Advantage Gold Series by Ebtron

GOLD SERIES *TECHNICAL MANUAL*

Installation, Operation and Maintenance Technical Manual

GTx116

"Plug & Play" Transmitters

Includes Analog output models: GTA116-P, GTA116-F & GTA116-B
Includes RS-485 output models: GTN116-P, GTN116-F & GTN116-B
Includes Ethernet output models: GTE116-P, GTE116-F & GTE116-B
Includes LonWorks® output models: GTL116-P, GTL116-F & GTL116-B

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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Insert latest changed pages (in bold text); remove and dispose of superseded pages.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 **44.**

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OVERVIEW

EBTRON's top-of-the-line GTx116 (Figure 1) transmitter can process up to 16 individual sensing points and is compatible with a number of *EBTRON* sensor systems. The transmitter requires 24 VAC and provides the host controls with output signals for airflow and temperature.

Each transmitter is fully independent of the sensor probes and does not require field matching to sensor probes.

Figure 2 shows the GTx116 transmitter features. All GTx116 transmitters include a 16 character LCD display that indicates airflow, temperature and system status. The display is also used during configuration and diagnostic modes. Field configuration is accomplished using a simple four-button interface on the main circuit board. Individual airflow and temperature measurements can be displayed from the diagnostic mode and are beneficial as an HVAC system diagnostic tool. The airflow output signal can be filtered and a process low limit can be set that forces the output to zero when the airflow rate falls below the user defined value. Both features are important for outside air intake applications that are affected by transient wind gusts at low airflow rates. An airflow offset and gain feature can be set using the four-button interface for installations that require field calibration or adjustment. The GTx116 transmitter is available in an analog version and in network versions as shown in Ordering Guide, Figure 3.

SPECIFICATIONS

Maximum Sensing Points
- 16 (16 airflow + 16 temperature, independently processed)

Sensor System Configuration (max.)
- Type A (probes x sensors: 2x8 (GP1 probes)
- Type B (probes x sensors: 4x4 (GP1 probes), 4x1 (GF1 fan inlets and GB1 "bleed" sensors)

Digital Signal Processing
- Microprocessor: Yes
- Multiplexing: 32 individual channels
- A/D Converter: 12-Bit

"Plug and Play" Sensor Systems
- Probes do not require matching to transmitter

Power Requirements
- Voltage: 24 VAC (22.8 to 26.4 VAC), isolation not required
- "Brownout" protection: "Watchdog" reset circuit
- Power: 12 to 20 VA (dependent on number of sensors)
- Protection: Over voltage, over current and surge protection

Enclosure
- Aluminum

User Interface
- Pushbutton and LCD display

Display
- 16 character alpha-numeric display (auto-ranging)

[1] 0-5 VDC analog output option introduced with firmware v. 5.04.

Output to Host Controls

Output/Protocols Supported:

a.) GTA116: Isolated 0-5[1]/0-10 VDC or 4-20mA (resolution 0.025% F.S.)

b.) GTN116: RS-485, 156.25 kbps max., BACnet®, Modbus, JCI® N2-Bus®

c.) GTE116: 10 BaseT Ethernet, BACnet®, Modbus, TCP/IP

d.) GTL116: LonWorks® Free Topology Transceiver

Airflow Output Adjustments:
- Offset/gain (pushbutton LCD display)
- Airflow Output Signal Filter: 0 (off) to 99% (pushbutton LCD display)
- Airflow Low Limit Cutoff: Forces output to zero below user defined value

System Diagnostics
- Sensor/transmitter diagnostic mode with notification

Environmental Limits
- Operating Temperature: -20° F to 120° F (-28.8° C to 48.8° C)
- Moisture: 0 to 99% rh, non condensing (protect from water)

Compatible Sensor Systems

GP1 probes, GF1 fan inlets, and GB1 "bleed" sensors

Listings
- UL® 873 Airflow & Temperature Indicating Devices
- CE (European Union -P probe shipments only)

Warranty
- 36 months from shipment

Figure 1. GTx116 Transmitter

ADVANCED TECHNOLOGY

- Microprocessor-based electronics with industrial grade integrated circuits.
- "Plug and Play" design.
- Accepts up to 16 individual airflow and temperature sensor pairs.
- LCD display.
- Push-button user interface for simple field configuration and diagnostics.
- Airflow and temperature output.
- Analog output signals and network protocols interface with all building automation systems.
- Expansion port allows for connection to *EBTRON* peripheral devices such as the *EB-Link* Infra-Red adapter that interfaces with your PDA for real-time duct traverses.

Network Connectivity Solutions

BACnet®
LonWorks®
Modbus
META SYS. COMPATIBLE
Ethernet

GTx116 TRANSMITTER FEATURES

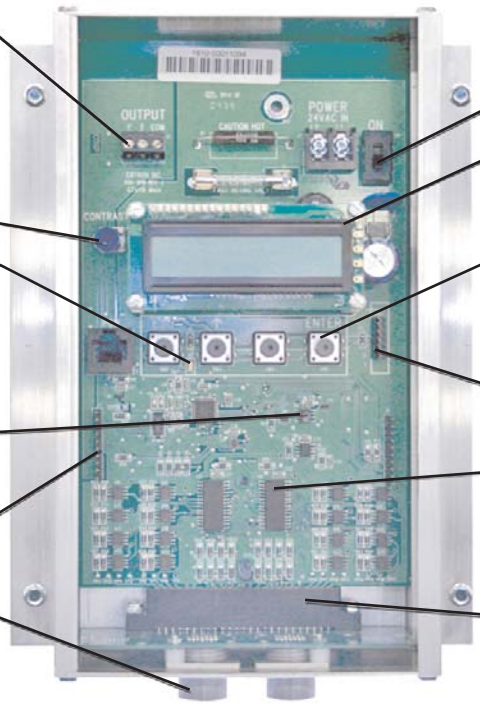

Figure 2. GTx116 Transmitter Features

ORDERING GUIDE FOR GTx116 TRANSMITTER

G T _ 1 1 6 - _

Transmitter Type
- Type A 2 x 8 Sensor Connectors
- Type B 4 x 4 Sensor Connectors

Transmitter Output
- A Analog, 0-5VDC / 0-10VDC or 4-20mA
- N RS-485, BACnet®, Modbus, JCI® N2-Bus®, BACnet® ARCNET®
- E Ethernet, BACnet®, Modbus, TCP/IP
- L LonWorks® Free Topology

Figure 3. GTx116 Transmitter Ordering Guide

Table 1. GTx116 Connectivity Options

Output to Host Controls	Output/Protocols Supported	Airflow	Temperature	Status
Analog x=A	Linear 0-5VDC[1] / 0-10VDC or 4-20mA	Yes	Yes	Visual Only
RS-485 x=N	BACnet®-MS/TP, BACnet®-ARCNET®	Yes	Yes	Yes
	Modbus-RTU			
	JCI® N2-Bus®			
Ethernet x=E	BACnet® Ethernet	Yes	Yes	Yes
	BACnet®-IP			
	Modbus-TCP			
	TCP/IP			
LonWorks® x=L	Free Topology Transceiver	Yes	Yes	Yes

[1] 0-5 VDC analog output option introduced in firmware version 5.04 and forward.

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GTx116 TRANSMITTER INSTALLATION

The GTx116 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 or snow.

The transmitter should be mounted upright in a field accessible location. The enclosure (Figure 4) 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. The transmitter should be located such that the connecting cables from all of the sensor probes 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 10 in. *(254.0 mm)* above, and 2 in. *(50.8 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

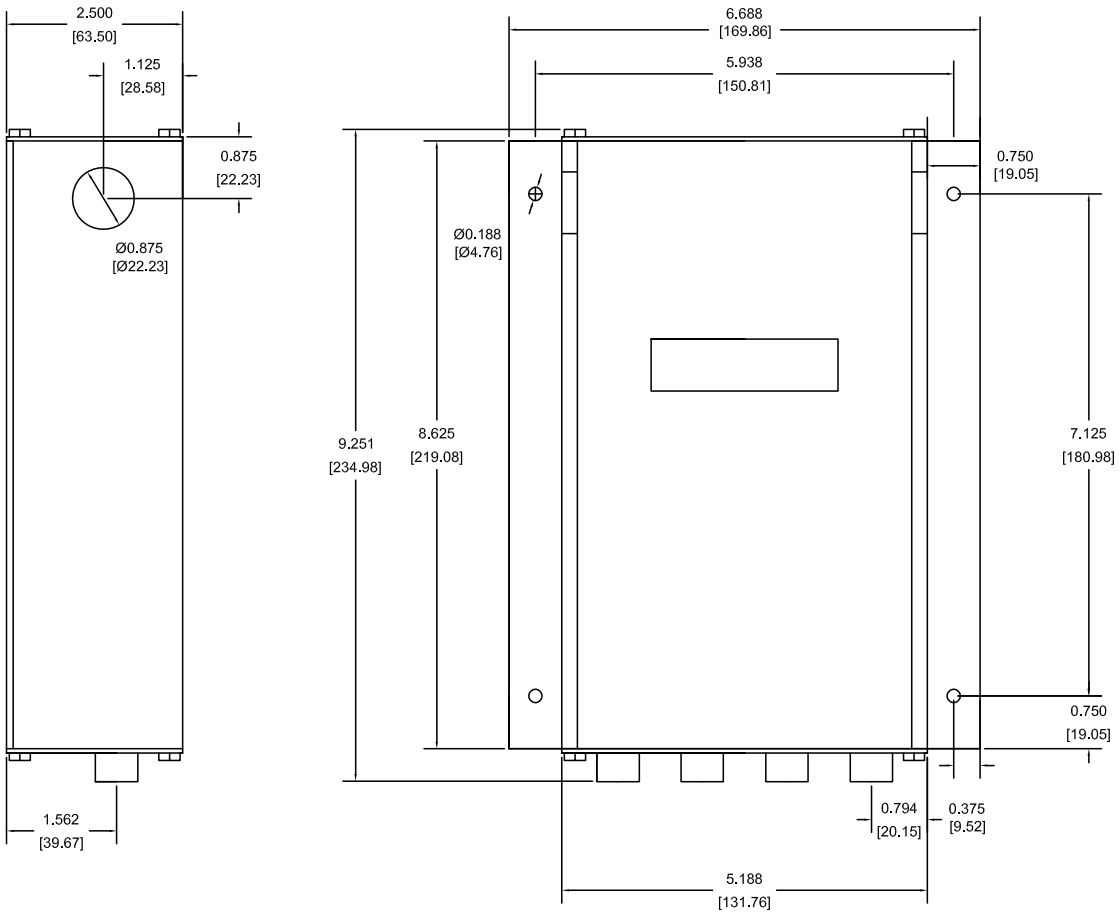

Figure 4. GTx116 Transmitter Mechanical Detail Drawing

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Power Transformer Selection

Select a 24 VAC transformer based on the maximum power requirements indicated on the transmitter label (20 VA) or from the table below. 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.

Table 2. GTx116 Power Transformer Selection Guide

Total Sensors	Minimum VA Req.	Total Sensors	Minimum VA Req.	Total Sensors	Minimum VA Req.	Total Sensors	Minimum VA Req.
1	12	5	14	9	17	13	19
2	13	6	15	10	17	14	19
3	13	7	15	11	18	15	20
4	14	8	16	12	18	16	20

Connecting Power to the Transmitter

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 terminal labeled "POWER" on the upper right hand side of the main circuit board (Figure 5). Since the output signals are isolated from the power supply, it is not necessary to provide an isolated (secondary not grounded) power source.

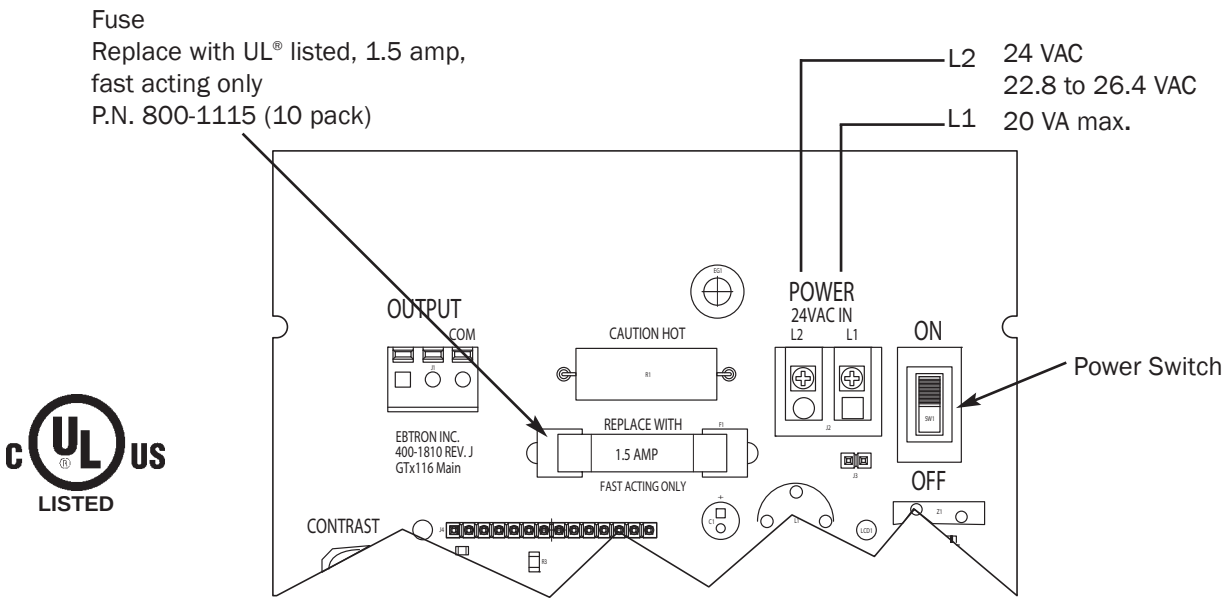

Figure 5. GTx116 Power Connections

Multiple GTx116 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.

