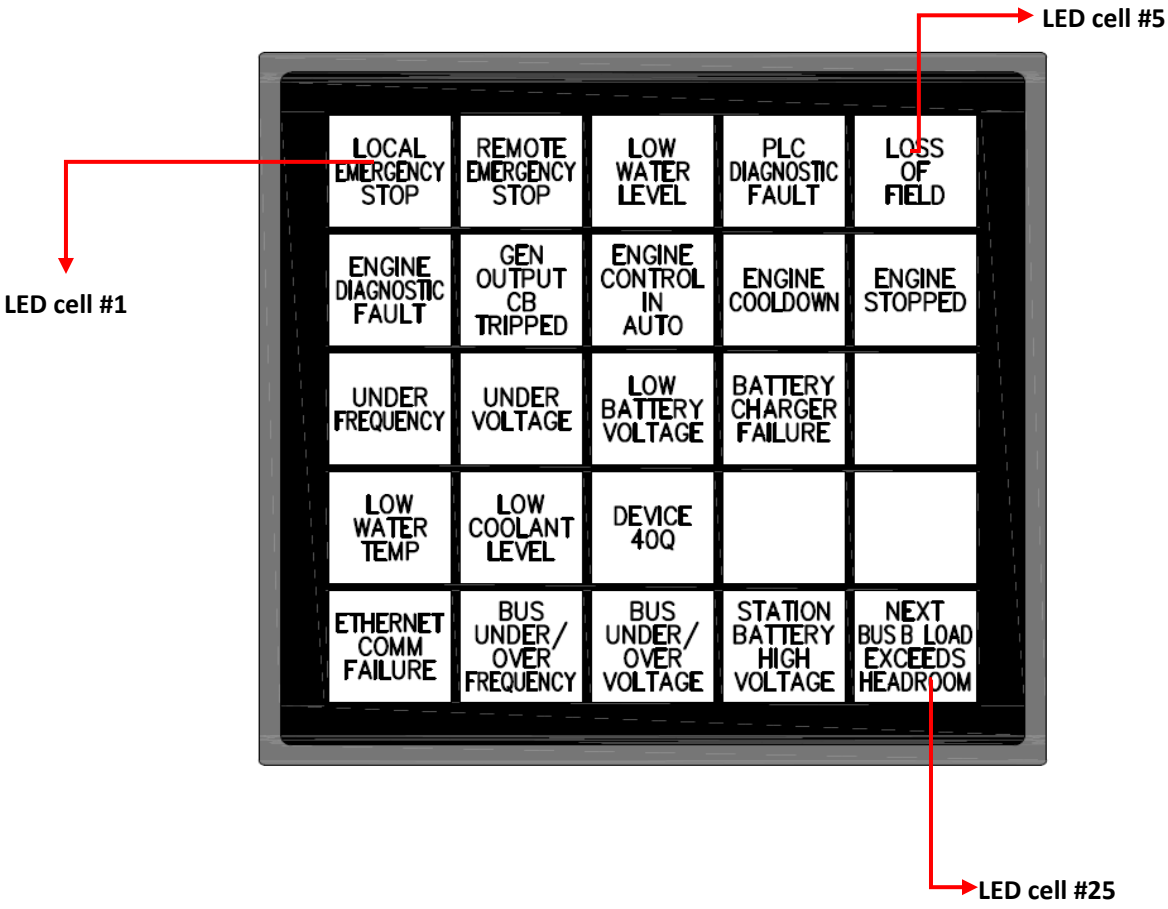


Figure 10 : ABB-SANN-5X5 LED cells number

6.1 LED Enable and Disable

When disabled, an LED cell will remain OFF. When enabled, each LED cell will turn ON and OFF based on its color setting and blink rate.

To enable or disable the LED cells, use the following Modbus registers:

- **LED Enable Register A** (Modbus holding register 40001): Bits 0 through 9 control the top two rows of LEDs (LED cells 1 through 10). For example, setting Bit 3 of LED Enable Register A to 1 will enable LED cell 4.

- **LED Enable Register B** (Modbus holding register 40002): Bits 0 through 14 control the bottom three rows of LEDs (LED cells 11 through 25). Here's a clear summary of the key points regarding the LED control and behavior of the ABB-ANN-5X5 Annunciator:

LED Control Overview

1. **Independent Settings**:

- The enable/disable state of an LED cell does not affect its color or blink rate settings.
- You can configure an LED's color and blink rate before enabling it.

2. **Enable/Disable LEDs**:

- You can turn LEDs ON and OFF without changing their color or blink rate by manipulating the LED Enable registers (40001 and 40002).

3. **Power Cycling**:

- When the ABB-ANN-5X5 Annunciator is powered off and then back on, both LED Enable registers are reset to zero, which disables all LED cells.
- This means all settings for enabling LEDs will need to be reapplied after a power cycle.

4. **Periodic Polling**:

- It is essential to poll and refresh the LED Enable registers regularly to ensure they have not been reset due to power interruptions.

Best Practices

Setup: Configure the color and blink rate settings first, then enable the LEDs.

Monitoring: Regularly check the LED Enable registers to confirm that the LEDs are still enabled after any power interruptions.

This approach ensures that your LED configurations remain intact and function as intended.

6.2. LED Color

Here's a detailed overview of how to control the color states of the LED cells on the ABB-ANN-5X5 Annunciator:

LED Color States

Each LED cell has six possible color states:

- 0: LED Off
- 1: Red
- 2: Green
- 3: Amber
- 4: Blue
- 5: White

LED Color Registers

The color for LED cells 1 through 25 is controlled by the LED Color registers, specifically Modbus holding registers 40021 through 40045. Here's how the registers correspond to the LED cells:

- LED Cell 1: Modbus register 40021
- LED Cell 2: Modbus register 40022
- LED Cell 3: Modbus register 40023
- ...
- LED Cell 25: Modbus register 40045

Setting the Color

To set the color of a specific LED cell, write the corresponding value to its LED Color register.

Example:

To set LED cell 3 to Green, write 2 to Modbus register 40023.

Enabling the LED

Before the LED cell can turn ON, the corresponding enable bit in the LED Enable registers (40001 and 40002) must be set to 1.

Example Workflow:

1. Set the Color:

Write to the color register for the desired LED cell (e.g., write 2 to 40023 for LED cell 3 to make it Green).

2. Enable the LED:

Ensure the corresponding bit in the LED Enable register is set to 1 (e.g., Bit 2 of register 40001 for LED cell 3).

3. Activate the LED:

Once the color is set and the LED is enabled, the LED cell will turn ON with the specified color.

Summary

- Use Modbus registers 40021 to 40045 to set colors for LED cells 1 to 25.
- Enable the LEDs using the appropriate bits in the LED Enable registers.
- Regularly check settings to ensure they are maintained after power cycles.

6.3. LED Blink Rate

Here's a comprehensive overview of how to configure the blink rates for the LED cells on the ABB-ANN-5X5 Annunciator:

LED Blink Rates

Each LED cell can be configured with the following blink rates:

- 0: No Blink (LED is ON continuously)
- 1: Blink every 250 milliseconds
- 2: Blink every 500 milliseconds
- 3: Blink every 1 second
- 4: Blink every 2 seconds
- 5: Blink every 5 seconds
- Any Value > 5: No Blink

Blink Rate Cycle

A LED set to a specific blink rate will complete one ONOFF cycle in the specified time.

For example, an LED configured to blink at 250 milliseconds will be:

- ON for 125 milliseconds
- OFF for 125 milliseconds
- This pattern continues.

LED Blink Rate Registers

The blink rate for LED cells 1 through 25 is controlled by the LED Blink Rate registers, specifically Modbus holding registers 40046 through 40070. Here's how the registers correspond to the LED cells:

- LED Cell 1: Modbus register 40046
- LED Cell 2: Modbus register 40047
- LED Cell 3: Modbus register 40048
- ...
- LED Cell 25: Modbus register 40070

Setting the Blink Rate

To set the blink rate of a specific LED cell, write the corresponding value to its LED Blink Rate register.

