EBTRON®
Thermal Dispersion Airflow Measurement

Model **STN104**
Quick Installation Guide

Silver Series Thermal Dispersion Airflow Measurement Technology

Advantage
Silver Series by Ebtron

Quick Installation Guide

STN104

RS-485 Output Transmitter

Document: IG_STN104_R1B

c UL us
LISTED

SILVER SERIES
INSTALLATION GUIDE

IG_STN104_R1B

Part Number: 930-0080

EBTRON, Inc. 1663 Hwy. 701 S., Loris SC 29569 • Toll Free: 800.2*EBTRON* (232.8766) • Fax: 843.756.1838 • Internet: *EBTRON*.com

LIST OF EFFECTIVE AND CHANGED PAGES

Insert latest changed pages (in bold text); remove and dispose of superseded pages.
Total number of pages in this manual is **10.**

Page No	Revision *	Description of Change	Date
1	**R1B**	**Changed document revision to R1B**	**08/24/2009**
2	**R1B**	**Updated List of Effective pages for R1B changes**	**08/24/2009**
4	**R1B**	**Revised 0.5A Power Fuse part number to 800-1110 (10 pack)**	**08/24/2009**
1 through 10	R1A	Initial Document Release	03/23/2009

* R1A indicates an original page without change

Table of Contents

List of Figures

List of Tables

APPLICATION

This document provides initial installation and network configuration details for the EBTRON model STN104 transmitter. Refer to the separate technical manual, TM_STN104 for complete Installation, Operation and Maintenance details.

STA104 TRANSMITTER INSTALLATION

The STA104 transmitter is designed for use in an environment between -20° F to 120° F *(-28.8° C to 48.8° C)* where it will not be exposed to rain, snow or condensation.

Mount the transmitter upright in a field accessible location. The enclosure (Figure 1) is designed to accept 3/4 in. *(19.0 mm)* conduit fittings for signal and power wiring at the top left and right sides of the circuit board. Locate the transmitter so that the connecting cables from all of the sensor probes will reach the receptacles on the bottom of the transmitter enclosure.

In locations exposed to direct rain and/or snow, the transmitter must be enclosed in a NEMA4 enclosure.

Leave at least 7" *(177.8 mm)* above, and 3" *(76.2 mm)* to each side and bottom, of unobstructed space around the transmitter to allow for heat dissipation and cover removal.

Locate the transmitter in a location that can be reached by all connecting cables from the sensor probes.

Do not drill into the transmitter enclosure since metal shavings could damage the electronics.