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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 GTx116 transmitter enclosure. Probes are *"Plug and Play"* and do not have to be connected to a specific receptacle on the transmitter. Transmitters can accept GP1, GF1 or GB1 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 in Figure 6.

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 7. 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 GP1 sensor probe manual. Proper installation simplifies sensor location decoding during data analysis.

TYPE A TRANSMITTER

Accepts 1 or 2 probes up to 8 sensors each.

TYPE B TRANSMITTER

Accepts 1 to 4 probes up to 4 sensors each.

Figure 6. Type A and Type B Transmitter Detail

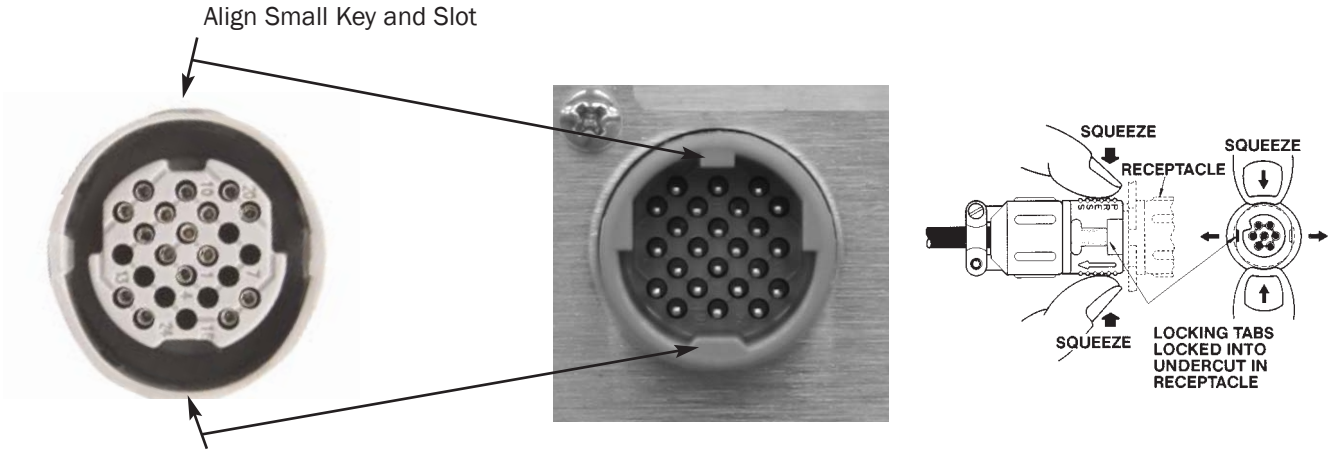


Figure 7. Connector Detail

LCD Display and Menu Item Keys

Following a brief initialization at power up, the GTx116 LCD display automatically displays airflow and temperature when duct/plenum probes (**GP1**), fan inlet probes (**GF1**) or 'bleed' air flow sensors (**GB1**) have been connected. Refer to the menus and descriptions which appear later in this manual for a complete description of programming features.

GTA116 - Analog Transmitter Set Up

The GTA116 provides independent 12-bit (4096 discrete states) linear analog outputs for airflow at OUT1, and for temperature at OUT2; each with over voltage and over current protection. The ***EBTRON*** Analog output card plugs directly onto the main circuit board as shown below. Airflow and temperature outputs are field selectable for either VDC (0-5[1]VDC / 0-10VDC) or mA (4-20 mA). Outputs are galvanically and optically isolated from the main power supply to permit simple integration with virtually all building automation systems.

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. Connect signal wires for airflow rate and temperature to the small, three position output terminal labeled "OUTPUT" on the upper left hand side of the main circuit board as indicated in Figure 8. Airflow output is at terminal 1, and temperature output is at terminal 2.

When configured for a 4-20mA output, the GTA116 is a "4-wire" device. The host controls should not provide any excitation voltage to the output of the GTA116.

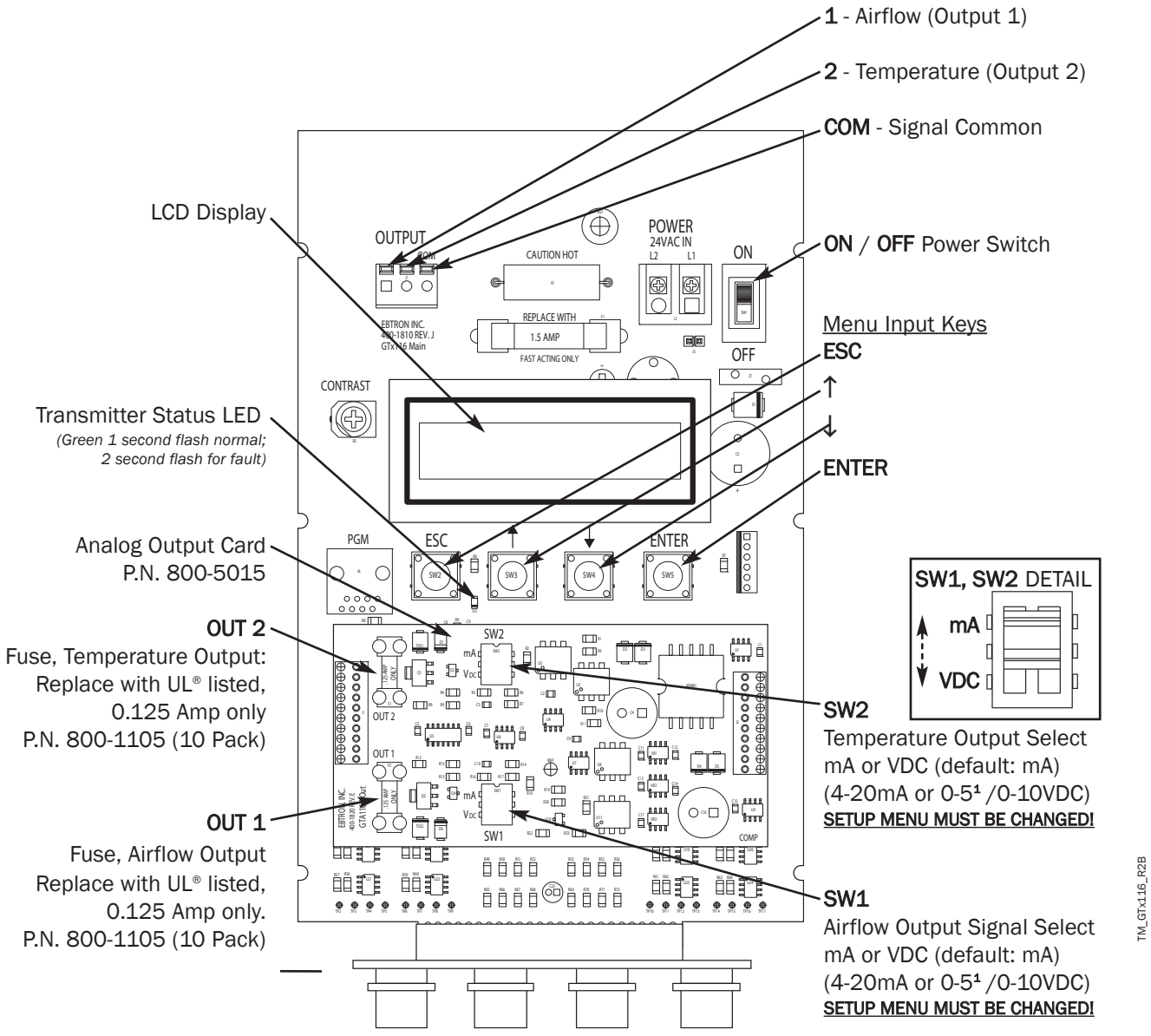


Figure 8. GTA116 Analog Transmitter Interior Detail

[1] 0-5 VDC analog output option introduced with firmware version 5.04.

GTA116 - Analog Output Signal Selection, 0-5[1]VDC / 0-10VDC / 4-20mA

The analog outputs signal type at OUT1 (airflow) and OUT2 (temperature) can each be set for mA or VDC output via switches SW1/SW2 (Figure 8) **and** by selecting 4-20mA, 0-5[1]VDC or 0-10VDC ranges in Setup menu options ***OUT1=** / ***OUT2=** settings (Figures 15 and 16). When changing Setup menu options ***OUT1=** or ***OUT2=** , the LCD display provides a user prompt ("***SET SW1/SW2 ON BOARD***") to set SW1 and/or SW2 switches to the proper position. The transmitter is shipped from the factory with SW1/SW2 and Setup menu options ***OUT1=** and ***OUT2=** all set for 4-20mA.

To change the analog output signal type at OUT1 or OUT2, the corresponding switch (SW1/SW2) settings AND the Setup menu *OUT1= / *OUT2= settings must ALL agree. Refer to Figure 8 for SW1/SW2 and Figures 15 and 16 for Setup menu selections.

GTA116 - Converting Analog Output Signals to Airflow and Temperature

Since the accuracy of the GTA116 is "percent of reading" there should be no need to reconfigure the default output scales listed inside of the transmitter cover. However, factory default settings can be easily reconfigured in the field (see: CHANGING FACTORY DEFAULT SETTINGS).

The equivalent volumetric flow full scale reading can easily be determined by multiplying the full scale reading by the free area where the airflow measuring station is located (free area x 1000 for S.I. scaling when the area is calculated in square meters). For -P units, the free area is electronically programmed into the probe, and is printed on the hang-tag of each sensor probe. For -F and -B units, the free area must be determined after the units are installed. Table 3 lists specific conversion factors for analog voltage or current options for each sensor type.

GTA116 - Sending a Test Output Signal to the Host Control System

A test output signal between 0 and 100% of the full scale output (4 to 20 mA or 0-5[1]VDC/0-10VDC) can be provided by the GTA116 transmitter to verify proper conversion of the output signals from the GTA116 transmitter at the host control system. To set a fixed output signal for airflow and temperature, simultaneously press and release the "ENTER" and "ESC" buttons within 10 seconds of power up. Use the "DOWN" arrow button until "*TESTOUT=0%" is displayed. Press the "ENTER" button and use the "UP" and "DOWN" arrow buttons to select an output between 0 and 100% of the full scale. Press the "ENTER" button to set the output percentage. Press the "ESC" button when verification is complete to return to the normal operating mode.

[1] 0-5 VDC analog output option introduced with firmware version 5.04.

Table 3. GTA116 Converting Analog to Airflow/Temperature

When OUTPUT 1 is Configured as Linear Airflow (FPM, MPS):

	ANALOG OUTPUT SCALING AND TYPE		
TO CONVERT TO	**0-10 VDC**	**0-5 VDC[1]**	**4-20 mA**
Unidirectional Airflow (FPM, MPS)	Output Voltage/10 x FS1	Output Voltage/5 x FS1	(Output Current-4)/16 x FS1
Unidirectional Airflow (CFM)	Area (SQF) x Output/10 x FS1	Area (SQF) x Output/5 x FS1	Area (SQF) x (Output - 4)/16 x FS1
Unidirectional Airflow (LPS)	Area (SQM) x Output/10 x FS1 x 1000	Area (SQM) x Output/5 x FS1 x 1000	Area (SQM) x (Output - 4)/16 x FS1 x 1000
Bidirectional Airflow (FPM,MPS) (-B only)	(Output Voltage - 5)/5 x FS1	(Output Voltage –2.5)/2.5 x FS1	(Output Current - 12)/8 x FS1
Bidirectional Airflow (CFM) (-B only)	Kv x (Output Voltage - 5)/5 x FS1 *K is determined by field measurement or from K tables in Bleed Sensor Technical Manual, TM_GB1.*	Kv x (Output Voltage –2.5)/2.5 x FS1 *K is determined by field measurement or from K tables in Bleed Sensor Technical Manual, TM_GB1.*	Kv x (Output Current - 12)/8 x FS1 *K is determined by field measurement or from K tables in Bleed Sensor Technical Manual, TM_GB1.*
Bidirectional Airflow (LPS) (-B only)			

When OUTPUT 1 is Configured as Volumetric Airflow (CFM, LPS):

	ANALOG OUTPUT SCALING AND TYPE		
TO CONVERT TO	**0-10 VDC**	**0-5 VDC[1]**	**4-20 mA**
Unidirectional Airflow (CFM, LPS)	Output Voltage/10 x FS1	Output Voltage/5 x FS1	(Output Current - 4)/16 x FS1
Bidirectional Airflow (CFM, LPS) (-B only)	(Output Voltage - 5)/5 x FS1	(Output Voltage –2.5)/2.5 x FS1	(Output Current - 12)/8 x FS1

When OUTPUT 1 is Configured as Pressure (iWC, PA):

	ANALOG OUTPUT SCALING AND TYPE		
TO CONVERT TO	**0-10 VDC**	**0-5 VDC[1]**	**4-20 mA**
Unidirectional Pressure (iWC, PA)	Output Voltage/10 x FS1	Output Voltage/5 x FS1	(Output Current - 4)/16 x FS1
Bidirectional Pressure (iWC, PA)	(Output Voltage - 5)/5 x FS1	(Output Voltage –2.5)/2.5 x FS1	(Output Current - 12)/8 x FS1

When OUTPUT 2 is Configured as Temperature (°F,°C):

	ANALOG OUTPUT SCALING AND TYPE		
TO CONVERT TO	**0-10 VDC**	**0-5 VDC[1]**	**4-20 mA**
Temp (°F,°C)	Output Voltage/10 x (FS2 - MS2) + MS2	Output Voltage/5 x (FS2 - MS2) + MS2	(Output Current - 4)/16 x (FS2 - MS2) + MS2

NOTES:

[1] 0-5 VDC analog output option introduced in firmware version 5.04 and forward.