Example:

To set LED cell 3 to blink at a 2second rate, write 4 to Modbus register 40048.

Enabling the LED for Blinking

For the LED cell to blink:

1. The corresponding Enable bit in the LED Enable register must be set to 1.

2. The Color register must be set to a value between 1 and 5 (i.e., not set to 0).

Example Workflow

1. Set the Color:

Write a value (e.g., 2 for Green) to the color register (e.g., 40048 for LED cell 3).

2. Enable the LED:

Set the corresponding bit in the LED Enable register (e.g., Bit 2 of register 40001).

3. Set the Blink Rate:

Write the desired blink rate value (e.g., 4 for a 2second rate) to the blink rate register (e.g., 40048).

4. Activate the LED:

Once the color is set, the LED is enabled, and the blink rate is defined, the LED cell will blink according to the specified settings.

Summary

- Use Modbus registers 40046 to 40070 to set blink rates for LED cells 1 to 25.
- Ensure the LED cell is enabled and its color is set to a valid value (15) for blinking to function.
- Regularly monitor settings to ensure they are maintained after power cycles.

6.4. Heartbeat

Here's a comprehensive overview of the Heartbeat function for the ABB-ANN-5X5 Annunciator:

Heartbeat Function Overview

The Heartbeat function is designed to alert observers of a communication failure between the Modbus master and the ABB-ANN-5X5 Annunciator.

Functionality:

If a communication failure is detected, LED cell 25 will:

- Flash at a 250 milliseconds blink rate.
- Cycle through the following colors: Red, Green, Blue and Amber.

Heartbeat Register

The Modbus Holding Register 40003 controls the activation and timing of the Heartbeat function.

Activation Procedure:

1. At Power-Up:

   The Heartbeat function is deactivated (register is set to 0).

2. To Activate Heartbeat:

   Write a nonzero value to the Heartbeat register (Modbus Holding Register 40003).

   The ABB-ANN-5X5 Annunciator will:

   Clear the Heartbeat register to 0.

   Start a 60 second timer.

3. Maintaining the Heartbeat:

   The Modbus master must write another nonzero value to the Heartbeat register before the 60 second timer expires.

   If a nonzero value is written within the time frame, the timer resets.

4. Communication Failure:

   If the 60 second timer expires without receiving another nonzero value:

   The ABB-ANN-5X5 Annunciator interprets this as a communication failure.

   On the next write of a nonzero value to the Heartbeat register, LED cell 25 will start flashing as described.

Deactivation and Recovery

Once the Heartbeat function is activated, it cannot be deactivated without cycling power to the device.

After a power cycle, LED cell 25 will return to normal operations, and the Heartbeat function will be deactivated.

Summary

- The Heartbeat function helps monitor Modbus communication status.
- Use Modbus Holding Register 40003 to activate and manage the Heartbeat.

- Write a nonzero value within 60 seconds to maintain communication; otherwise, a failure alert will trigger.
- To deactivate the function, a power cycle is required.

6.5. Communication Status LED

Communication Status LED Behavior on the ABB-ANN-5X5 Annunciator:

The Communication Status LED on the rear panel of the ABB-ANN-5X5 Annunciator provides vital feedback on the communication status with the Modbus master. Here's what the different LED signals indicate:

LED Signaling Conditions:

1. Constant Illumination:

Indicates: The ABB-ANN-5X5 Annunciator is operating normally but is not currently sending or receiving any data.

2. One Blink (Momentary):

Indicates: The unit has successfully sent or received a Modbus data packet. Each blink corresponds to a successful transmission.

3. One Blink (Repeating Pattern):

- Indicates: This continuous pattern of single blinks is Blink Code 1.
- Meaning: A bad data packet occurred during the last transmission.
- Error Code: The Error Code Register (Modbus Holding Register 40004) will read 01h.

Possible Causes:

- Invalid CRC at the end of the data packet.
- More than 500 milliseconds between data bytes.
- Invalid or unsupported Modbus command.

4. Three Blinks (Repeating Pattern):

- Indicates: This continuous pattern of three blinks is Blink Code 3.
- Meaning: The previous data transmission included out of range address or data.
- Error Code: The Error Code Register (Modbus Holding Register 40004) will read 03h.
- Implications: The address or data sent was not valid for the expected range.

Summary

- Constant Illumination: Normal operation, no data activity.
- One Blink: Successful data transmission.
- One Blink (Repeating): Bad data packet (Error Code 01h).
- Three Blinks: Out of range address or data (Error Code 03h).

Monitoring the Communication Status LED can help quickly diagnose communication issues between the ABB-ANN-5X5 Annunciator and the Modbus master, ensuring efficient troubleshooting and system reliability.

6.6. Error Code Register

Error Code Register Overview

The Error Code Register (Modbus holding register 40004) on the ABB-ANN-5X5 Annunciator is essential for monitoring communication integrity. Here's a breakdown of its functionality:

Register Functionality

- Stores Recent Errors: The register keeps track of the most recent communication error detected by the ABB-ANN-5X5 Annunciator.
- Clearing Errors: The Modbus master can clear the Error Code by writing 00h to this register.

Writing to the Error Code Register

Any value written to the Error Code register will be displayed the next time the register is read, assuming no communication errors occur during or after the write operation.

Writing 00h is recommended to reset the error state, but it is not required. The written value does not affect the operation of the ABB-ANN-5X5 Annunciator.

Error Code Values

The following values indicate the types of communication errors:

- **00h**: No communication error has occurred.

- **01h**: A bad data packet was received. This can result from:

  An invalid CRC at the end of the data packet.

  More than 500 milliseconds between data bytes.

  An invalid or unsupported Modbus command.

- **03h**: The data was received incorrectly. This can be caused by:

  A read or write attempt to an address less than 40001.

  A read or write attempt to an address greater than 40070.

  A command to read or write multiple holding registers that extends beyond the valid range.

Summary

- Modbus holding register 40004 (Error Code Register)
- Clear Error: Write 00h to reset.
- Error Codes:
  1. **00h**: No error.
  2. **01h**: Bad data packet (issues with CRC, timing, or invalid commands).
  3. **03h**: Incorrect address access (out of valid range).

Regular monitoring and clearing of the Error Code Register are crucial for ensuring reliable communication between the Modbus master and the ABB-ANN-5X5 Annunciator.

6.7. Power-Up Lamp Test

The Power-Up Lamp Test serves two primary functions:

1. LED Color Testing: Tests all three colors of LEDs in all 25 LED cells.

2. Configuration Display: Displays the current communication settings and firmware version of the ABB-ANN-5X5 Annunciator.

Steps to Run the Power-Up Lamp Test

1. Disconnect Power:

- Ensure the ABB-ANN-5X5 Annunciator is powered off.

2. Configure SW1:

- Set SW1, position 5 to the UP position (1).
- Set SW1, positions 1 through 4 to a valid Modbus address between 1 and 15.

3. Reconnect Power:

- Turn the power back on to the ABB-ANN-5X5 Annunciator.

4. LED Illumination:

All 25 LED cells will sequentially illuminate in the following order:

- Red
- Green
- Amber

5. Display Configuration:

After the LED colors cycle, the screen will display the current configuration of the ABB-ANN-5X5 Annunciator.

Configuration Screen Breakdown

Rows 1 through 3: Represent the communication settings of the ABB-ANN-5X5 Annunciator, with one LED illuminated in each row:

Row 1: Baud Rate

- LED 1: 4.8k
- LED 2: 9.6k
- LED 3: 19.2k
- LED 4: 28.8k

Row 2: Stop Bits

- LED 6: 1 Stop Bit
- LED 7: 2 Stop Bits

Row 3: Parity

- LED 11: No Parity
- LED 12: Even Parity
- LED 13: Odd Parity

Rows 4 and 5: Display the firmware version of the ABB-ANN-5X5 Annunciator.

Row 4: Binary representation of X (the major version).

- LED 16 is the least significant bit (LSB) of X.

Row 5: Binary representation of Y (the minor version).

- LED 21 is the least significant bit (LSB) of Y.

Note: An LED in the ON state represents a 1 in that bit position.