Mechanical Dimensions

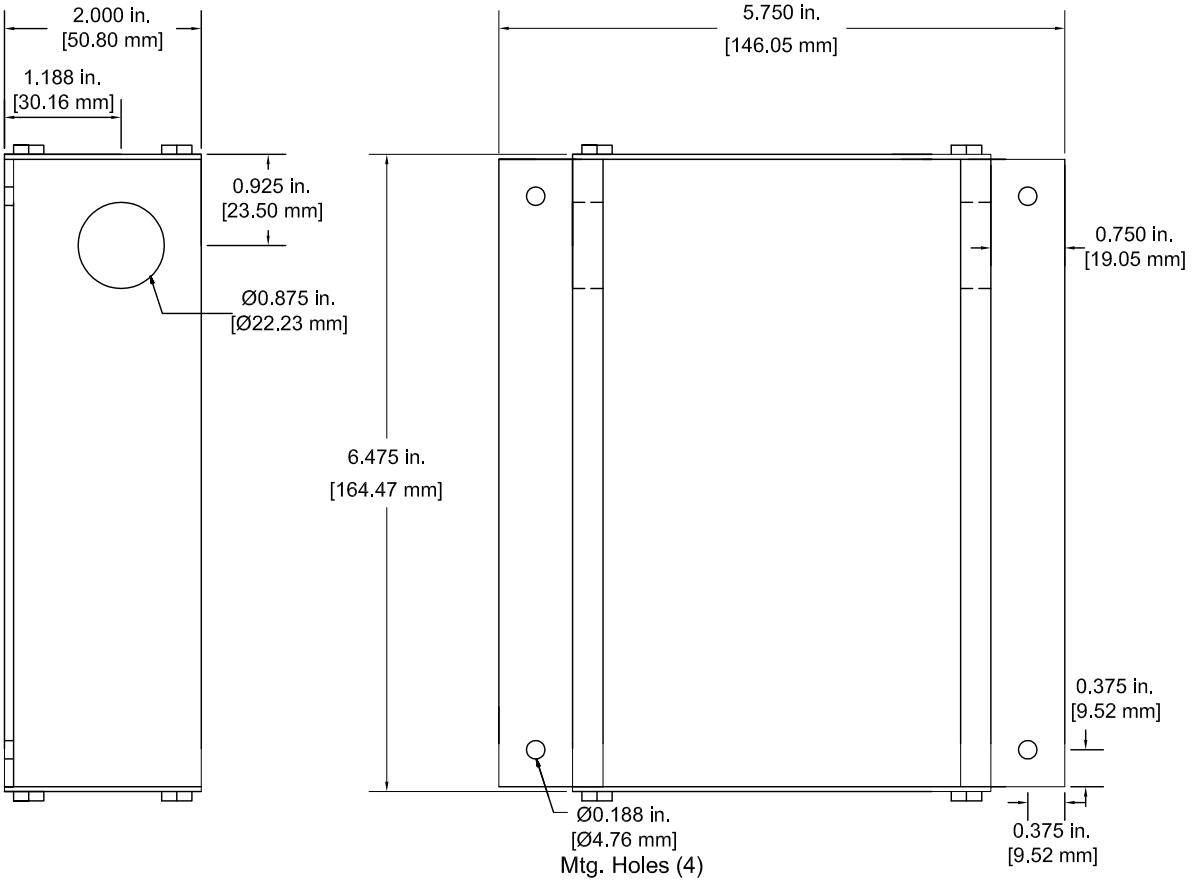


Figure 1. STN104 Transmitter Mechanical Detail Drawing

IG_STN104_R1A

SILVER SERIES *INSTALLATION GUIDE*

STA104 POWER TRANSFORMER SELECTION

The 24 VAC transformer selected must be capable of supplying 8 VA. The operating supply voltage (transmitter power "ON" with all sensor probes connected) should not be less than 22.8 VAC or greater than 26.4 VAC.

STA104 POWER CONNECTIONS

Slide the cover plate up and off of the transmitter enclosure, and ensure that the power switch is in the "OFF" position before connecting the 24 VAC power source.

Connect 24 VAC power to the large, two position power input terminals labeled "POWER - L2/L1" on the upper right hand side of the main circuit board as shown below. It is not necessary to provide an isolated (secondary not grounded) power source since the output signals are galvanically isolated from the power supply.