FS1 is OUTPUT1 full scale analog output value from SETUP MENU.

FS2 is OUTPUT2 full scale analog output value from SETUP MENU.

MS2 is OUTPUT2 minimum scale analog output value from SETUP MENU.

TM_GTx116_R2D

GTN116 - RS-485 Transmitter Set Up

The GTN116 provides an RS-485 differential bus/line transceiver designed to integrate with various network protocols and topologies via on-board field selectable option switches. The ***EBTRON*** RS-485 output card plugs directly onto the main circuit board as shown below. Network protocol, MS/TP address/device instance number and line termination are all selected via separate dip switches 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 will 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 termination, dip switch settings, wiring and set up procedures for the GTN116 transmitter. Note that the network address and device instance number will initially be set to the same value. The later paragraphs in this section detail the procedures to establish unique address and device instance number values.

Power Switch

OUTPUT - **NOT USED** **(See RS-485 Connections below)**

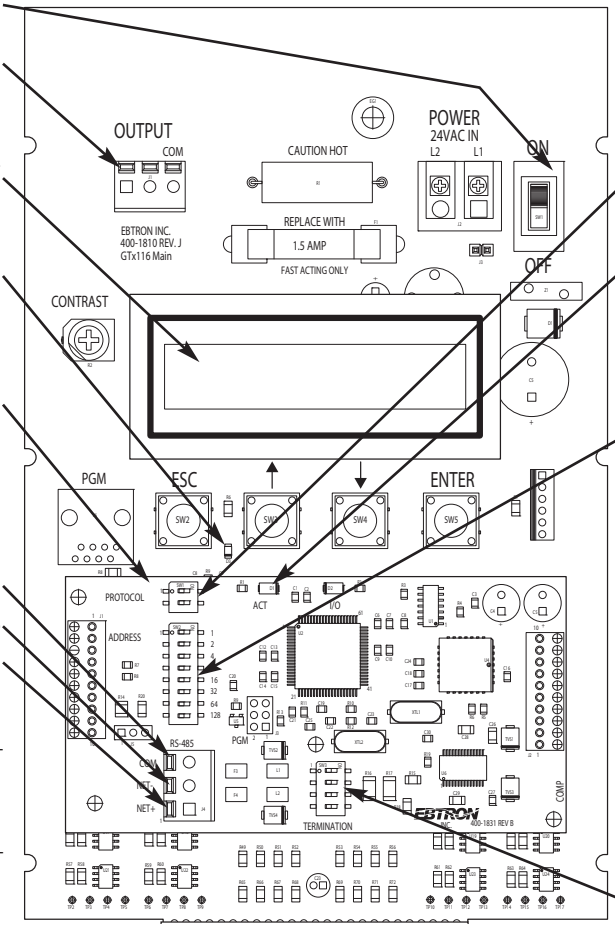
LCD Display

Transmitter Status LED
(Green 1 second flash normal; 2 second flash for fault)

RS-485 Output Card P.N. 800-5021

RS-485 Connections
COM*
NET –
NET +

***CAUTION**
For **ISOLATED** output, the **COM** connection **MUST BE CONNECTED** to the network common for proper operation.
For **NON-ISOLATED** output, the **COM** connection **MUST BE CONNECTED** to the common ground that the other network devices are using (typically the ground side of the 24VAC supply, which is the L2 lug of the POWER terminals). Refer to **RS-485 Network Wiring Connections** paragraph for additional detail.



PROTOCOL DIP Switch

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

ACT LED
(Green indicating RS-485 network activity).

ADDRESS (Device Instance*) DIP Switch

DIP Switch Number and Position 1	2	3	4	5	6	7	8	Network Address
off	off	off	off	off	off	off	off	**0**
on	off	off	off	off	off	off	off	**1**
off	**on**	off	off	off	off	off	off	**2**
on	**on**	off	off	off	off	off	off	**3**
:	:	:	:	:	:	:	:	⬇
on	**on**	**on**	**on**	**on**	**on**	**on**	**on**	**255**

*Device Instance is initially set to the same value as Address. See text to set unique values.

To reset BACnet® factory default settings, first power down the transmitter, then move ADDRESS switch 8 to "ON" and power up transmitter. Lastly, move switch 8 to "OFF" when complete.

TERMINATION DIP Switch

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

Figure 9. GTN116 RS-485 Transmitter Interior Detail

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

TM_GTx116_R2B

GTN116 - Setting the Network Protocol

The GTN116 transmitter is shipped from the factory with the default protocol set to BACnet® MS/TP (Master). Network protocol can be changed by powering the transmitter OFF, and then setting the PROTOCOL Dip switch to the desired protocol as shown in Figure 9. When changing protocols, ensure that network wiring, address selection, baud rate and network termination options have been set as required for the new protocol. When the transmitter is powered ON, the new network protocol will become effective.

GTN116 - Setting Transmitter Termination Option

The GTN116 includes termination selection options permitting appropriate termination depending upon 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 DIP switch labeled "TERMINATION" (Figure 9) on the circuit card. To ensure reliable network operation, only one network device on each network segment should be terminated with either of the following methods:
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.
As an alternative, any **one** device that is connected on the network segment that is equipped to provide a FAIL SAFE BIAS between the NET+ and NET- (A and B) communication lines will guarantee 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.

Check the network/network segment to ensure that only 1 device is terminated with either of these methods. If multiple devices are terminated as described above, network segment operation will be adversely affected.

If the network or network segment is already terminated properly as described above, then set the TERMINATION dip switch for the NO TERMINATION option to ensure that the transmitter communicates properly on the network.

GTN116 - Setting the Network Address

The ADDRESS DIP switch performs differently for BACnet and for N2 and Modbus protocols. When the GTN116 is set for N2 and 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, the setting of ADDRESS DIP switch number 8 at initial transmitter POWER ON determines the BACnet device instance and address as described in the following paragraphs.

GTN116 - Set BACnet Factory Defaults, BACnet Address and Device Instance Number at First Startup

For BACnet MS/TP and BACnet ARCNET protocols, each device on the network segment must be assigned a **unique** address between 1 and 127 for 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 by setting the ADDRESS DIP switches 1-8 on the GTN116 Network Card (Figure 9).

The following procedure will reset all GTN116 transmitter BACnet objects to their factory default values, and will also set the transmitter BACnet address and Device Instance Number to the same value: (Refer to the following 2 paragraphs to change the address and device instance number independently).

a. Ensure that the POWER switch is in the OFF position.
b. Set the ADDRESS dip switches 1-7 to the desired BACnet address (1-127).
c. Set the ADDRESS dip switch number 8 ON (default switch).
d. Set the POWER switch to the ON position.
e. Wait at least 10 seconds.
f. Return ADDRESS dip switch number 8 OFF. The BACnet Address and Device Instance are now set to the number selected by the ADDRESS dip switches 1-7 in step b.

TM_GTx116_R2B

GTN116 - Changing the BACnet Address without changing the Device Instance Number

The following procedure is only effective for BACnet MS/TP and BACnet ARCNET protocols. To change the BACnet address and permit the Device Instance Number to remain unchanged from the value previously selected:

a. Ensure that the POWER switch is in the OFF position.
b. Set ADDRESS switches 1-7 to the desired BACnet address (1-127).
c. Set ADDRESS dip switch number 8 to OFF (default switch).
d. Set the POWER switch to the ON position. The BACnet address is now set to the value set in step b, and the Device Instance Number remains at the previous value.

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

GTN116 - Changing the BACnet Device Instance Number without changing the Address

The following procedure is only effective for BACnet MS/TP and BACnet ARCNET protocols. 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.

GTN116 - Setting the MS/TP Baud Rate

The GTN116 transmitter is set at the factory for an MS/TP baud rate of 76,800 baud. The MS/TP baud rate can be changed if necessary over the network, or at the GTN116 transmitter as follows:

a. Allow transmitter to start up with correct MS/TP address set in prior paragraph.

b. Record the MS/TP address switch setting so that you can re-set it after completion of MS/TP Baud rate selection.

c. Set ADDRESS DIP switches 1-4 (Figure 9) to the desired baud rate as follows:

MS/TP Baud Rate Selection

(Use ADDRESS DIP Switch)

ADDRESS DIP Switch Number/Position								MS/TP
1	2	3	4	5	6	7	8	Baud Rate
off	off	off	off	X	X	X	X	Auto Baud
on	off	off	off	X	X	X	X	76,800
off	on	off	off	X	X	X	X	38,400
off	off	on	off	X	X	X	X	19,200
off	off	off	on	X	X	X	X	9,600

Only Address Switches 1-4 are used to set the Baud Rate - See text.

d. Set ADDRESS DIP switch 8 to ON for at least 1 second, and then set it back to OFF. This will select and store the new value.

e. Restore the ADDRESS DIP switches 1-4 to the address setting recorded in step b. MS/TP Baud rate is now set.

NOTE

These switches **only affect MS/TP baud rate**; and **not any other network protocols**. ARCNET runs at 156.25k baud; N2 runs at 9600 baud, and Modbus defaults to 9600 baud, but can be changed to 19.2k baud by writing to it over the network (see “Function 06” in Table 5).

GTN116 - 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 GTN116 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 GTN116, 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 “RS-485” on the lower left hand side of the RS-485 circuit board as shown in Figure 9.

Connecting to an Isolated RS-485 Network:

Connect the NET+, NET- and COM terminals to the network with shielded twisted pair cable meeting the specifications defined in the previous paragraph (typically using two pairs, with one wire not used; one pair for +/- and both wires in 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 HTN104 is not the first or last device, set the on-board termination DIP switches for NO TERMINATION. If the HTN104 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 a shielded twisted pair cable meeting the specifications defined in the previous paragraph. 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 HTN104 is not the first or last device, set the on-board termination DIP switches for NO TERMINATION. If the HTN104 is the first or last device, set the on-board termination DIP switches to either END OF LINE or FAIL SAFE BIAS termination. Because the HTN104 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 HTN104 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 Figure 9).

Tables 4 through 6 list the specific values provided for each communication protocol.

Table 4. GTN116 RS-485 BACnet Object List

BACnet® ARCNET®
BACnet® MS/TP

Baud Rates: 9.6, 19.2, 38.4, 76.8, 156.25* Kbps

Type, Instance	Description	Default Units
Device, 1	Device Object	
Analog Input, 1	Airflow	FPM
Analog Input, 2	Differential Pressure	in.w.c.
Analog Input, 3	Temperature	°F
Analog Value, 1	Area	sq.ft.
Analog Value, 2	Baud Rate	None
Analog Value, 3	Airflow Traverse	FPM
Analog Value, 4	Temp Traverse	°F
Binary Value, 1	Auto Baud Rate Detection	None

* 156.25 Kbps on BACnet® ARCNET® only.

User Executed Services Supported:
Subscribe COV, Read Property, Write Property,
Device Communication Control, Who-Is

Table 5. GTN116 RS-485 Modbus Register Map

Modbus

Modbus RTU

REGISTER MAP

Baud Rate: 9,600 or 19,200 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
04			30013	1		Sensor Type	1 = Probe, 2 = Bleed, 255 = Fan
04			30014	1		Connector C1 Sensors	0 to 8
04			30015	1		Connector C2 Sensors	0 to 8
04			30016	1		Connector C3 Sensors	0 to 8
04			30017	1		Connector C4 Sensors	0 to 8
04	30018- 30049	30082 - 30113		32	FPM	Airflow Traverse	0 to 15,000
04	30018	30082		2	FPM	Insert 1 Flow	0 to 15,000
04	30049	30113		2	FPM	Insert 16 Flow	0 to 15,000
04	30050 - 30081	30114 - 30145		32	°F	Temperature Traverse	-20 to +160
04	30050	30114		2	°F	Insert 1 Temp	-20 to +160
04	30081	30145		2	°F	Insert 16 Temp	-20 to +160
06			40201	1		Modbus Baud Rate	0=9,600 1=19,200

Table 6. GTN116 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

TM_GTx116_R2B

GTE116 Ethernet Transmitter Set Up

The GTE116 provides a full duplex IEEE 802.3 ethernet interface with automatic re-transmission on collision and cyclic redundancy checking on network data. An on-board microcontroller performs over 7 million instructions per second to insure minimal network latency. Link status as well as network activity are available via on-board LED indicators. The ***EBTRON*** Ethernet output card plugs directly onto the main circuit board as shown below.