6.8. Intensity of LED lights

Adjusting LED Intensity for the ABB-ANN-5X5 Annunciator

The intensity of the LED light for cells 1 through 25 can be adjusted using the LED Intensity register, specifically Modbus holding register 40071. Here's how to change the intensity:

1. Write to Register: Enter a value between 0 and 15 into register 40071.

- 0: Brightest intensity
- 15: Least bright intensity

2. Simultaneous Adjustment: Please note that you cannot modify the intensity of individual cells. All LED cells will be modified simultaneously based on the value you write to register 40071.

This allows for cohesive control over the brightness of the entire array of LEDs on the Annunciator.

7. Appendix A

7.1. Appendix A: Front view

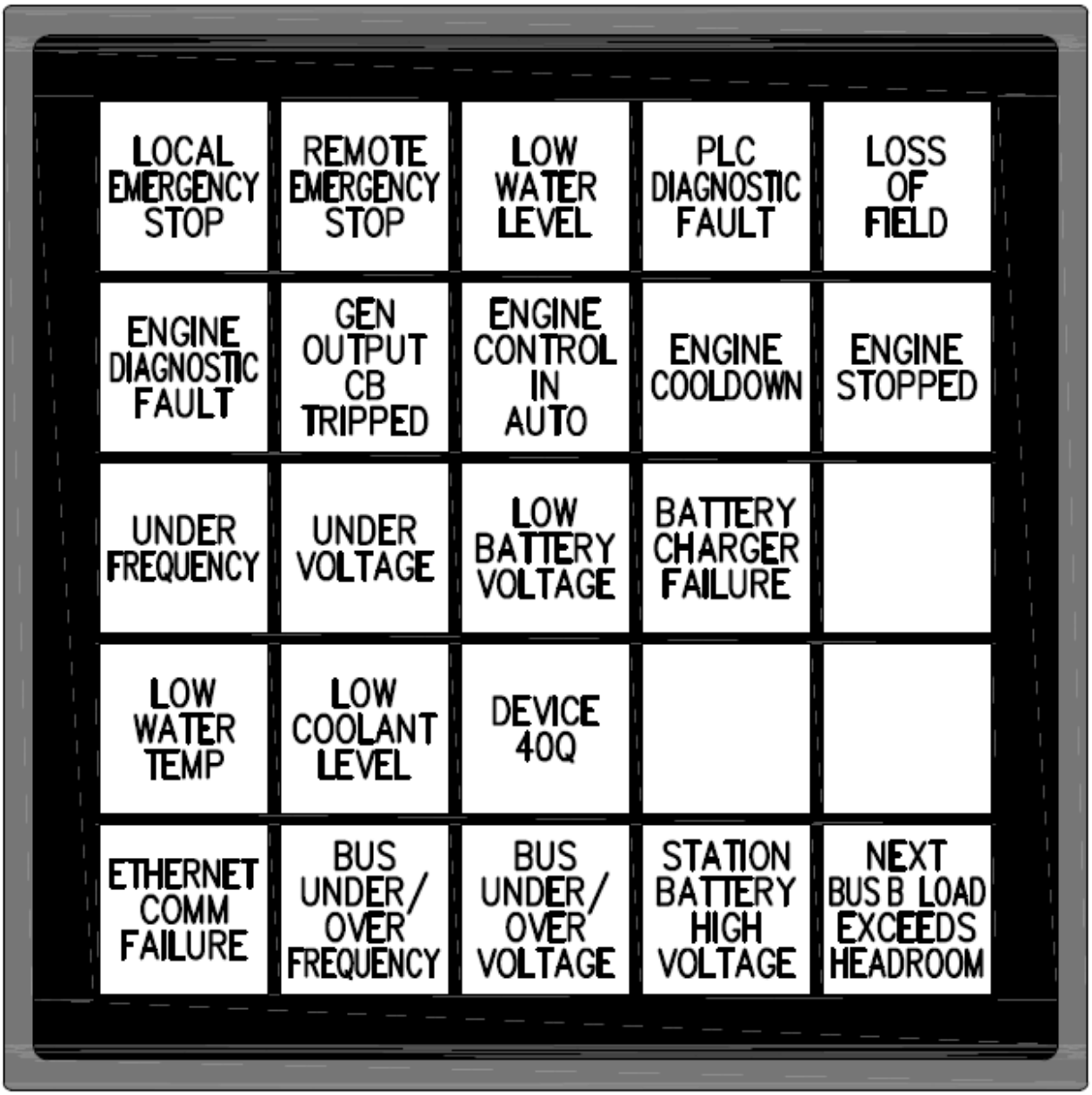


Figure 11: ABB-SANN-5X5 Annunciator Front Panel

7.2. Appendix A: Rear View

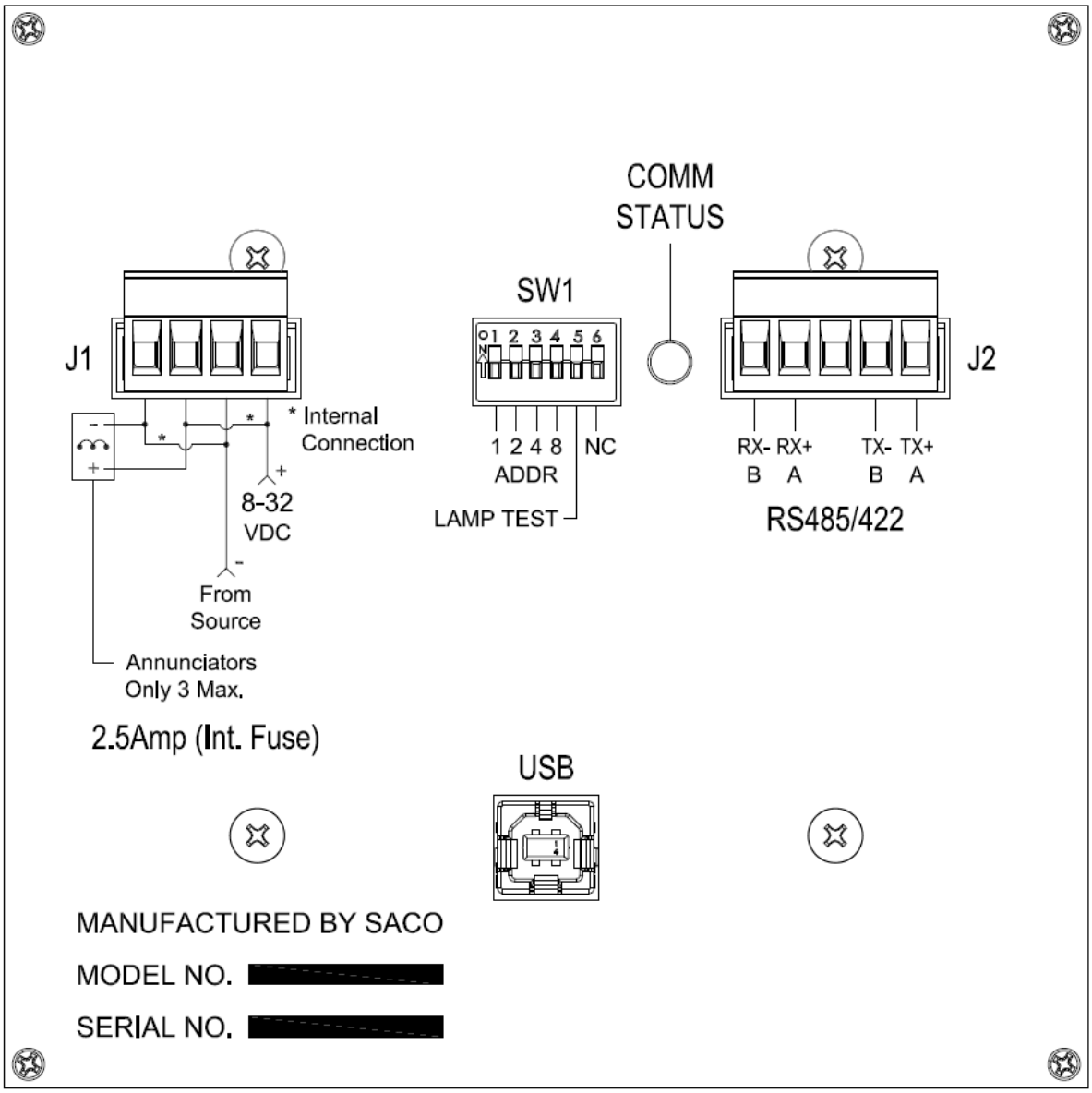


Figure 12:ABB-SANN-5X5 Annunciator Rear Panel

7.3. Appendix A: Panel Installation

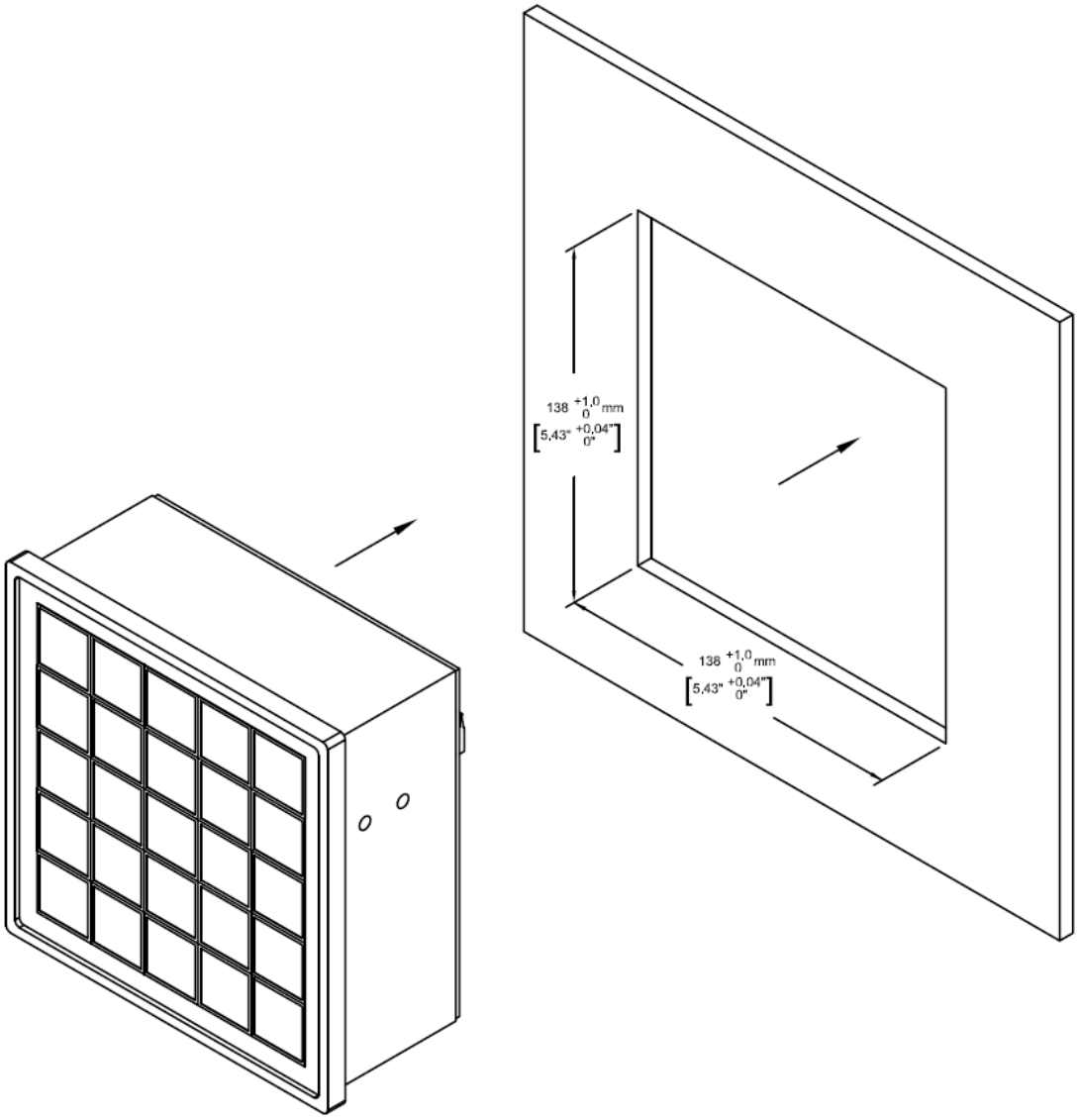