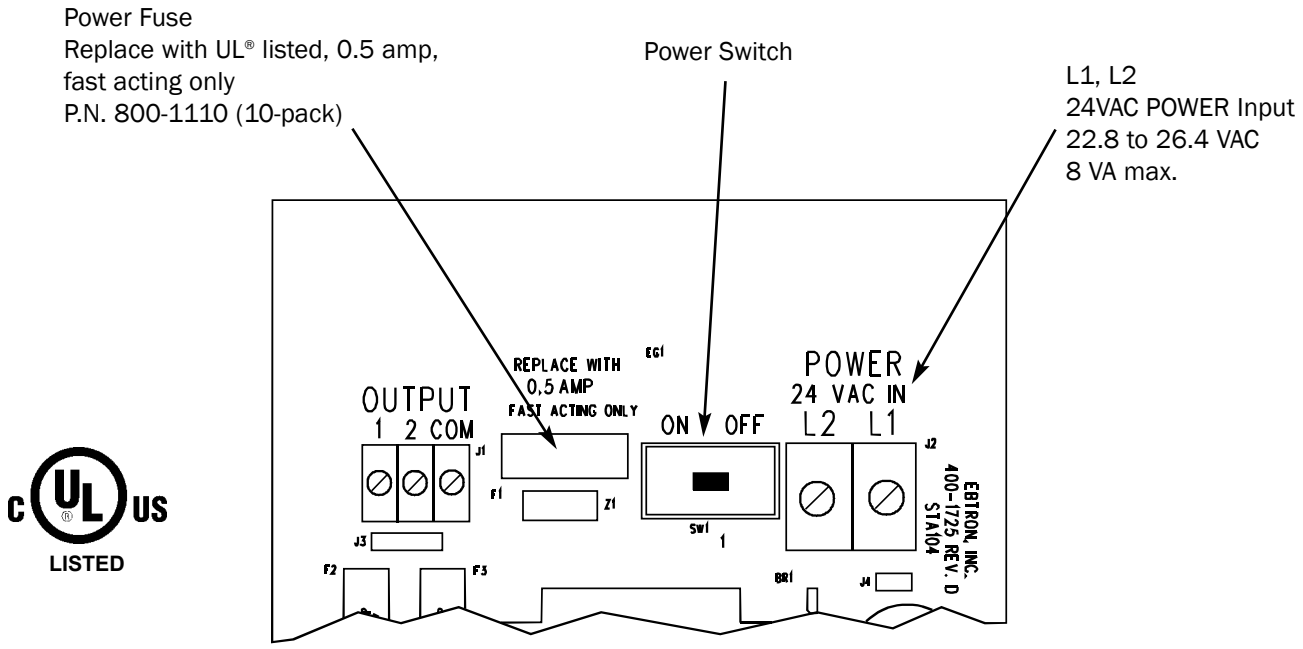


Figure 2. STA104 Power Connections

Multiple STA104 transmitters wired to a single transformer must be wired "in-phase" (L1 to L1, L2 to L2).

Sensor probes must be connected to the transmitter before turning the power switch to the "on" position to properly "flash" sensor calibration data to the transmitter.

IG_STN104_R1B

CONNECTING SENSOR PROBES TO THE TRANSMITTER

After mounting the sensor probes and transmitter, connect one or more sensor probe cable plugs to the circular receptacles located at the bottom of the STN104 transmitter enclosure. Probes are *"Plug and Play"* and do not have to be connected to a specific receptacle on the transmitter. Transmitters can accept SP1, SF1 or SB1 sensors. Mixing sensor types on a single transmitter is not permitted. Match probes to transmitter by type (A or B) as indicated on the tags on the transmitter and sensor probes as shown below.

Provide a "drip loop" at the transmitter if there will be the potential for water runoff or condensation along the sensor probe cable(s).

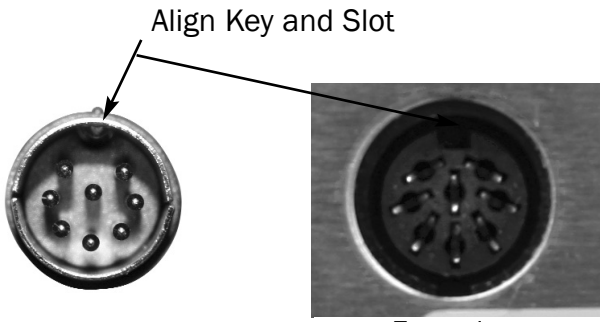
Sensor probe cable plugs are "keyed" as shown in Figure 3 detail below. Line up plug with receptacle and push straight on to receptacle. DO NOT TWIST. Squeeze cable plug "ribs" towards receptacle when removing. Forcing the cable plug in or out of the receptacle will damage the connectors and void warranty.

If traverse data is desired, the probes should be installed and connected to the transmitter using the mounting convention specified in the separate SP1 sensor probe manual. Proper installation simplifies sensor location decoding during data analysis.