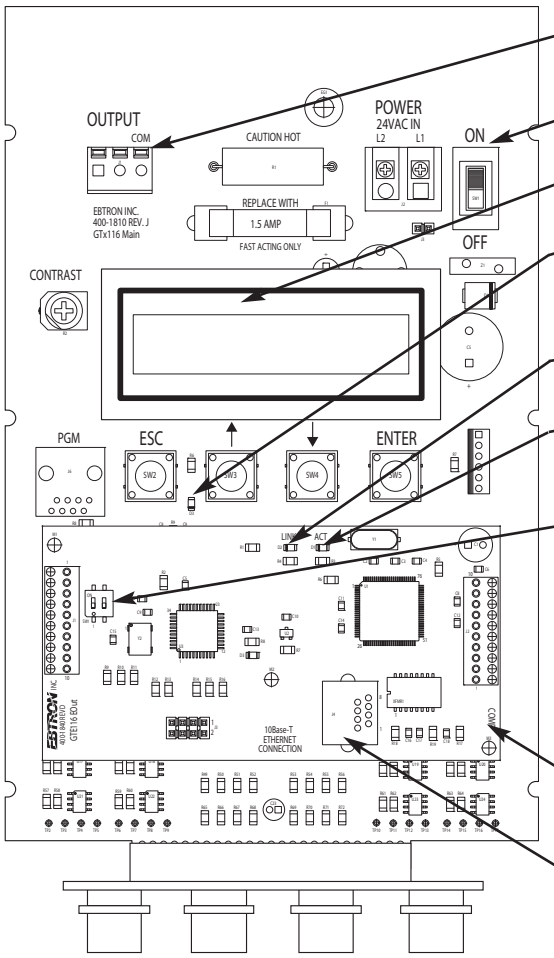
The transmitter must be configured for proper protocol prior to power up. Therefore, wiring to the ethernet network will be accomplished following configuration of the DIP switches. The transmitter is factory shipped with the protocol set for BACnet® Ethernet. The PROTOCOL DIP switch is located on the output card (Figure 10).

If the DIP switches are moved after power up, the transmitter must be turned "OFF" and then "ON" for the new switch positions to be activated.

GTE116 - IP Set Up for BACnet® IP and TCP/IP (see Register Map for Modbus)

Setup requires writing a text string to the device object location property (BACnet®) or through your web browser (TCP/IP). The Default IP address is 10.0.0.100, where the address format = wwwxxxyyyzzz.
Example: 10.0.0.100 enter as 010000000100. Tables 7 through 9 list the specific features of each protocol.

BACnet®IP	TCP/IP
IP Address text string: SETIP{address}	http://{ipaddress}/SETIP{address}
Subnet Mask text string: SETMK{address}	http://{ipaddress}/SETMK{address}
Default Router text string: SETRT{address}	http://{ipaddress}/SETRT{address}



Not used - See RJ45 Ethernet Connector Below

Power Switch

LCD Display

D3 - Transmitter Status LED
(Green 1 second flash normal; 2 second flash for fault)

LINK LED (green) indicates ethernet Link status

ACT LED (green) indicates ethernet activity

Protocol DIP Switch

Position		Protocol/Reset Default Addresses
1	2	
off	off	BACnet® Ethernet
off	on	BACnet® IP, Modbus TCP, TCP/IP
on	off	Not Used
on	on	Set IP to 10.0.0.100 Set Subnet Mask to 255.255.255.0 Set Default Router to 10.0.0.1

Ethernet Output Card
P.N. 800-5025

RJ45 Ethernet Connector

TM_GTx116_R2B

Figure 10. GTE116 Ethernet Transmitter Interior Detail

GTE116 - Resetting to Factory Defaults (BACnet® IP, Modbus TCP AND TCP/IP ONLY)

Addresses can be reset using the GTE116 hardware. First, turn the power switch on the main circuit card to the "OFF" position. Set SW1 to pos1=on, pos2=on. Turn the power to the "ON" position for 1 second or more. Turn the power switch to the "OFF" position and set SW1 to the proper protocol for the network (see Figure 9).

GTE116 - Transmitter Custom Data Acquisition Software Application

EBTRON provides free software to communicate with GTE116 Ethernet transmitters allowing users to write custom data acquisition software with Microsoft® Excel® using any 10base-T Ethernet connection (RJ45). Software can be downloaded at www.ebtron.com/ethernet.

EBTRON assumes that the user is knowledgeable regarding the use of Microsoft® Excel® and Visual Basic® for Applications (VBA) and can properly setup Microsoft® Windows® for Ethernet communications to the ***EBTRON*** transmitter.

GTE116 - Using the Custom Data Acquisition Software

Copy the dynamic link library GTEModbus.dll and the GTEModbus.bas module into the folder that you will save your completed Excel® file in. You must open your Excel® document from its specified location for the dll files to be recognized.

Set the macro security to medium (Macro>Security>{select Medium}). If you have not previously selected medium, you must close then reopen Excel® for the settings to take effect.

Create your spreadsheet and open the Visual Basic Editor® (Tools>Macro>Visual Basic Editor).

Import the module GTEModbus.bas into your project (File>Import>{GTEModbus.bas}).

The module contains two functions:

GTE116_MODBUS_READ_FPM (ByVal IP As String, ByVal Delay As Integer)

(returns velocity in fpm or the error codes 99999 or 99998)

GTE116_MODBUS_READ_F (ByVal IP As String, ByVal Delay As Integer)

(returns average temperature in °F or the error codes 99999 or 99998) where

IP is a string equal to the transmitter IP Address

Delay is an integer equal to the delay between readings in ms

Example:

```
Private Sub CommandButton_1_Click()
    Dim Airflow As Double
    Dim Temperature As Double

    'This code returns a double precision variable for Airflow and Temperature when a button on
    'the active worksheet named CommandButton_1 is clicked.
    'The value for Airflow is written to the worksheet cell at row 1, column 1 (cell A1).
    'The value for Temperature is written to the worksheet cell at row 2, column 1 (cell B2).
    'The IP address is 10.0.0.100 (device default value if not set by user).
    'The delay between readings is 500 ms (0.5 seconds).

    Airflow = GTE116_MODBUS_READ_FPM("10.0.0.100", 500)
    Temperature = GTE116_MODBUS_READ_F("10.0.0.100", 500)
     Cells(1, 1) = Airflow
     Cells(2, 1) = Temperature
End Sub
```

GTE116 - Ethernet Network Wiring Connections

Ensure that the transmitter termination, protocol and address/device instance number have been properly set up as previously described. Ensure that the power switch is in the "OFF" position. Connect the 10base-T ethernet connection (RJ45) to the female connector on the output card as shown in Figure 10.

Tables 7 through 9 list the specific values provided for each communication protocol.

BACnet® Ethernet®
BACnet® IP

Table 7. GTE116 BACnet Object List

OBJECTS

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.

Modbus

Modbus TCP

Table 8. GTE116 Modbus Register Map

REGISTER MAP

	IEEE Floating Point		Binary				
Function	low/high word	high/low word		Length	Units	Point Description	Range/Value
01			00001	1		Status	0:OK, 1:Trbl.
03			40001	4		IP Address	
03			40005	4		Subnet Mask	
03			40009	4		Default Router	
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

TCP/IP

Table 9. GTE116 TCP/IP Example

http://{IPAddress}

EBTRON GTE 116

Status	FPM	F
Normal	1210.29	80.84

http://{IPAddress}/DP.htm

EBTRON GTE 116

Status	Dynamic Pressure	F
Normal	-0.48121	80.01

TM_GTx116_R2B

GTL116 LonWorks® Transmitter Set Up

The GTL116 includes a full featured LonWorks® compatible interface. The ***EBTRON*** LonWorks output card (part number 800-5030) plugs directly onto the GTL116 main circuit board as shown below. It includes a high speed FTT-10A, 78k baud free topology transceiver interface that is relatively insensitive to network wiring topology. The GTL116 may be pre-configured using the GTL116.XIF file available for download at www.ebtron.com/lonworks, or configured at installation via direct LonWorks® parameter upload from the GTL116 transmitter. A service push-button and LED are provided for standard installation. A "Wink" LED is provided for easy device identification. An "Activity" LED and separate transmit and receive "TX" and "RX" provide visual indication of transmitter and communication status. The "Activity" LED normally flashes on for 1 second, off for 1 second when the card is commissioned and online, and remains illuminated constantly if there is an error

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. Connect network cables to the small, three position output terminal labeled "OUTPUT" on the upper left hand side of the main circuit board (shown below) at terminals 1 and 2 only.

GTL116 - LonWorks® Network Connections

Connect the transmitter output to the LonWorks bus in a "daisy-chain" configuration using a shielded, twisted pair communication wire with a signal ground conductor (3 wires and a shield). The transmitter provides an output that is isolated from the main power input. Connect the LonWorks cable at the "OUTPUT" terminal block as follows:

OUTPUT TERMINAL	SIGNAL DESCRIPTION
1	NET+
2	NET-
COM	COMMON (NOT USED)

(The shield will typically be grounded at one end of the bus and not connected to the transmitter terminals.)

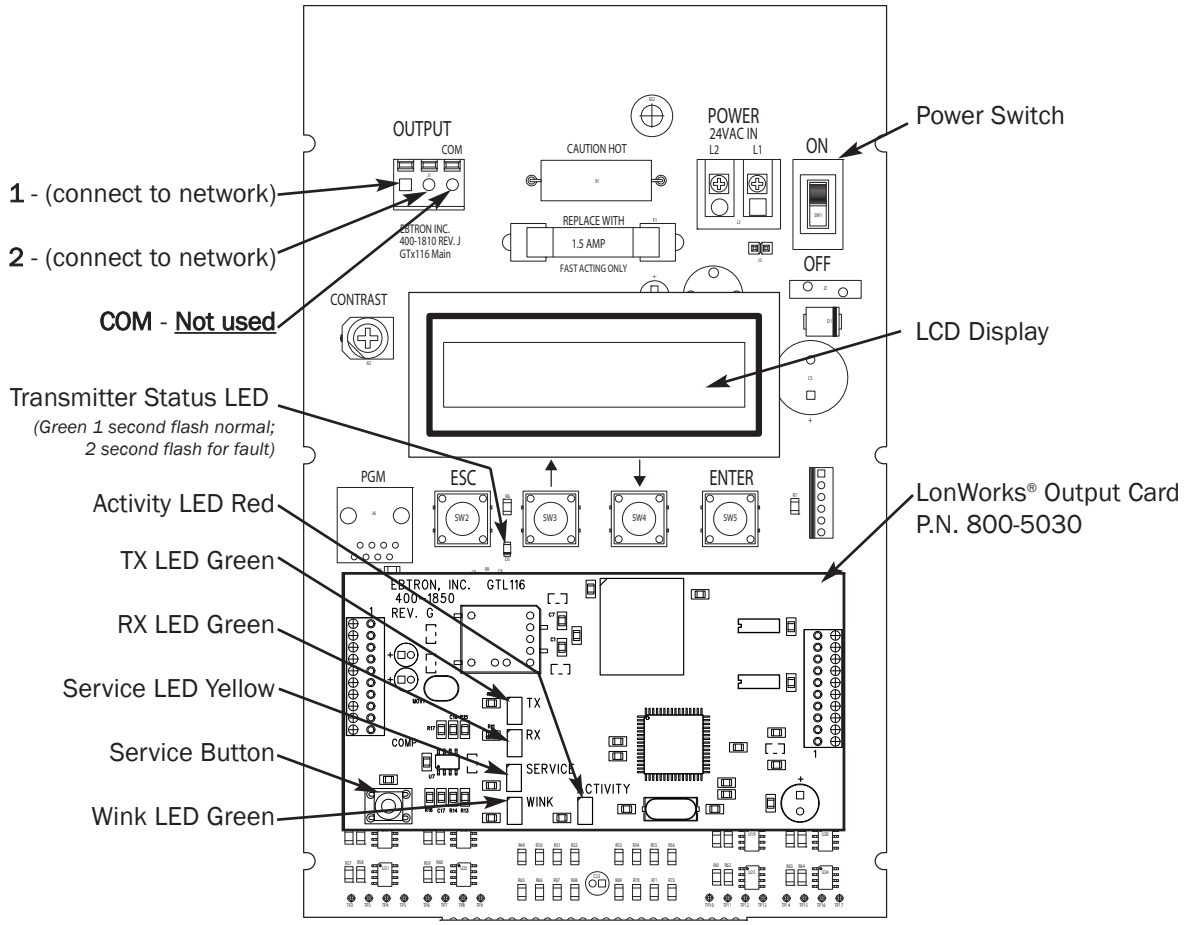


Figure 11. GTL116 LonWorks Transmitter Interior Detail

GTL116 - LonWorks® INTERFACE

Introduction

The Ebtron LonWorks interface adapter is designed to provide an output capability for connection to an Echelon LonWorks based network. Two basic function blocks are provided. These include a node object and a gtx116 function block.