Figure 13: ABB-SANN-5X5 Annunciator Panel Installation 1

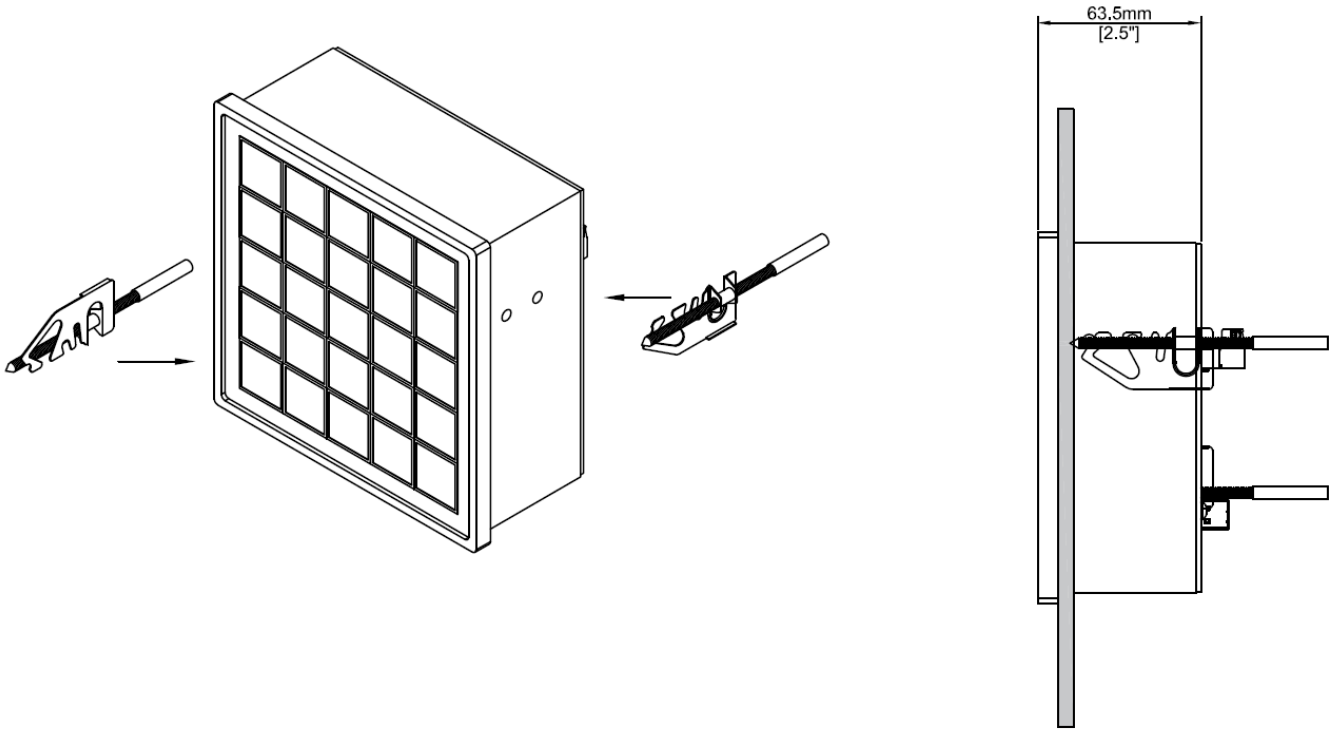


Figure 14: ABB-SANN-5X5 Annunciator Panel Installation 2

7.4. Appendix A: Front Tiles

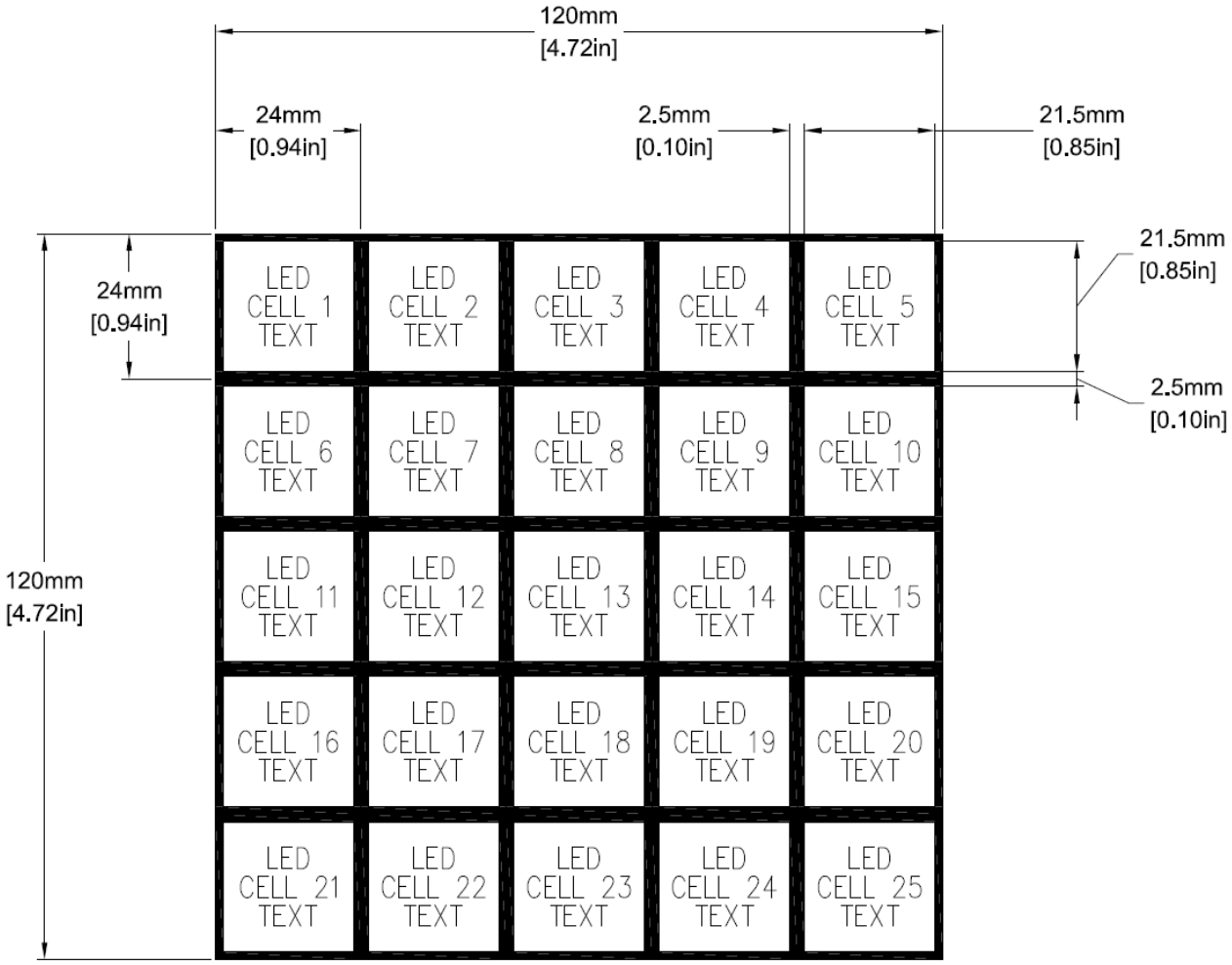
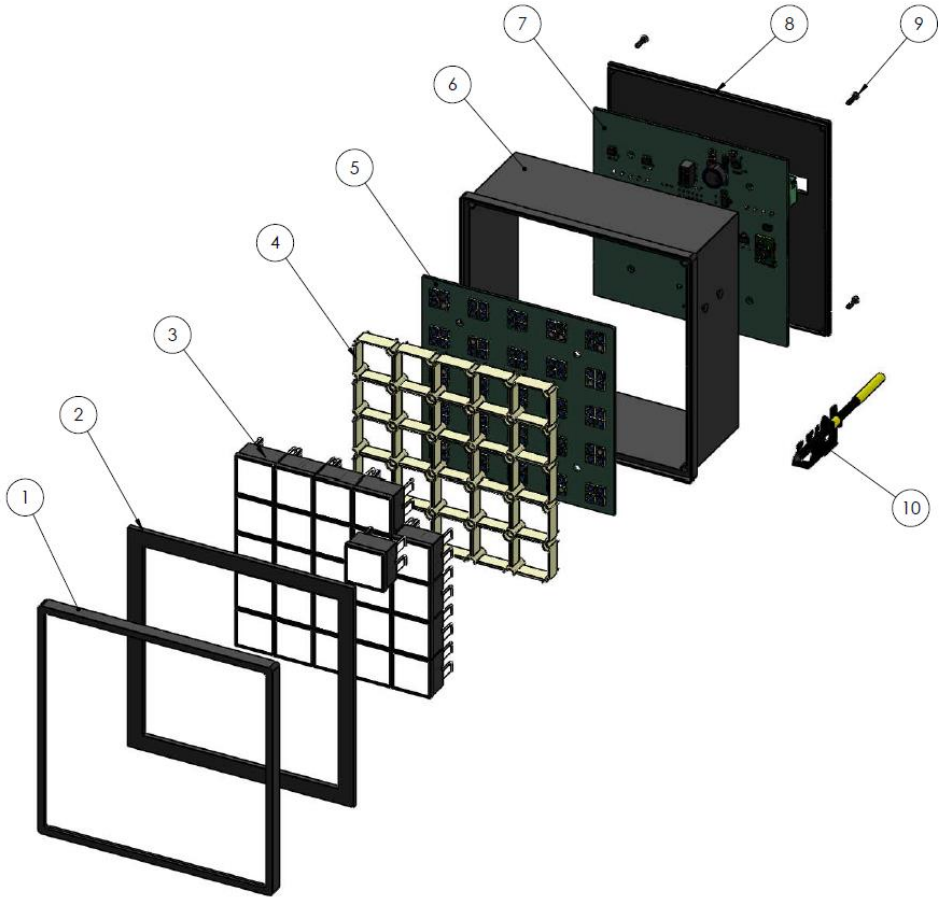


Figure 15: ABB-SANN-5X5 Annunciator Front Tiles

7.5 Appendix A: Explode View



1. Bezel Frame
2. Spacer Plate
3. White Translucent Tiles (Removable individually from front)
4. Grid Module
5. Front LED Board
6. Enclosure
7. Main Board
8. Rear Plate
9. Screws
10. Mounting Brackets