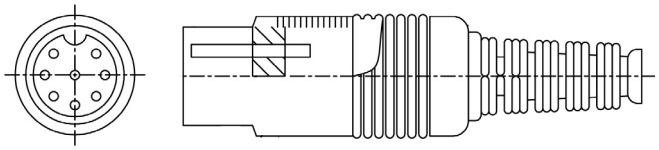
TYPE A TRANSMITTER
Accepts 1 probe up to 4 sensors.

TYPE B TRANSMITTER
Accepts 2 probes up to 2 sensors each.

TYPE C TRANSMITTER
Accepts 4 probes, 1 sensor each.



Type B Shown



Pull to Remove
DO NOT TWIST!

Figure 3. STA104 Connector Detail

IG_STN104_R1A

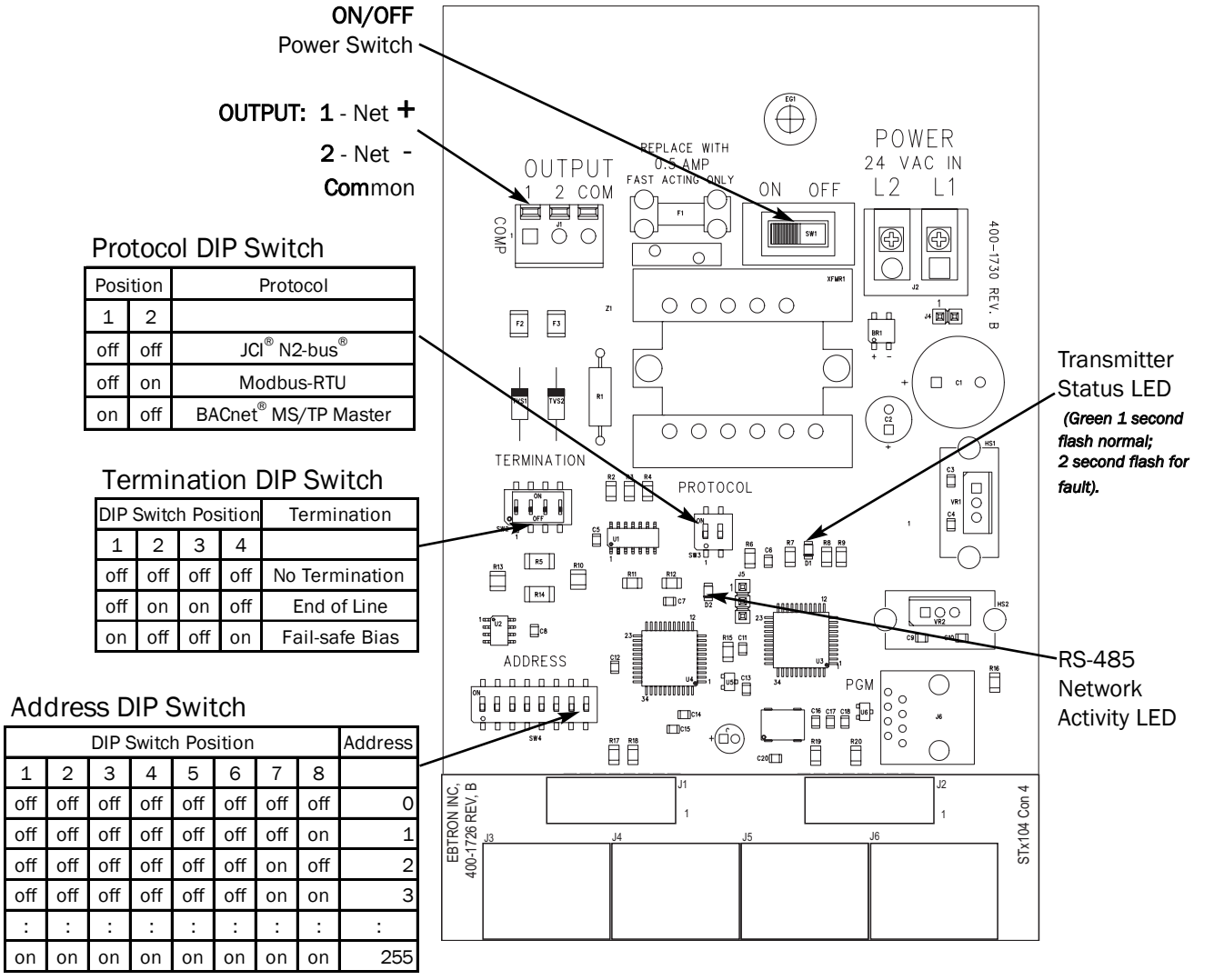
STN104 RS-485 INTERFACE

STN104 RS-485 Transmitter Set Up

The STN104 features a differential bus/line transceiver designed to meet the requirements of the RS-485 standard for multipoint data transmission. Bus contention and wiring fault conditions are over-current and over-voltage protected, including automatic thermal shutdown of the RS-485 transceiver. The flexibility to integrate with various network protocols and topologies is provided via on-board field-selectable option switches for protocol selection, line termination and address as shown in Figure 9. The transmitter must be configured for proper protocol, address, device instance and termination prior to power up. Therefore, wiring to the RS-485 network must be accomplished following configuration of the DIP switches.

The transmitter is shipped from the factory with the default protocol set to **BACnet® MS/TP** (**Master**), network **address 1**, (as well as **Device Instance 1**) and **No Termination**. The following paragraphs detail initial transmitter dip switch settings and network wiring instructions for the STN104 transmitter. Note that the network address and the device instance number are initially set to the same value (1). The later paragraphs in this section detail the procedure to establish unique address and device instance number values.

If DIP switch settings are changed after power up, the transmitter must be turned "OFF" and then "ON" in order for the new switch positions to be recognized and then stored by the transmitter.



Protocol DIP Switch

Position		Protocol
1	2	
off	off	JCI® N2-bus®
off	on	Modbus-RTU
on	off	BACnet® MS/TP Master

Termination DIP Switch