The node object is used for overhead activities on the LonWorks bus. This object is of little interest to the end user.

The gtx116 function block contains a set of network variables and configuration properties that allow the end user to monitor various parameters related to airflow, pressure, and temperature that are generated by the transmitter.

Basic Description

The LonWorks protocol is based on "network variable objects"("nvo"). Each device on the network communicates with other devices by "connecting" to the variables of the device it wishes to monitor. These variables consist primarily of pre-defined types that are part of the network specification.

Additionally, a special class of network properties is defined to allow the configuration of various parameters within a device. These are intended to control the basic operation of a device.

All network variables are defined in terms of "SNVT_xxx". SNVT is an acronym for Standard Network Variable Type. "xxx" is a descriptive phrase that relates to the units used by the parameter represented by the variable. All of the variables described below are always visible on the network; however, some variables are meaningful only with certain types of sensors attached to the transmitter. Tables 10 through 16 describe each of the variables used and the configuration properties for each.

All configuration properties are defined in terms of "SCPTxxx". SCPT is an acronym for Standard Configuration Property Type. There are configuration properties that apply to multiple objects, but may not be listed directly under them when viewed on the network. Check the "applies to" tag in the description for the configuration property in the following sections.

Velocity and Flow Variables and Configuration

This section details the air flow and air velocity variables and how the configuration properties relate to them.

Velocity and Flow Variables

Table 10. GTL116 LonWorks® Node Velocity and Flow Variables

Air Flow Sensor Objects					
Variable Name	**Variable Type**	**Measurement**	**Type Category**	**Type Resolution**	**Units**
nvoAirVel	SNVT_speed_mil	Linear Velocity	Unsigned Long	0.001	Feet/second
nvoAirFlow	SNVT_flow	Flow Volume	Unsigned Long	1	Cubic feet/min
nvoAirFlowFl	SNVT_flow_f	Flow Volume	Floating Point	n/a	Cubic feet/min

For the "nvoAirFlow" and "nvoAirFlowFl" variables to be meaningful, the ductArea configuration property must be set.

nvoAirVel (SNVT_speed_mil - Air Velocity)

This variable provides simple linear airflow in feet/second.

nvoAirFlow (SNVT_flow - Airflow)

This variable provides volumetric airflow in cubic feet/min. For this variable to be meaningful, the ductArea configuration property must be set.

nvoAirFlowFl (SNVT_flow_f - Airflow Float)

This variable provides volumetric airflow in cubic feet/min. For this variable to be meaningful the ductArea configuration property must be set.

Velocity and Flow Configuration Properties

Table 11. GTL116 LonWorks® Node Velocity and Flow Configuration Properties

Air Flow Sensor Configuration Properties					
nvoAirVel	SCPTmaxSendTime	Time	Signed Long	0.1	Seconds
nvoAirVel	SCPTminSendTime	Time	Signed Long	0.1	Seconds
nvoAirVel	SCPTminDelta	Linear Velocity	Unsigned Long	0.001	Feet/second
nvoAirFlow	SCPTductArea	Area	Unsigned Long	0.0002	Square Meters

nvoAirVel (SCPTmaxSendTime - Maximum Time Between Updates)

This configuration property sets the maximum time to elapse between updates to the network for velocity and flow to occur.

nvoAirVel (SCPTminSendTime - Minimum Time Before Updates)

This configuration property sets the minimum time to elapse before an update to the network for velocity and flow may be sent. This configuration property takes priority over **maxSendTime** and **sndDelta**.

nvoAirVel (SCPTsndDelta - Minimum Change for Update)

This configuration property sets the minimum change in velocity that will cause an update of flow and velocity to the network. The change is only checked for in velocity, and when the minimum is reached updates will occur for nvoVel, nvoFlow, and nvoFlowFl.

nvoAirFlow (SCPTductArea - Duct Area for Air Flow Calculation)

This configuration property sets the duct area to be used in flow calculations. Note that this variable must be set to a non-zero value to get flow information.

Pressure Variables and Configuration Properties

This section details the pressure variables and how the configuration properties relate to them.

Pressure Variables

Table 12. GTL116 LonWorks® Node Pressure Variables

Dynamic Pressure Sensor Object					
Variable Name	**SNVT**	**Measurement**	**Type Category**	**Type Resolution**	**Units**
nvoPrecisePres	SNVT_press_p	Pressure	Signed Long	0.00001	Inches of H2O
nvoFloatPres	SNVT_press_f	Pressure	Floating Point	n/a	Inches of H2O

nvoPrecisePres (SNVT_press_p - Airflow Pressure)

This variable provides air pressure in inches of H2O. For this variable to be meaningful a bleed sensor must be attached to the transmitter.

nvoFloatPres (SNVT_press_f - Airflow Pressure Float)

This variable provides air pressure in inches of H2O. For this variable to be meaningful a bleed sensor must be attached to the transmitter.

Pressure Configuration Properties

Table 13. GTL116 LonWorks® Node Pressure Configuration

Dynamic Pressure Sensor Configuration Properties					
nvoPrecisePres	SCPTmaxSendTime	Time	Signed Long	0.1	Seconds
nvoPrecisePres	SCPTminSendTime	Time	Signed Long	0.1	Seconds
nvoPrecisePres	SCPTsndDelta	Pressure	Signed Long	0.0001	Inches of H2O

nvoPrecisePres (SCPTmaxSendTime - Maximum Time Between Updates)

This configuration property sets the maximum time to elapse between updates to the network for pressure to occur.

nvoPrecisePres (SCPTminSendTime - Minimum Time Before Updates)

This configuration property sets the minimum time to elapse before an update to the network for pressure may be sent. This configuration property takes priority over maxSendTime and sndDelta.

nvoPrecisePres (SCPTsndDelta - Minimum Change for Update)

This configuration property sets the minimum change in pressure that will cause an update for pressure to the network. When this change is met both nvoPrecisePres and nvoFloatPres will be updated on the network.

Temperature Variables and Configuration Properties

This section details the temperature variable and how the configuration properties that relate to it.

Table 14. GTL116 LonWorks® Node Temperature Variable

Variable Name	SNVT	Measurement	Type Category	Type Resolution	Units
nvoTemp	SNVT_temp_p	Temperature	Signed Long	0.01	Degrees F

nvoTemp (SNVT_temp_p - Temperature Variable)

This network variable provides temperature in degrees Fahrenheit.

Temperature Configuration Properties

Table 15. GTL116 LonWorks® Node Temperature Variable

Temperature Sensor Configuration Properties					
nvoTemp	SCPTmaxSendTime	Time	Signed Long	0.1	Seconds
nvoTemp	SCPTminDeltaTemp	Temperature	Signed Long	0.001	Degrees F
nvoTemp	SCPTminSendTime	Time	Signed Long	0.01	Seconds

nvoTemp (SCPTmaxSendTime - Maximum Time Between Updates)

This configuration property sets the maximum time to elapse between updates to the network for temperature to occur.

nvoTemp (SCPTminDeltaTemp - Minimum Change for Update)

This configuration property sets the minimum change in temperature that will cause an update of nvoTemp to the network.

nvoTemp (SCPTminSendTime - Minimum Time Before Updates)

This configuration property sets the minimum time to elapse before an update to the network for temperature may be sent. This configuration property takes priority over maxSendTime and minDeltaTemp.

Default Delta Values

This section details the default Delta values which determine when updates are sent from the transmitter to the network. The Delta Values in Table 16 are set with a large factory default value to prevent any undesired messages from being sent to the network. Refer to the preceding paragraphs for a description and configuration of the Delta values.

Table 16. GTL116 LonWorks® Node Temperature Variable

Delta Values		
nvoAirVel	SCPTsndDelta	200 fps
nvoPrecisePres	SCPTsndDelta	1 iWc
nvoTemp	SCPTminDeltaTemp	160 °F

GTx116 TRANSMITTER SET UP

To ensure a successful start-up, verify that the airflow measuring station and transmitter are installed in accordance to ***EBTRON*** guidelines.

Check the physical installation, power connections and model specific signal wiring prior to turning the power switch to the "on" position.

Move the power switch to the "ON" position. The transmitter executes a complete self-check each time the power is turned on that takes 10 seconds to complete. Check that the readings at the host control system return an output that matches the output of the GTx116.

The GTA116 is designed to operate on "POWER-UP". Default output signals are set to 4-20mA. No field configuration is necessary unless the output signal type required is 0-5[1]VDC/0-10VDC. The GTN116, GTE116 and GTL116 must be properly configured based on the system network protocol. Review the section for the corresponding transmitter output card or contact ***EBTRON*** Customer Service, toll free, at 800-232-8766.

Transmitter Initialization

The GTx116 Transmitter automatically initializes at power-up and conducts full system diagnostics. Under normal conditions, there is no reason to enter the *Initialization Mode*. The transmitter should only be initialized if one of the actions below is required. To enter the *Initialization Mode*, simultaneously press and release the "ENTER" and "ESC" buttons during the first 10 seconds after the transmitter power-up delay is completed (indicated by "--------"). Navigate through the menus as shown in Figure 12 below.

[1] 0-5 VDC analog output option introduced with firmware version 5.04.

Press and release Enter and Escape during first 10 seconds of operation to select

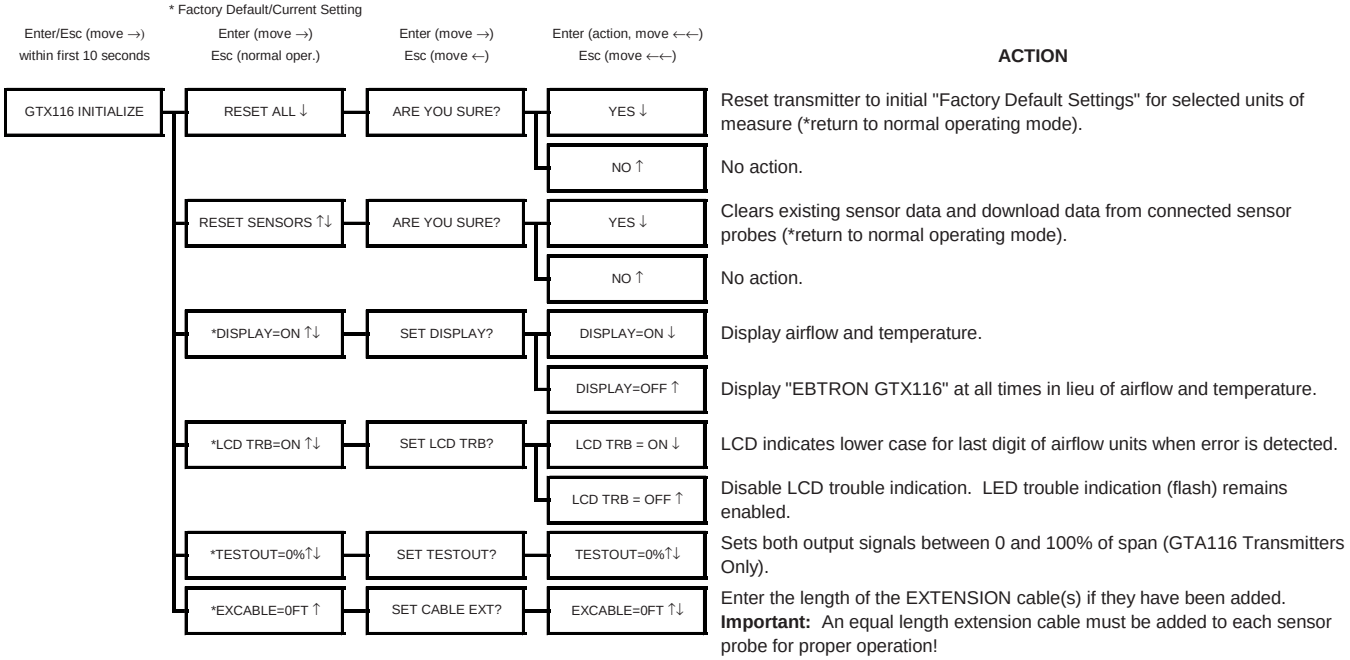


Figure 12. Transmitter Initialization Menu

Changing the System of Units

The GTx116 transmitter is provided with the system of units set to I-P. To change to S.I., simultaneously press and release the "UP" and "DOWN" arrow buttons during normal operation. "IP/SI UNITS" will be indicated on the LCD display. Press "ENTER" three times and use the "UP" and "DOWN" arrow buttons until the system of units desired is indicated. Press the "ENTER" button to select changes then press "ESC" twice to return to the normal operating mode. Figure 13 details the System of Units menu. Note that the Setup Menus of Figures 15 and 16 are shown in IP System Of Units. When SI System of Units is selected, the units of measure abbreviations used in the menus is as shown in Table 17.