Figure 16: ABB-SANN-5X5 Annunciator Explode View

8.0. Appendix B

8.1. Appendix B: Register Table

Holding Reg.	Bit	Description	Value	Read-Only or Read-Write
40001		**LED Enable Register A**		**Read-Write**
	0	LED 1 Enable	1 = Enable, 0 = Disabled	
	1	LED 2 Enable	1 = Enable, 0 = Disabled	
	2	LED 3 Enable	1 = Enable, 0 = Disabled	
	3	LED 4 Enable	1 = Enable, 0 = Disabled	
	4	LED 5 Enable	1 = Enable, 0 = Disabled	
	5	LED 6 Enable	1 = Enable, 0 = Disabled	
	6	LED 7 Enable	1 = Enable, 0 = Disabled	
	7	LED 8 Enable	1 = Enable, 0 = Disabled	
	8	LED 9 Enable	1 = Enable, 0 = Disabled	
	9	LED 10 Enable	1 = Enable, 0 = Disabled	
	10	Unused		
	11	Unused		
	12	Unused		
	13	Unused		
	14	Unused		
	15	Unused		
40002		**LED Enable Register B**		**Read-Write**
	0	LED 11 Enable	1 = Enable, 0 = Disabled	
	1	LED 12 Enable	1 = Enable, 0 = Disabled	
	2	LED 13 Enable	1 = Enable, 0 = Disabled	
	3	LED 14 Enable	1 = Enable, 0 = Disabled	
	4	LED 15 Enable	1 = Enable, 0 = Disabled	
	5	LED 16 Enable	1 = Enable, 0 = Disabled	
	6	LED 17 Enable	1 = Enable, 0 = Disabled	
	7	LED 18 Enable	1 = Enable, 0 = Disabled	
	8	LED 19 Enable	1 = Enable, 0 = Disabled	
	9	LED 20 Enable	1 = Enable, 0 = Disabled	
	10	LED 21 Enable	1 = Enable, 0 = Disabled	
	11	LED 22 Enable	1 = Enable, 0 = Disabled	
	12	LED 23 Enable	1 = Enable, 0 = Disabled	
	13	LED 24 Enable	1 = Enable, 0 = Disabled	
	14	LED 25 Enable	1 = Enable, 0 = Disabled	
	15	Unused		
40003		**Heartbeat**	**Always reads as 0**	**Read-Write**
			Write Value > 0 to enable or Service Heartbeat function	
40004		**Error Code**	**00 = No Error**	**Read-Write**
			1 = Bad Packet Received 3 = Data or Adress Out of Range	

Holding Reg.	Bit	Description	Value	Read-Only or Read-Write
40005		**Hardware/Firmware Revision**		**Read-Only**
	[7:0]	Firmware Revision	Example: 13h = R1.3	
	[15:8]	Hardware Revision	Example: 10h = R1.0	
40006		**Unused**		**Read-Write**
40007		**Unused**		**Read-Write**
40008		**Unused**		**Read-Write**
40009		**Unused**		**Read-Write**
40010		**Unused**		**Read-Write**
40011		**UART Baud Rate**		**Read-Write**
			0 = 19.2k	
			1 = 4.8k	
			2 = 9.6k	
			3 = 19.2k	
			4 = 28.8k	
			> 4 = 19.2k	
40012		**UART Parity**		**Read-Write**
			0 = No Parity	
			1 = No Parity	
			2 = Even Parity	
			3 = Odd Parity	
			>3 = No Parity	
40014		**Reply Delay**		**Read-Write**
			0 – 255 = 0 – 255 msec >255 = 255 msec	
40015		**Unused**		**Read-Write**
40016		**Unused**		**Read-Write**
40017		**Unused**		**Read-Write**
40018		**Unused**		**Read-Write**
40019		**Unused**		**Read-Write**
40020		**Unused**		**Read-Write**

Holding Reg.	Bit	Description	Value	Read-Only or Read-Write
40021		LED 1 Enable	See Note 2	Read-Write
40022		LED 2 Enable	See Note 2	Read-Write
40023		LED 3 Enable	See Note 2	Read-Write
40024		LED 4 Enable	See Note 2	Read-Write
40025		LED 5 Enable	See Note 2	Read-Write
40026		LED 6 Enable	See Note 2	Read-Write
40027		LED 7 Enable	See Note 2	Read-Write
40028		LED 8 Enable	See Note 2	Read-Write
40029		LED 9 Enable	See Note 2	Read-Write
40030		LED 10 Enable	See Note 2	Read-Write
40031		LED 11 Enable	See Note 2	Read-Write
40032		LED 12 Enable	See Note 2	Read-Write
40033		LED 13 Enable	See Note 2	Read-Write
40034		LED 14 Enable	See Note 2	Read-Write
40035		LED 15 Enable	See Note 2	Read-Write
40036		LED 16 Enable	See Note 2	Read-Write
40037		LED 17 Enable	See Note 2	Read-Write
40038		LED 18 Enable	See Note 2	Read-Write
40039		LED 19 Enable	See Note 2	Read-Write
40040		LED 20 Enable	See Note 2	Read-Write
40041		LED 21 Enable	See Note 2	Read-Write
40042		LED 22 Enable	See Note 2	Read-Write
40043		LED 23 Enable	See Note 2	Read-Write
40044		LED 24 Enable	See Note 2	Read-Write
40045		LED 25 Enable	See Note 2	Read-Write

Holding Reg.	Bit	Description	Value	Read-Only or Read-Write
40046		LED 1 Blink Rate	See Note 3	Read-Write
40047		LED 2 Blink Rate	See Note 3	Read-Write
40048		LED 3 Blink Rate	See Note 3	Read-Write
40049		LED 4 Blink Rate	See Note 3	Read-Write
40050		LED 5 Blink Rate	See Note 3	Read-Write
40051		LED 6 Blink Rate	See Note 3	Read-Write
40052		LED 7 Blink Rate	See Note 3	Read-Write
40053		LED 8 Blink Rate	See Note 3	Read-Write
40054		LED 9 Blink Rate	See Note 3	Read-Write
40055		LED 10 Blink Rate	See Note 3	Read-Write
40056		LED 11 Blink Rate	See Note 3	Read-Write
40057		LED 12 Blink Rate	See Note 3	Read-Write
40058		LED 13 Blink Rate	See Note 3	Read-Write
40059		LED 14 Blink Rate	See Note 3	Read-Write
40060		LED 15 Blink Rate	See Note 3	Read-Write
40061		LED 16 Blink Rate	See Note 3	Read-Write
40062		LED 17 Blink Rate	See Note 3	Read-Write
40063		LED 18 Blink Rate	See Note 3	Read-Write

40064		LED 19 Blink Rate	See Note 3	Read-Write
40065		LED 20 Blink Rate	See Note 3	Read-Write
40066		LED 21 Blink Rate	See Note 3	Read-Write
40067		LED 22 Blink Rate	See Note 3	Read-Write
40068		LED 23 Blink Rate	See Note 3	Read-Write
40069		LED 24 Blink Rate	See Note 3	Read-Write
40070		LED 25 Blink Rate	See Note 3	Read-Write
40071		Light Intensity	0 to 15. 0 = Max./ 15 = Min.	Read-Write

Table 7: Registers

Notes on Modbus Holding Registers:

1. **Holding Register 40004 (Error Code):**

- Can be written to with any value.
- The written value has no effect on the operation of the LED Annunciator.
- This register remains Read-Write so that the Modbus master can clear the register after reading the Error Code data.

2. **Holding Registers 40021 - 40045 (LED Color Control):**

- Control the color of LED cells 1 through 25.
- Values:

  0 = Off

  1 = Red

  2 = Green

  3 = Amber

  4 = Blue

  5 = White

  Any value greater than 5 = Off

3. **Holding Registers 40046 - 40070 (LED Blink Rate Control)**:

- Control the blink rate of LED cells 1 through 25.
- Values:

  0 = No Blink

  1 = 250 milliseconds

  2 = 500 milliseconds
  3 = 1000 milliseconds (1 second)
  4 = 2000 milliseconds (2 seconds)
  5 = 5000 milliseconds (5 seconds)
  Any value greater than **5** = No Blink

These notes provide essential information for configuring the LED Annunciator's operation effectively.