DIP Switch Position				Termination
1	2	3	4	
off	off	off	off	No Termination
off	on	on	off	End of Line
on	off	off	on	Fail-safe Bias

Address DIP Switch

DIP Switch Position								Address
1	2	3	4	5	6	7	8	
off	off	off	off	off	off	off	off	0
off	off	off	off	off	off	off	on	1
off	off	off	off	off	off	on	off	2
off	off	off	off	off	off	on	on	3
:	:	:	:	:	:	:	:	:
on	on	on	on	on	on	on	on	255

Figure 4. STN104 RS-485 Transmitter Circuit Board Detail

EBTRON, Inc. 1663 Hwy. 701 S., Loris SC 29569 • Toll Free: 800.2*EBTRON* (232.8766) • Fax: 843.756.1838 • Internet: *EBTRON*.com

STN104 - Setting Network Protocol

The STN104 transmitter is shipped from the factory with the protocol set to the **BACnet® MS/TP (Master)**. Tables 1 and 2 list the BACnet Object List and Standard Object Types Supported. Modbus or N2 protocol can be selected by changing the "**PROTOCOL**" DIP switch setting as shown on the main circuit board (Figure 4). Tables 3 and 4 list the specific features using Modbus and N2 protocols. Network protocol is changed by powering the transmitter **OFF**, and then setting the **PROTOCOL** Dip switch to the desired protocol. When changing protocol, ensure that suitable network wiring exists, and that the address selection, baud rate and network termination options selected are appropriate for the new protocol. When the transmitter is powered ON, the new network protocol will become effective.

STN104 - Setting Transmitter Termination Option

The STN104 includes termination selection options that can be set to one of three values, depending on where in the network or network segment the transmitter is connected. Options for NO TERMINATION (default setting), END OF LINE TERMINATION (120 ohms), or FAIL SAFE BIAS are available by setting the **TERMINATION** DIP switch on the main circuit board (Figure 4). To ensure reliable network operation, only one network device on each network segment should be terminated with either FAIL SAFE BIAS or END OF LINE termination methods.