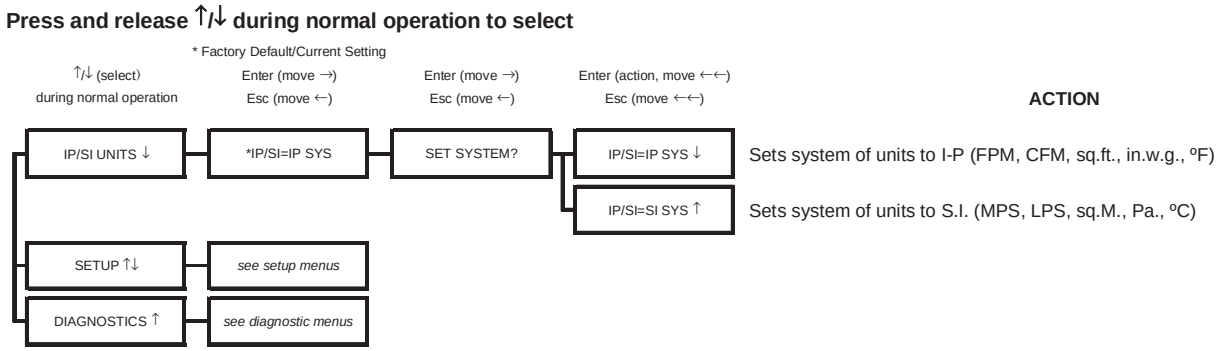


Figure 13. System of Units Menu

Table 17. Standard "IP" and "SI" Menu Units Abbreviations

"IP" System of Units	Description	"SI" System of Units	Description
FPM	Feet per minute	MPS	Meters per second
CFM	Cubic feet per minute	LPS	Liters per second
SQF	Square feet	SQM	Square meters
iWc	Inches H_20 (Water column)	Pa	Pascals
F	Fahrenheit	C	Celsius

Factory Defaults for GP1 (-P), GF1 (-F), GB1 (-B) Sensor Probes

The GTx116 transmitter is "plug and play" and does not require setup unless a network option is selected that requires configuration. Table 18 shows the factory default settings for all compatible sensor probes.

To change the Factory Default Settings, see: CHANGING FACTORY DEFAULT SETTINGS.

Table 18. Factory Default Menu Settings

Display	Sensor Type	Description	I-P	S.I.
*LCDU/M=	ALL	Airflow units of measure	FPM	MPS
*AR1=	-P and -F	Free area where station is located	0.00 sq.ft.	0.000 sq.meters
*K_V=	-B	Output 1 K_V factor for Airflow	0.00	0.000
*K_P=	-B	Output 1 K_P factor for Pressure	1.000	1.000
*DIRECTION=	-B	Output 1 Polarity	BI (bidirectional)	BI (bidirectional)
*OUT1=	ALL	GTA116 output 1 signal (airflow) [or pressure on -B]	4-20mA	4-20mA
*OUT1 U/M=	ALL	Output 1 units of measure	FPM	MPS
*FS1=	-P Probes	GTA116 output 1 signal full scale	5,000 FPM	25 MPS
	-F Fan Inlets		10,000 FPM	50 MPS
	-B Bleed Sensors		3,000 FPM	15 MPS
*LL1=	-P and -F	GTA116 low limit cutoff	0 FPM	0 MPS
*LL1=	-B (airflow)		0 FPM	0 MPS
*LL1=	-B (pressure)		0 in.w.c.	0 Pa
*OFF-GAIN1=	ALL	Output 1 Offset-Gain On/Off	Off	Off
*GAIN1=	ALL	Output 1 Gain factor	1.000	1.000
*OFFSET1=	ALL	Output 1 Offset factor	0.000 FPM	0.000 MPS
*OG1MODE1=	ALL	Output 1 Offset-Gain Mode	1 (direct entry)	1 (direct entry)
*FILTER1=	ALL	Output 1 Digital Noise Filter	0 (off)	0 (off)
*OUT2METH=	-P and -F	Temperature Averaging	Arithmetic Avg.	Arithmetic Avg.
*OUT2=	ALL	GTA116 output 2 signal (temperature)	4-20mA	4-20mA
*MS2=	ALL	GTA116 output 2 signal minimum scale	-20° F	-30° C
*FS2=	ALL	GTA116 output 2 signal full scale	160° F	70° C

TRANSMITTER CALIBRATION

The GTx116 uses high quality industrial grade components and is designed for years of trouble-free operation. Periodic recalibration of the transmitter is neither required nor recommended. Transmitter field calibration verifiers are available for purchase from ***EBTRON*** for installations requiring periodic validation of instrumentation. Contact ***EBTRON*** for more information.

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CHANGING FACTORY DEFAULT SETTINGS

Setup Menu Options

The GTx116 Transmitter has been setup and tested at the factory and is fully operational when sensor probes are connected and power is applied by turning the power switch to the "ON" position. The transmitter automatically determines the type of sensors connected and defaults to predetermined factory settings. Factory settings can easily be changed in the field by entering the *Main Menu* by simultaneously pressing and releasing the "UP" and "DOWN" buttons while the transmitter is in its normal operating mode. (Figures 15 and 16 are detailed flow charts of the setup menus for each type of probe and for the system of units selected.) The *Setup Menu* for the connected sensor probe type (-P, -F or -B) will automatically be detected and displayed by the transmitter. Navigate through the menu using Figures 15 and 16 to make changes to the transmitter configuration. The settings take effect immediately. The following are common field modifications to the factory default settings.

Output Scaling

EBTRON's Gold Series sensors are individually calibrated between 0 and the factory default full scale to standards in wind tunnels traceable to the National Institute of Standards and Technology (NIST). Sensors are independent and produce "percent of reading" accuracy. Changing the full scale does not change the accuracy of the device). Factory default output scaling for analog GTA116 transmitters can be changed using the setup menu of Figures 15 and 16.

Changing the LCD Display from Velocity FPM to Volumetric Flow CFM (MPS to LPS for SI units)

The GTx116 transmitter is shipped from the factory to display velocity in FPM (or MPS). Therefore, transmitter to sensor probe matching is not required. To change the GTx116 LCD display to indicate volumetric flow, (CFM or LPS) enter the *Setup Menu* (Figures 15 and 16) and change the menu item "*LCD1U/M=FPM" to "*LCD1U/M=CFM" ("*LCD U/M = MPS" to "*LCD U/M = LPS" for SI units). Since this is a volumetric value, the free area of the airflow measurement probe location **must** be entered in square feet (square meters for SI units) in the *Setup Menu*. For -P sensors, the free area is printed on the attached hang-tag. For -F and -B probes, the free area of the probe must be determined following installation in accordance with the installation guidelines. Changing the LCD display units will not affect the separate analog output signal. The analog output signal can be changed separately as described below.

Converting the Analog Output Signal from FPM to CFM (MPS to LPS for SI units scaling)

The GTx116 transmitter is shipped from the factory with analog output"OUTPUT 1" set to indicate velocity in FPM. To automatically convert this analog velocity output to volumetric flow (CFM or LPS), simply set the *OUT1 U/M from FPM (default) to CFM in the *Setup Menu* (Figures 15 and 16). If you wish to manually convert the velocity output to volumetric flow (CFM or LPS), simply multiply the indicated output velocity (in FPM or MPS) by the free area of the air flow probe installation location (free area x 1000 for SI units when area is calculated in square meters). For -P sensors, the total free area is programmed into the probe at the factory and is printed on the probe hang-tag. For -F and -B sensor probes, determine the free area following installation in accordance with the installation guidelines. Refer also to Table 3 for a complete listing of conversions for each of the analog outputs of the GTx116.

Locking the Configuration Settings

The GTx116 transmitter configuration settings can be locked by opening the *Lock Menu* then entering a user defined lock code between 1 and 9999. When locked, user defined settings can be changed only when the user defined code is entered in the *Initialization, IP/SI Units* or *Setup Menus*. To enter the *Lock Menu*, press the "ESCAPE" and "UP" arrow simultaneously at any time. The *Lock Menu* requires a code to be entered, then verified, for the lock to be enabled. Figure 14 (below) details the Lock menu

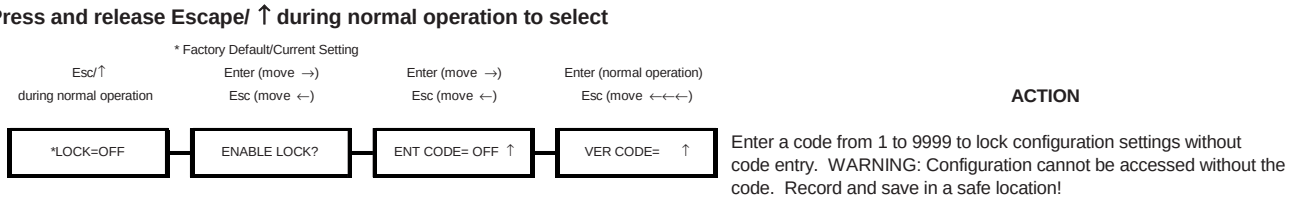

Figure 14. Factory Default Lock Menu Settings

When the LOCK is enabled, user defined settings can only be changed after entering the user defined LOCK CODE. STORE THE LOCK CODE IN A SAFE LOCATION! For security reasons, lock codes can only be disabled by returning the transmitter to *EBTRON*.

Setup Menu Options: -P and -F Sensor Systems (IP/SI Units Set for "IP SYS") Part 1 of 2

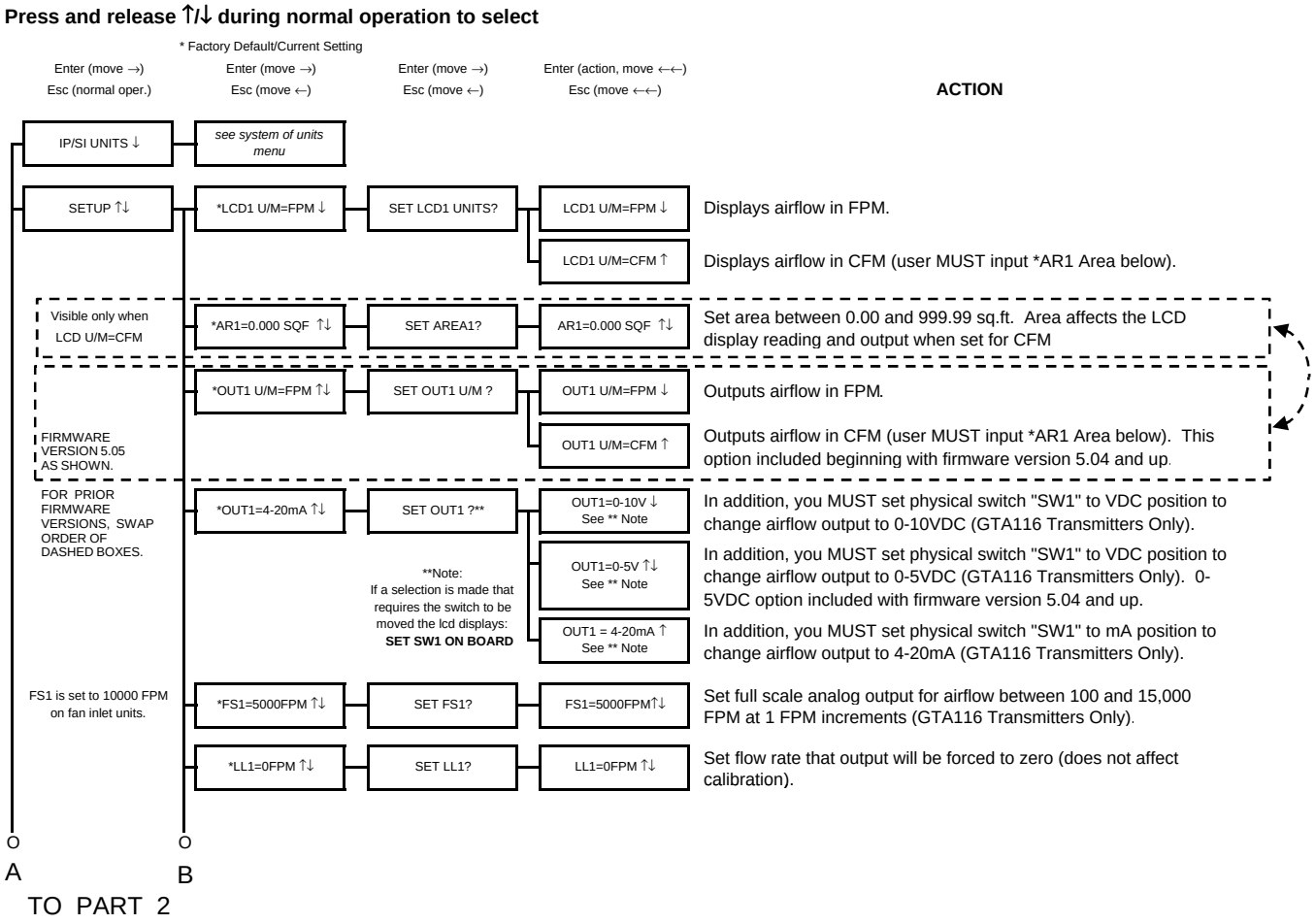

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Figure 15. Setup Menu Options: -P and -F Sensor Systems ("IP SYS")