8.2. Appendix B: Setup & Configuration

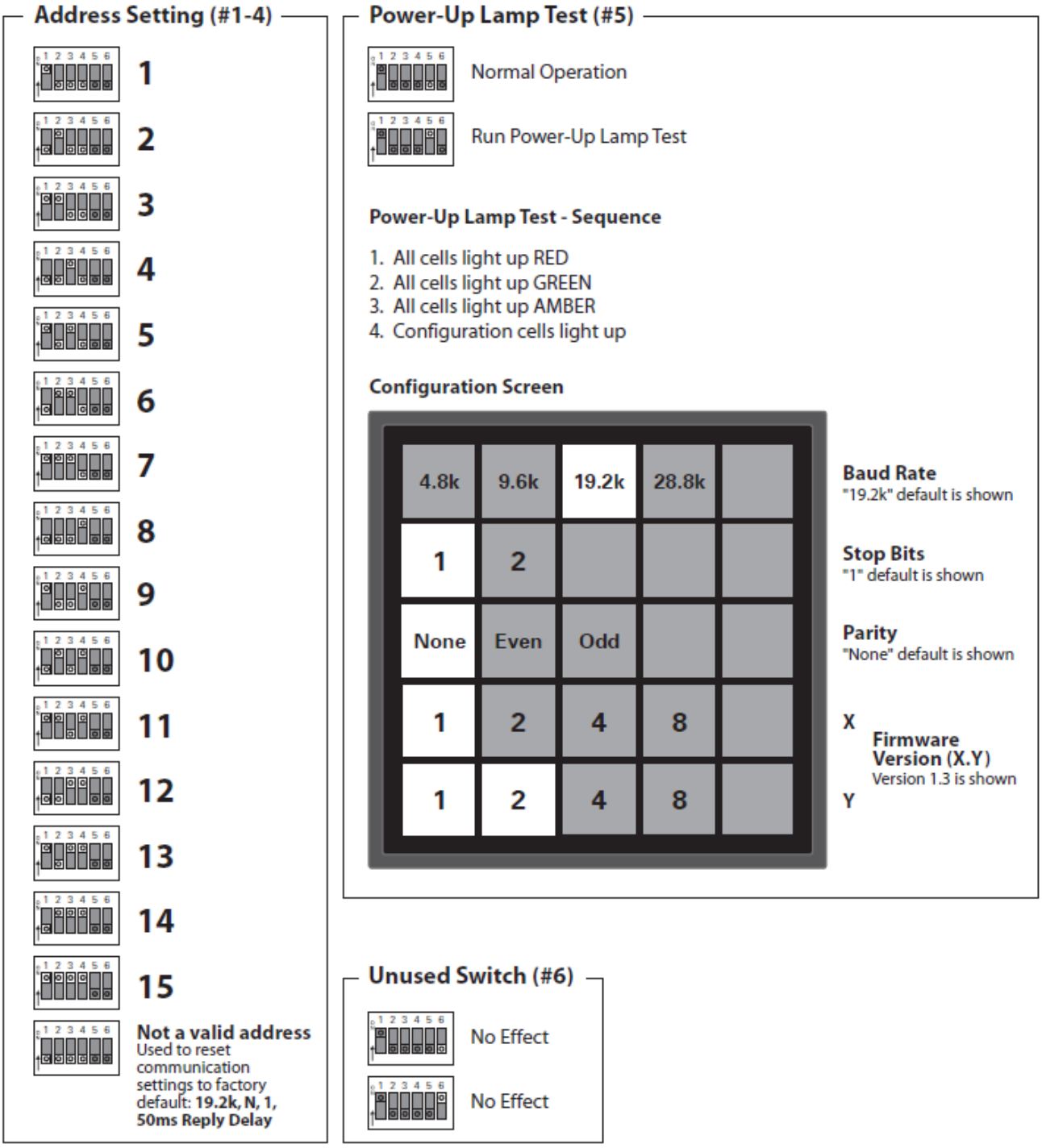


Figure 17: Setup & Configuration

8.3. Appendix B: Connections

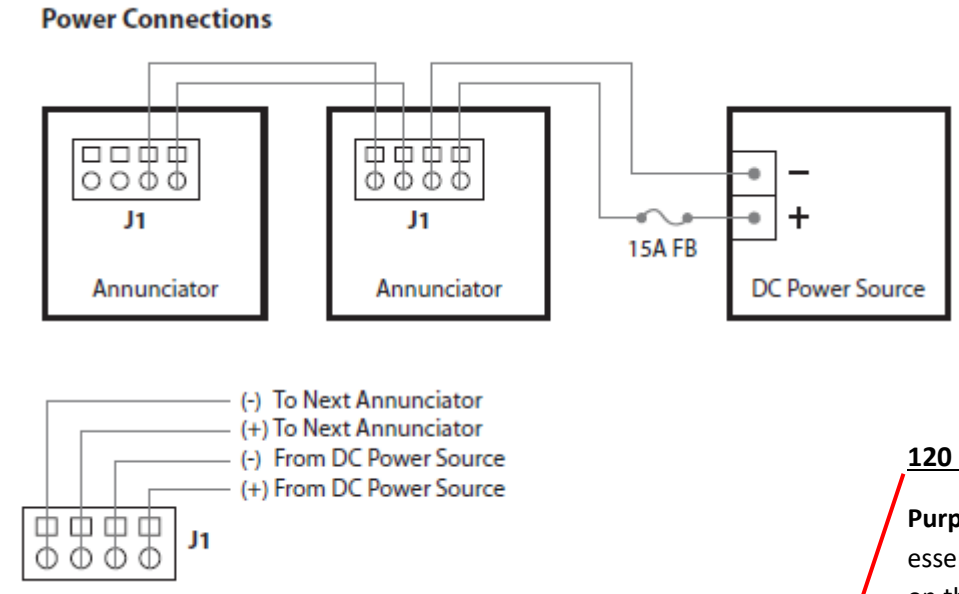


Figure 18: Daisy Chain Power Connection

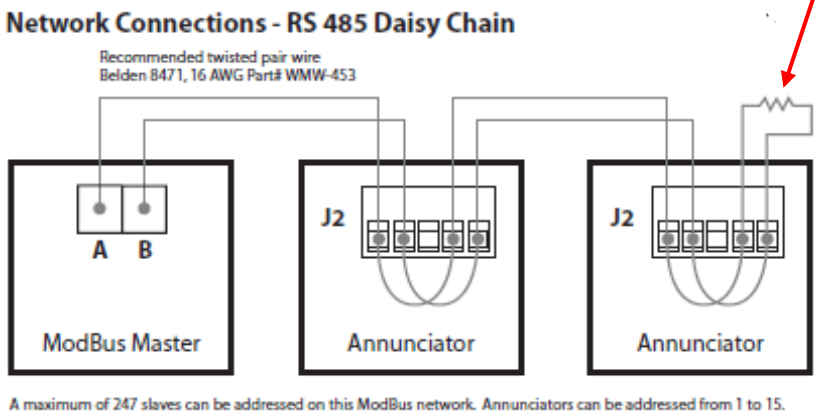


Figure 19: RS-485/422 Daisy Chain Connection

120 Ohm Terminating Resistor

Purpose: A 120 Ohm terminating resistor is essential for preventing signal reflections on the communication line in RS485 or RS-422 networks.

Connection: This resistor must be connected at the end of the daisy chain configuration, specifically on the last slave device in the chain.

Installation: Ensure that the resistor is securely connected to maintain optimal communication quality and prevent potential data transmission errors.

Using this terminating resistor is critical for reliable communication in your Modbus network.

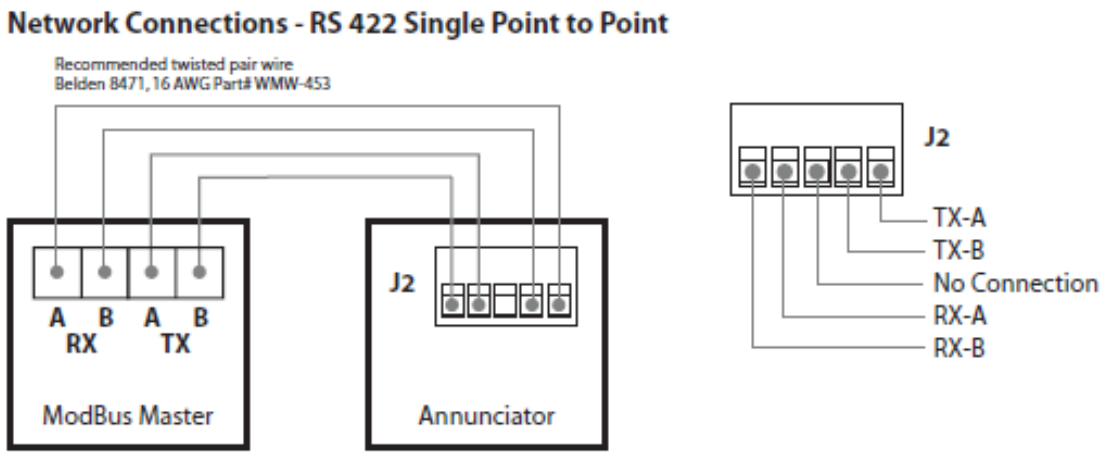


Figure 20: RS485/422 Point to Point Connection

8.4. Appendix B: Modbus Protocol

Modbus Protocol Overview

For a detailed specification of the Modbus protocol, visit **www.modbus.org**. The Modbus protocol is essential for communication between devices on a Modbus network, enabling them to parse messages and perform necessary actions based on the commands received.