Any **one** device that is equipped to provide a **FAIL SAFE BIAS** termination can be connected on a network segment to provide FAIL SAFE BIAS between the NET+ and NET- (A and B) communication lines. This termination option guarantees that the entire bus segment is in a known state during idle-line conditions (when no device is driving the bus). This is the preferred termination method.

As an alternative, an **END OF LINE** termination resistance (of 120 ohms nominal) can be installed at only **one** device located at **either end** of the network segment between the NET+ and NET- (A and B) communication lines.

Check and verify that only 1 device in the network/segment is terminated with either of these methods. If multiple devices are terminated with either FAIL SAFE BIAS or END OF LINE options, network/segment operation will be adversely affected.

If the network or network segment is already terminated properly by another device as described above, select the **NO TERMINATION** option.

STN104 Setting the Transmitter Address

The STN104 transmitter is shipped from the factory with the network address set to **1**. The ADDRESS DIP switch has 8 switches, with the least significant bit (LSB) at switch position number 8. The ADDRESS DIP switch performs differently for BACnet and for N2 or Modbus protocols as described below.

STN104 - Setting Network Address for N2 or Modbus Protocol

When the STN104 is set for N2 or Modbus protocols, the ADDRESS switch is read constantly by the transmitter during operation. The address can therefore be changed at any time without the need to reset transmitter POWER. All eight switches are used to allow a maximum address of 255.

However, for BACnet protocol, the setting of ADDRESS DIP switch number 1 at initial transmitter POWER ON determines the BACnet device instance and address as described in the following paragraphs.

STN104 - Set BACnet Factory Defaults, BACnet Address & Device Instance Number at First Startup

For BACnet MS/TP protocol, each device on the network segment must be assigned a **unique** address between 1 and 127 on the network segment it will be connected to prior to power up. ***EBTRON*** provides a method to set the BACnet address and the Device Instance Number using **ADDRESS** DIP switches 1-8 on the main circuit board.

The following procedure resets all STN104 transmitter BACnet objects to the factory default values, and also sets the transmitter BACnet address and Device Instance Number to the same value: (Refer to the two paragraphs that follow to change the address and device instance number independently).

a. Ensure that the POWER switch is in the OFF position.
b. Set ADDRESS dip switches 2-8 to the desired BACnet Device Instance Number and address (1-127).
c. Set ADDRESS dip switch number 1 ON (default switch).
d. Set the POWER switch to the ON position.
e. Wait at least 10 seconds.
f. Return ADDRESS dip switch number 1 to OFF. The Device Instance Number and BACnet Address are now set to the value selected by ADDRESS dip switches 2-8 in step b.

EBTRON, Inc. 1663 Hwy. 701 S., Loris SC 29569 • Toll Free: 800.2*EBTRON* (232.8766) • Fax: 843.756.1838 • Internet: *EBTRON*.com

STN104 - Changing the BACnet Address without changing the Device Instance Number

The following procedure is only effective for BACnet MS/TP protocol. To set the BACnet address and leave the Device Instance Number unchanged from the value previously selected, perform the following steps:

a. Ensure that the POWER switch is in the OFF position.
b. Set ADDRESS switches 2-8 to the new desired BACnet address (1-127).
c. Set ADDRESS dip switch number 1 to OFF (default switch).
d. Set the POWER switch to the ON position. The BACnet address is now set to the value selected in step b, and the Device Instance Number remains at the prior value.

STN104 - Changing the BACnet Device Instance Number without changing the Address

The following procedure is only effective for BACnet MS/TP protocol. The Device Instance Number can be changed to any number between 1 and 4,194,302 by writing to the Device Object's Object Identifier Property over the network, without affecting the BACnet address.