Setup Menu Options: -P and -F Sensor Systems (IP/SI Units Set for "IP SYS") Part 2 of 2

Press and release ↑/↓ during normal operation to select

* Factory Default/Current Setting

Enter (move →) Esc (normal oper.)	Enter (move →) Esc (move ←)	Enter (move →) Esc (move ←)	Enter (action, move ←←) Esc (move ←←)	**ACTION**

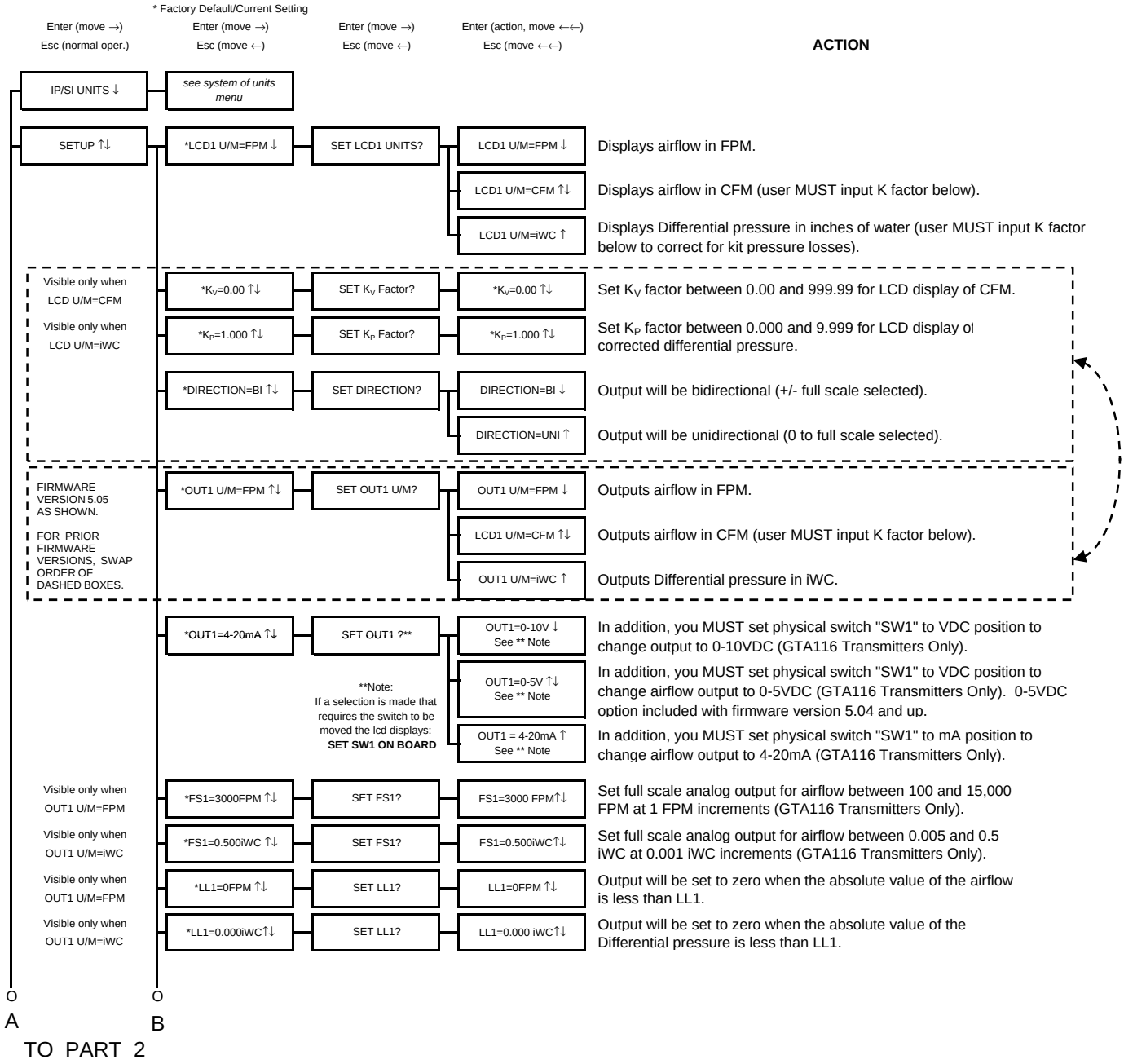
FROM PART 1

A O — B O

	*OFF-GAIN1=OFF ↑↓	SET OFF1-GAIN?	OFF-GAIN1=OFF ↓	Offset/Gain adjustments and menus for airflow are disabled.
			OFF-GAIN1=ON ↑	Offset/Gain adjustments and menus for airflow are enabled.
Visible only when OFF-GAIN=ON	*O-G1MODE=1↑↓	SET O-G1 MODE?	O-G1MODE=1 ↓	Mode 1 displays offset/gain values when adjusting output.
			O-G1MODE=2 ↑	Mode 2 displays airflow rate (real time) when adjusting output.
Visible only when OFF-GAIN=ON	*GAIN1=1.000 ↑↓	SET GAIN1?	GAIN1=1.000	Adjust ↑↓ to set gain when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↑↓ while viewing airflow rate when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
Visible only when OFF-GAIN=ON	*OFFSET1=0 ↑↓	SET OFFSET1?	OFFSET1=0	Adjust ↑↓ to set offset when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↑↓ while viewing airflow rate when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
	*FILTER1=0 ↑↓	ADJUST FILTER1?	FILTER1=0 ↑↓	Adjust dampening filter value from 0 (off) to 99%.
	*OUT2=4-20mA ↑↓	SET OUT2 ?**	OUT2=0-10V ↓ See ** Note	In addition, you MUST set physical switch "SW2" to VDC position to change output to 0-10VDC (GTA116 Transmitters Only).
		Note: If a selection is made that requires the switch to be moved the lcd displays: **SET SW2 ON BOARD	OUT2=0-5V ↑↓ See ** Note	In addition, you MUST set physical switch "SW2" to VDC position to change airflow output to 0-5VDC (GTA116 Transmitters Only). 0-5VDC option included beginning with firmware version 5.04 and up.
			OUT2 = 4-20mA ↑ See ** Note	In addition, you MUST set physical switch "SW2" to mA position to change airflow output to 4-20mA (GTA116 Transmitters Only).
	*OUT2METH=AVG↑↓	SET METHOD?	OUT2METH=AVG↓	Uses standard arithmetic average for temperature output.
			OUT2METH=WAVG ↑	Uses velocity weighted average for temperature output (most accurate method for temperature control).
	*MS2=-20 F ↑↓	SET MS2?	MS2=-20 F ↑↓	Set minimum scale analog output for temperature between -50º and 150º F at 1º F increments (GTA116 Transmitters Only).
	*FS2=160 F ↑	SET FS2?	FS2=160 F ↑↓	Set full scale analog output for temperature between 0 and 160º F at 1º F increments (GTA116 Transmitters Only). FS2 > MS2 + 10º F.
DIAGNOSTICS ↑	*see diagnostic menus*			

Setup Menu Options: -B Systems (IP/SI Units Set for "IP SYS") Part 1 of 2

Press and release ↑/↓ during normal operation to select



TM_GTx116_R2C

Figure 16. Setup Menu Options: -B Sensor Systems ("IP SYS")

Setup Menu Options: -B Systems (IP/SI Units Set for "IP SYS") Part 2 of 2

Press and release ↑/↓ during normal operation to select

* Factory Default/Current Setting

Enter (move →) Esc (normal oper.)	Enter (move →) Esc (move ←)	Enter (move →) Esc (move ←)	Enter (action, move ←←) Esc (move ←←)	**ACTION**

FROM PART 1

A O — B O

Visible only when OUT1 U/M=iWC	*LL1=0.000iWC↑↓	SET LL1?	LL1=0.000 iWC↑↓	Output will be set to zero when the absolute value of the Differential pressure is less than LL1.
	*OFF-GAIN1=OFF ↑↓	SET OFF-GAIN1?	OFF-GAIN1=OFF ↓	Offset/Gain adjustments and menus for airflow are disabled. Adjustments affect airflow and Differential pressure.
			OFF-GAIN1=ON ↑	Offset/Gain adjustments and menus for airflow are enabled. Adjustments affect airflow and Differential pressure.
Visible only when OFF-GAIN1=ON	*O-G1MODE=1↑↓	SET O-G1MODE	O-G1MODE=1 ↓	Mode 1 displays offset/gain values when adjusting output. Values are linearly related to airflow, not Differential pressure
			O-G1MODE=2 ↑	Mode 2 displays airflow rate or Differential pressure (real time) when adjusting output (whichever is selected on the display)
Visible only when OFF-GAIN1=ON	*GAIN1=1.000 ↑↓	SET GAIN1?	GAIN1=1.000	Adjust ↑↓ to set gain when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↑↓ while viewing airflow rate when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
Visible only when OFF-GAIN1=ON	*OFFSET1=0 ↑↓	SET OFFSET1?	OFFSET1=0	Adjust ↑↓ to set offset when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↑↓ while viewing airflow rate when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
	*FILTER1=0 ↑↓	ADJUST FILTER1?	FILTER1=0 ↑↓	Adjust dampening filter value from 0 (off) to 99%.
	*OUT2=4-20mA ↑↓	SET OUT2 ?**	OUT2=0-10V ↓ See ** Note	In addition, you MUST set physical switch "SW2" to VDC position to change output to 0-10VDC (GTA116 Transmitters Only).
		Note: If a selection is made that requires the switch to be moved the lcd displays: **SET SW2 ON BOARD	OUT2=0-5V ↑↓ See ** Note	In addition, you MUST set physical switch "SW2" to VDC position to change airflow output to 0-5VDC (GTA116 Transmitters Only). 0-5VDC option included with firmware version 5.04 and up.
			OUT2 = 4-20mA ↑ See ** Note	In addition, you MUST set physical switch "SW2" to mA position to change airflow output to 4-20mA (GTA116 Transmitters Only).
	*MS2=-20F ↑↓	SET MS2?	MS2=-20F ↑↓	Set minimum scale analog output for temperature between -50º and 150º F at 1º F increments (GTA116 Transmitters Only).
	*FS2=160F ↑	SET FS2?	FS2=160F ↑↓	Set full scale analog output for temperature between 0 and 160º F at 1º F increments (GTA116 Transmitters Only). FS2 > MS2+10º F.
DIAGNOSTICS ↑	*see diagnostic menus*			

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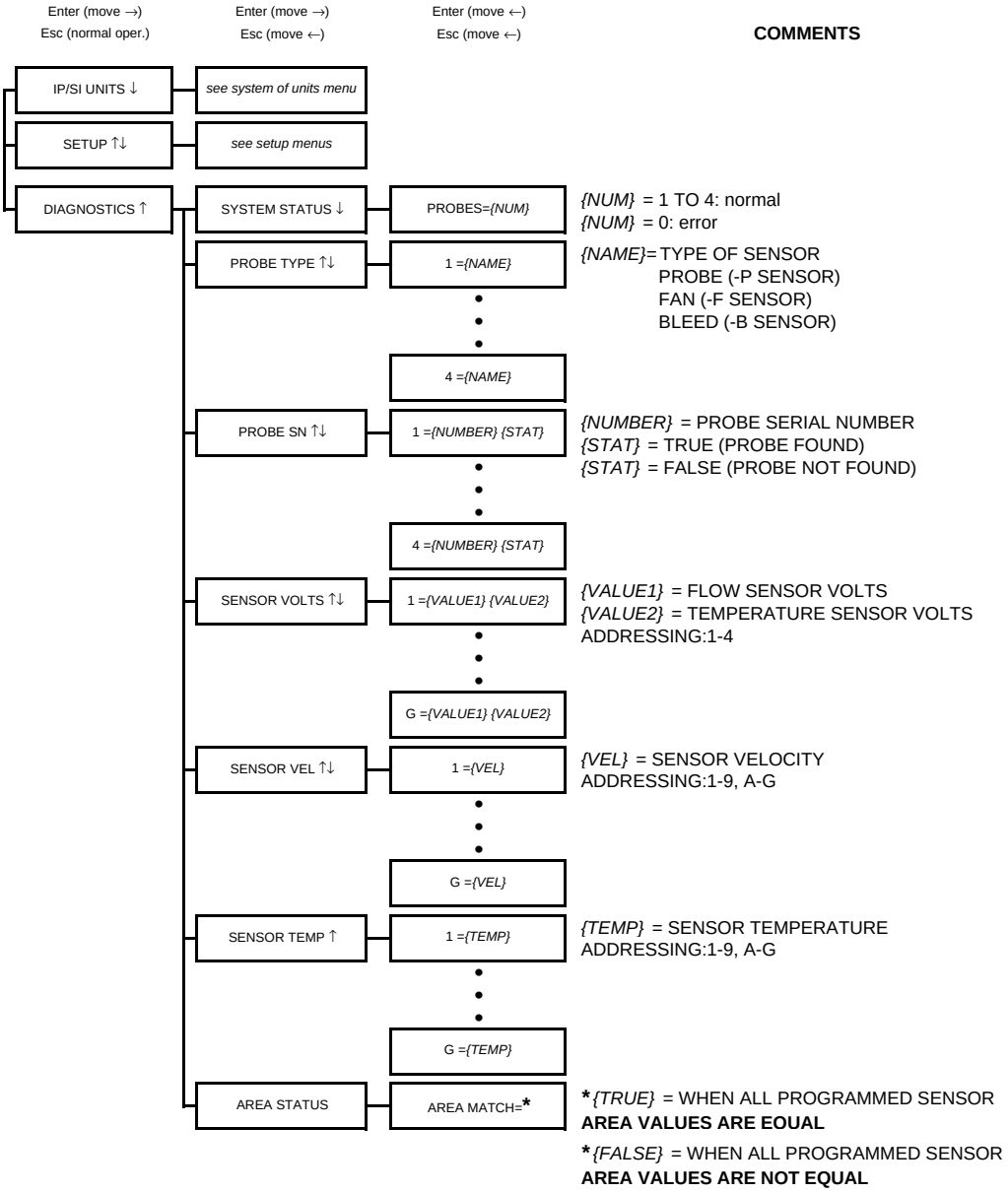
Navigating through the Diagnostics Menu (all System of Units)