Key Features of Modbus Protocol:

- Device Addressing: Each slave device has a unique address that the master uses to communicate with it.
- Message Recognition: The protocol enables each slave to recognize messages addressed to it, determine the requested action, and extract relevant data.
- Reply Construction: If a reply is needed, the slave constructs a response message following the Modbus protocol.

Structure of Modbus Messages

Query Message

A typical query message consists of several key components:

1. Slave Address: Indicates the address of the slave device the master wishes to communicate with.

2. Function Code: Specifies the command being requested (e.g., read or write to Holding Registers).

3. Starting Address High/Low Order: Represents the high and low bytes of the register address that the master reads from or writes to. Note that registers are addressed starting at 0 (e.g., Register 40001 corresponds to address 0).

4. Error Check Field: Contains a CRC (Cyclic Redundancy Check) value for error checking.

Additional Information for Specific Functions

Certain query messages may require additional fields:

- Number of Data Points High/Low Order: Specifies the high and low bytes of the number of addresses the master wants to read.
- Data High/Low Order: Indicates the high and low bytes of the data that will be written to the slave device.
- Number of Regs High/Low Order: Represents the high and low bytes for the number of registers to preset.
- Byte Count: Specifies the number of data bytes being sent to the slave.

Example of Query and Reply Messages:

Query Message: This is the format the master sends to the slave.

Reply Message: This is the format the slave sends back to the master after processing the request.

For specific examples of query and reply messages used by the ABB-SANN-5X5 Annunciator, refer to the appendices in the manual.

Read Holding Register (Function Code 03)

The Read Holding Register command allows the master device to obtain the binary contents of holding registers (4xxxx) in the addressed slave.

Query Example

This example reads registers 40006-40007 from slave 8.

Query:

- Slave Address: 08h
- Function Code: 03h
- Starting Address High Order: 00h
- Starting Address Low Order: 05h
- No. of Data Points High Order: 00h
- No. of Data Points Low Order: 02h

- Error Check Field (LRC or CRC): —

Response:

The slave responds with its address, function code, number of data bytes, and the data. The contents of the requested registers (data) are two bytes each. The first byte includes the high order bits, and the second includes the low order bits.

- Register 40006 has a value of 118 (76 hex).
- Register 40007 has a value of 120 (78 hex).

Response:

- Slave Address: 08h
- Function Code: 03h
- Byte Count: 04h
- High Order Data: 00h
- Low Order Data: 76h
- High Order Data: 00h
- Error Check Field (CRC): —
- Low Order Data: 78h

Modbus Protocol Illustration

Write Single Holding Register (Function Code 06):

This function allows the master to modify the contents of one holding register.

Query Message Example:

- Slave Address: 0Fh
- Function Code: 06h
- Starting Address High Order: 00h
- Starting Address Low Order: 28h
- Data High Order: 00h
- Data Low Order: 5Ch
- Error Check Field (CRC): —

Response:

The slave's response to the Write Single Holding Register query is to return the original message after the registers have been altered.

- Slave Address: 0Fh
- Function Code: 06h
- Starting Address High Order: 00h
- Starting Address Low Order: 28h
- Data High Order: 00h
- Data Low Order: 5Ch
- Error Check Field (CRC): —

Write Multiple Holding Registers (Function Code 16):

This function presets values into a sequence of holding registers.

Query Message Example:

To preset two registers starting at 40034 to 9 hex and 40035 to 32 hex in slave device 15.

- Slave Address: 0Fh
- Function Code: 10h
- Starting Address High Order: 00h
- Starting Address Low Order: 21h
- Number of Regs High Order: 00h
- Number of Regs Low Order: 02h
- Byte Count: 04h
- Data High Order: 00h
- Data Low Order: 09h
- Data High Order: 00h
- Data Low Order: 32h
- Error Check Field (CRC): —

Response:

The response from the slave is an echo of the slave address, function code, starting address, and number of registers to be loaded.

- Slave Address: 0Fh
- Function Code: 10h
- Starting Address High Order: 00h
- Starting Address Low Order: 21h
- Number of Regs High Order: 00h
- Number of Regs Low Order: 02h
- Error Check Field (CRC): —

9.0. Appendix B: Troubleshooting

Problem	Possible Cause	Corrective Action
Trouble configuring the ABB-SANN-5X5 Annunciator	No communications between the ABB-SANN-5X5 Annunciator and the Modbus master.	ABB-SANN-5X5 Annunciator and Modbus Master must match, even when modifying the configuration registers. Verify that the Modbus master and ABB-SANN-5X5 Annunciator have the same Baud Rate, Parity, and Stop Bits selected, then write new settings.
	LED 25 is flashing Red, then Green, then Amber.	Write a non-zero value to the Heartbeat register. A non-zero value must be written again within 60 seconds. See Appendix A for reference.
	ABB-SANN-5X5 Annunciator does not have power.	Apply power to the ABB-SANN-5X5 Annunciator.
	Communicating with the wrong addressed slave.	Verify that the address on the ABB-SANN-5X5 Annunciator matches the address you are communicating with.
	ABB-SANN-5X5 Annunciator's communication configuration does not match the Modbus masters.	Verify that the Modbus master and ABB-SANN-5X5 Annunciator have the same Baud Rate, Parity, and Stop Bits selected.
	Modbus master is communicating with ASCII protocol.	ABB-SANN-5X5 Annunciator supports only RTU protocol. Configure Modbus master to use RTU protocol.
	Not using twisted pair wire to make the network connection.	Make sure interconnect cable is a twisted pair.
	Network is RS485, but RX/TX A-A and B-B jumpers are not in place.	See Setup & Configuration SECTION for reference
	Proper polarity markings are not being followed.	Make sure that A & B on the ABB-SANN-5X5 Annunciator are connected to A & B on the Modbus master, respectively.
	Network is RS485, but termination resistor is not installed.	Install a 120 Ohm termination resistor between A & B at the last slave in the chain.
	Twisted pair wire length exceeds 4000 feet.	Install repeater if wire length exceeds 4000 feet.
	RS485 daisy chain has more than 32 devices.	Install one repeater for every 32 devices on the network.

	ABB-SANN-5X5 Annunciator is beginning its reply to Modbus master's query too early.	Adjust the Reply Delay register. See Appendix A for reference.
	LED cell is disabled.	Enable the LED cell with LED Enable Register A or B.
	LED color is set to 0, or a value greater than 5.	Select an LED color from 1 to 5.
	Power to the ABB-SANN-5X5 Annunciator was interrupted.	Apply power to the ABB-SANN-5X5 Annunciator.
	Power interruption reset the LED Enable registers.	Enable the LED cell with LED Enable Register A or B.
	Run a Power-Up Lamp Test.	Communication settings will be displayed.
	Reset communication settings to factory defaults.	See **SECTION 5.4** for reference.
ABB-SANN-5X5 Annunciator's communication settings unknown	LED cell does not illuminate.	Query address less than 40001. All queries must be within the address range from 40001 to 40071.
	Query address greater than 40071.	Multiple-register query ends at address greater than 40071.
	Invalid CRC.	Check for wiring problems that may cause bit errors – Wiring near noise sources, etc.
	Byte timeout: More than 500 msec between data bytes.	Check Modbus master for code errors or operating system latency problems.
	Invalid or unsupported Modbus command.	ABB-SANN-5X5 Annunciator recognizes only Modbus commands 03h, 06h, and 10h.
	Error Code 1: Bad packet received.	Network wire connection from the Modbus master to the ABB-SANN-5X5 Annunciator is broken, or the wire is not connected.
	Check the wire connection from the Modbus master to the ABB-SANN-5X5 Annunciator.	Connect the wire if necessary.

Table 8: Troubleshooting