STN104 - MS/TP Baud Rate

The STN104 transmitter is set at the factory for an MS/TP baud rate of 76,800 baud. N2 runs at 9600 baud, and Modbus defaults to 9600 baud.

STN104 - RS-485 Network Wiring Connections

Ensure that the transmitter termination, protocol and address/device instance number have been properly set up as previously described. The STN104 RS-485 network circuitry is isolated from the 24VAC power and "floats" with respect to ground by default. This allows for interface with both isolated and non-isolated networks. To wire the output signal, slide the cover plate up and off of the enclosure. Ensure that the power switch is in the "OFF" position. Determine whether the RS485 network requires an isolated or non-isolated interface to the STN104, and connect cables as outlined in the appropriate paragraph that follows. Pay particular attention to the network common connection and termination DIP switch requirements for each type of connection. Connections are made at the three position terminal block labeled "OUTPUT" at the upper left hand side of the main circuit board as shown in Figure 5.

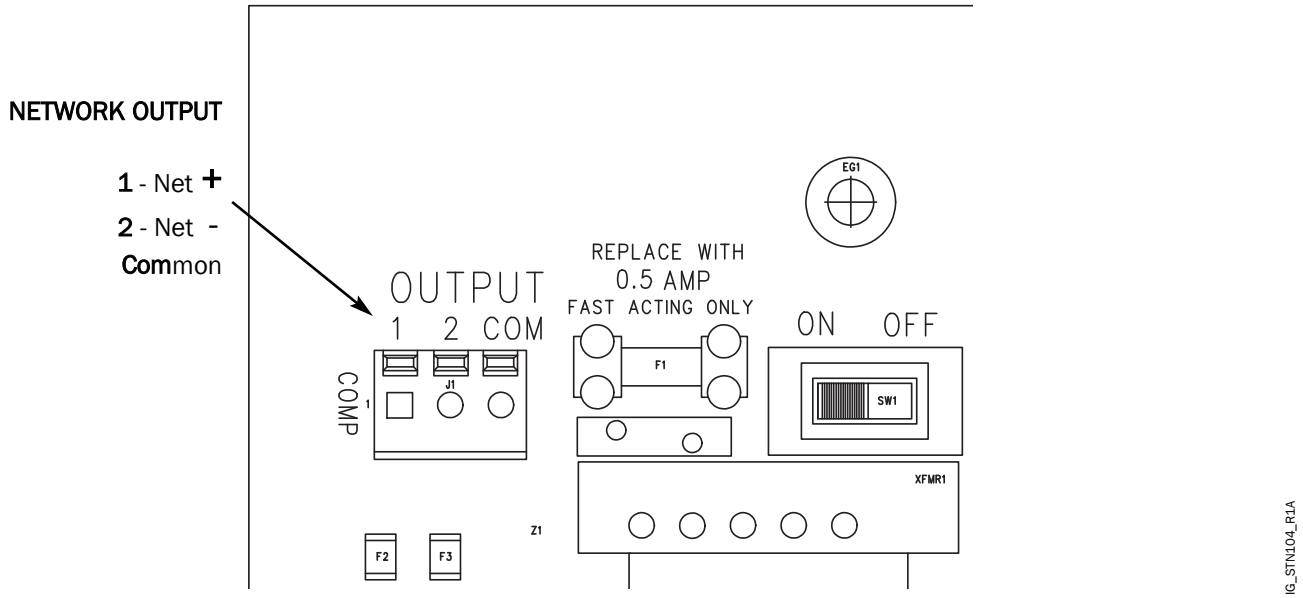


Figure 5. STN104 RS-485 Network Output Connection Detail

Connecting to an Isolated RS-485 Network:

Connect the NET+, NET- and COM terminals to the network using shielded twisted pair RS-485 cable (typically using two pairs, with one wire not used; use one pair for +/-, and both wires in the other pair for GND when using 2-pair cable). The connection to the network must be made in a "daisy chain" configuration. "T" connections and stubs are NOT permitted. The shield should be terminated at one end on the network only. If the STN104 is not the first or last device, set the on-board termination DIP switches for NO TERMINATION. If the STN104 is the first or last device, set the on-board termination DIP switches to either END OF LINE or FAIL SAFE BIAS termination.

CAUTION

For ISOLATED output, the COM connection MUST BE CONNECTED to the network common for proper operation.

Connecting to a Non-Isolated RS-485 Network:

Connect the NET+ and NET- terminals to the network with shielded twisted pair RS-485 cable. The connection to the network must be made in a "daisy chain" configuration. No "T" connections or stubs are permitted. The shield should be terminated at one end on the network only. If the STN104 is not the first or last device, set the on-board termination DIP switches for NO TERMINATION. If the STN104 is the first or last device, set the on-board termination DIP switches to either END OF LINE or FAIL SAFE BIAS termination. Since the STN104 output is isolated, the COM terminal must be connected to the "common ground" that the other devices on the network are using as their ground reference. This is typically the ground side of the 24VAC supply (L2 on the STN104 POWER terminals).

CAUTION

For NON-ISOLATED output, the COM connection MUST BE CONNECTED to the common ground that is used by the other network devices (typically the ground side of the 24VAC supply; the L2 terminal at the POWER connector block as shown in the STN104 Power Connections detail Figure 2).

Table 1. STN104 RS-485 BACnet Object List

BACnet® MS/TP

OBJECTS

Baud Rates: 9.6, 19.2, 38.4, 76.8 Kbps

Type	Description	Default Units
Device	Device Object	
Analog Input	Airflow	FPM
Analog Input	Differential Pressure	in.w.c.
Analog Input	Temperature	°F
Analog Value	Area	sq.ft.
Analog Value	Baud Rate	None
Binary Value	Auto Baud Rate Detection	None

Table 2. STN104 BACnet Standard Object Types Supported

Object	Create Object Service	Delete Object Service	Optional Properties Supported	Writeable Properties	Proprietary Properties	Property Range Restrictions
Analog Input 0 – Airflow	No	No	• Device Type • Reliability	• Units • Object Name	None	Units limited to: • FPM • CFM • MPS • LPS
Analog Input 1 – Pressure	No	No	• Device Type • Reliability	• Units • Object Name	None	Units limited to: • in. H_20 • Pa
Analog Input 2 – Temperature	No	No	• Device Type • Reliability	• Units • Object Name	None	Units limited to: • degrees C • degrees F
Analog Value 0 – Free Area	No	No	None	• Present Value • Object Name	None	None
Analog Value 1 – Baud Rate	No	No	None	• Present Value	None	None

Table 3. STN104 RS-485 Modbus Register Map

Modbus REGISTER MAP

Modbus RTU

Baud Rate: 9600 bps

	IEEE Floating Point		Binary				
Function	low/high word	high/low word		Length	Units	Point Description	Range/Value
02			10001	1		Status	0:OK, 1:Trbl.
04	30001	30007		2	FPM	Airflow	0 to 15,000
04	30003	30009		2	in.w.c.	Differential Pressure	-2.5 to +2.5
04	30005	30011		2	°F	Temperature	-20 to +160

Table 4. STN104 RS-485 JCI N2® -Bus Point Map

JCI® N2-Bus®

POINT MAP

Baud Rate: 9600 bps

NPT[1]	NPA[2]	Units	Point Description	Range/Value
AI	1	FPM	Airflow	0 to 15,000
AI	2	in.w.c.	Differential Pressure	-2.5 to +2.5
AI	3	°F	Temperature	-20 to +160
BI	1		Status	0:OK, 1:Trbl.

[1]Network Point Type

[2]Network Point Address

IG_STN104_R1A

EBTRON, Inc. 1663 Hwy. 701 S., Loris SC 29569 • Toll Free: 800.2*EBTRON* (232.8766) • Fax: 843.756.1838 • Internet: *EBTRON*.com