Press and release ↑/↓ during normal operation to select



TM_GTx116_R2B

Figure 17. Navigating through the Diagnostics Menu (all System of Units)

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

VIEWING SENSOR DATA

Viewing Sensor Data on the Local LCD Display

Airflow and temperature of individual sensors can be displayed on the local LCD display by entering the Diagnostic Menu. Depressing the up and down arrows on the GTx116 main circuit board (see Figure 8) simultaneously places the GTx116 into the Diagnostic Menu. The following paragraph details the Diagnostic menu options.

Navigating through the Diagnostics Menu

The Diagnostic Menu allows the user to verify locally on the LCD display the individual probe and sensor data. Figure 17 details the Diagnostic Menu options.

Viewing Sensor Data over RS-485 BACnet® or Modbus Networks

Airflow and temperature of individual sensors can also be read across an RS-485 BACnet® or Modbus network, or downloaded directly to a PDA if the infra-red ***EB-Link*** option has been installed. Refer to the following Sensor Addressing and Probe Positioning paragraph for the recommended probe installation configuration.

Two BACNET® analog variables can be read that contain a string describing the individual airflow and temperature data at the time of the request. The airflow variable is named **Airflow Traverse** and the temperature variable is named **Temperature Traverse**. The string is described as follows:

<sensor type>,<C1>,<C2>,<C3>,<C4>, $data_1$, $data_2$, $data_3$,...$data_n$

where:

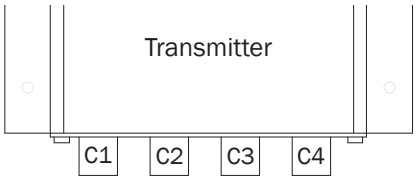
sensor type = PROBE, FAN or BLEED
C1 = number of sensors on connector C1 (0 to 8 on PROBE, 0 to 1 on FAN and BLEED)
C2 = number of sensors on connector C2 (0 to 8 on PROBE, 0 to 1 on FAN and BLEED)
C3 = number of sensors on connector C3 (0 to 8 on PROBE, 0 to 1 on FAN and BLEED)
C4 = number of sensors on connector C4 (0 to 8 on PROBE, 0 to 1 on FAN and BLEED)
data = airflow fpm (m/s) or temperature °F (°C) as sequential data starting at connector C1

Registers describing individual airflow and temperature data at the time of request are available when the device is configured for Modbus (see Register Map Table 5 located in the GTN116 RS-485 Transmitter Setup section of this manual).

Sensor Addressing and Probe Positioning

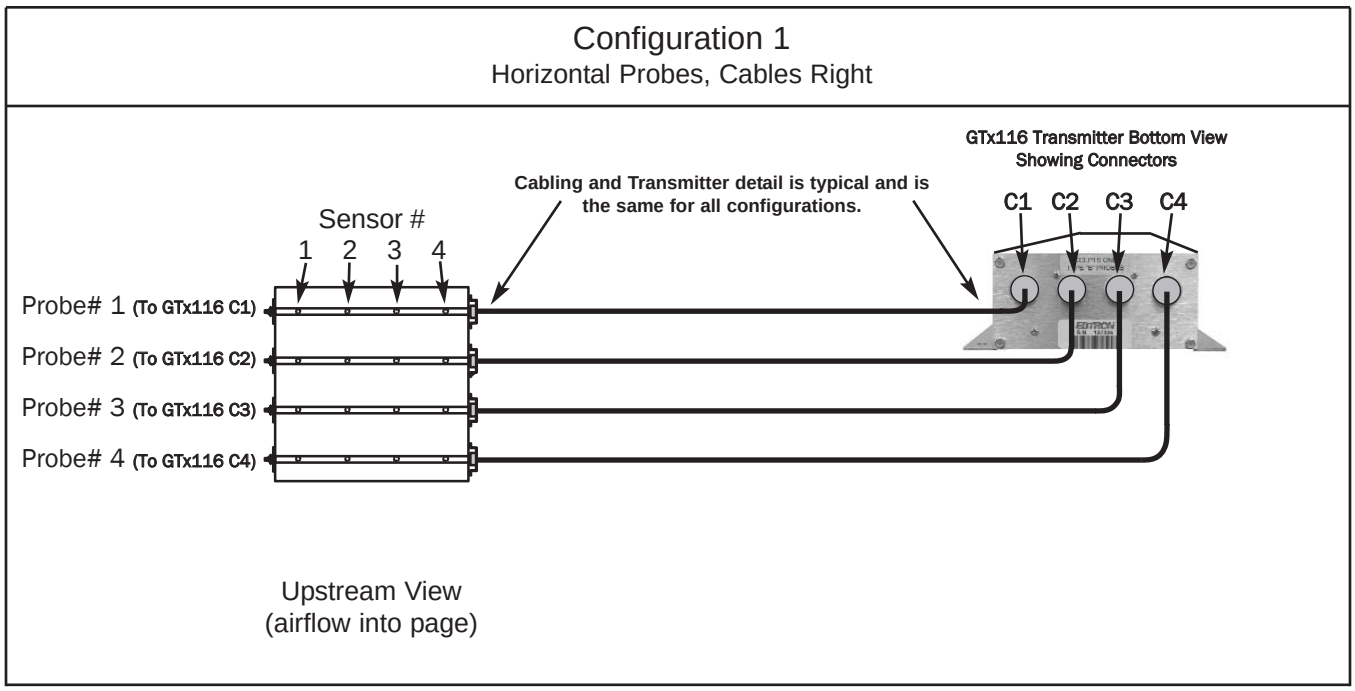
Sensors are automatically addressed after the power is energized to the transmitter. The probe that is connected to the left most **used** receptacle on the transmitter is probe number 1. The lowest sensor number on the probe is at the end opposite the connecting cable. Up to 16 sensors (addresses 1 to 9 then A to G where G is equal to sensor 16) can be individually viewed.

Example: Two 4 sensor probes are connected to receptacles C2 and C3 (refer to the connector diagram Figure 18). Sensors 1 to 4 are on C2 and sensors 5 to 8 are on C3. Sensors 1 and 5 are located at the end of the probe opposite from the connecting cable.



Connector Diagram

Figure 18. GTx116 Transmitter Connector Diagram



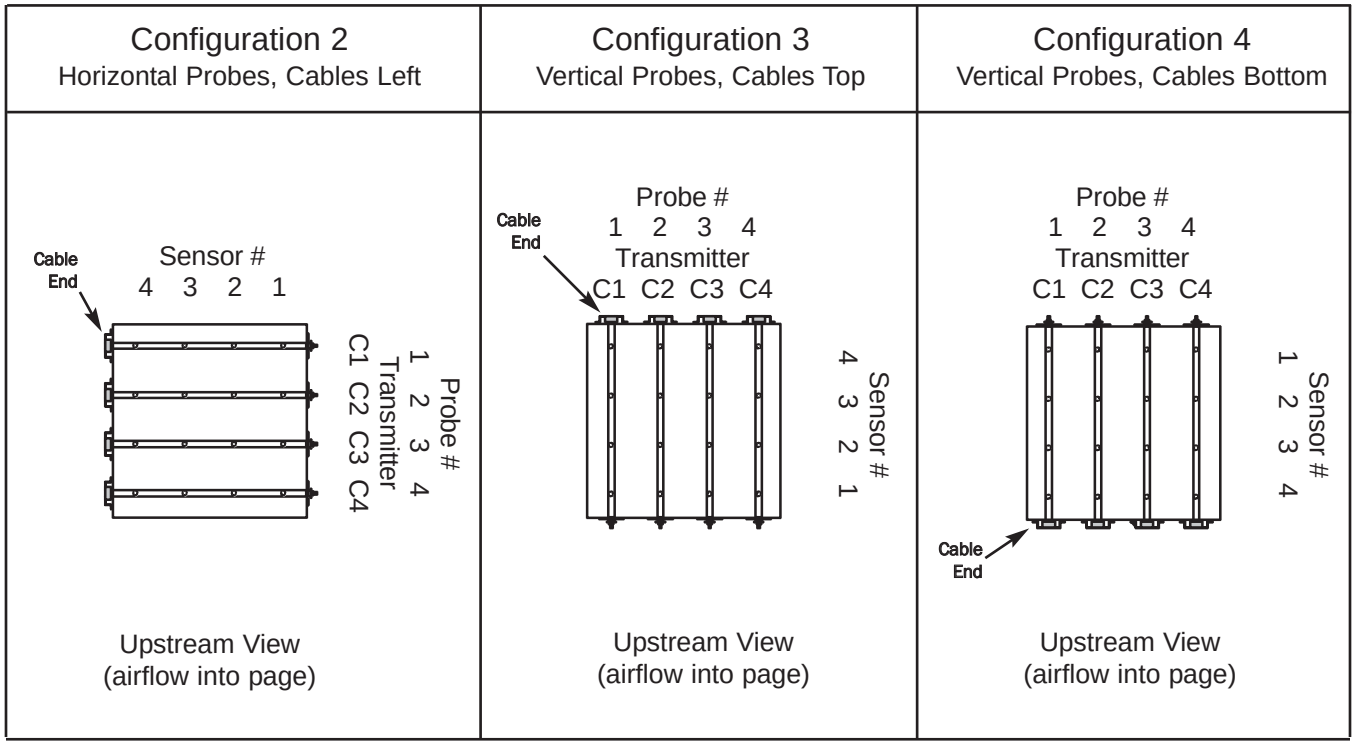


Figure 19. Recommended Probe Mounting and Connector Locations for Proper Decoding of Traverse and *EB-Link* Data

The probe that is connected to the left-most **used** receptacle (labeled **C1-C4**) on the transmitter is addressed as **probe 1**. The individual **sensors** within each probe are addressed with the lowest number at the probe end that is **opposite its connecting cable**. Up to 16 sensors can be individually viewed. Although any probe mounting style can be used, side mounted insertion is the easiest to verify the position of in the field. To standardize and simplify decoding of the data, ***EBTRON*** recommends the following mounting conventions (as shown in Figure 19):

Horizontal Mounting of Probes: place the lowest numbered probe at the top of the duct and connect to receptacle C1 (left most) on the transmitter.
Vertical Mounting of Probes: place the lowest numbered probe on the left side of duct when viewed from the upstream side of the mounting location and connect to receptacle C1 (left most) on the transmitter.

Note: if only average data is desired, the mounting position of the probes is not critical.

EB-Link WIRELESS INFRARED COMMUNICATIONS OPTION

The ***EB-Link*** wireless infrared communications option is ideal for air balance contractors, engineers, building owners and/or contractors who desire fast and accurate measurement without additional interfacing. Individual and average sensor airflow(s) and temperature(s) from GTx116 transmitters equipped with the ***EB-Link*** option can be instantly transferred to either a Palm® or Microsoft® Windows Mobile® operating system PDA, reducing the acquisition time and sampling error inherent with hand held measurements. The data can then be transferred to your PC for review, update or analysis.

In addition, a Setup-Upload feature permits rapid transfer of the desired transmitter setup configuration to an ***EB-Link*** equipped GTx116 transmitter. This is especially useful when multiple transmitters are to be set up or modified.

CAUTION: Observe all ElectroStatic Discharge (ESD) handling precautions. Do not touch internal components. Failure to observe ESD precautions can cause damage to components.

CAUTION: Turn the transmitter "POWER" switch to the "OFF" position before installing the *EB-Link* card. Failure to do so can cause damage to the *EB-Link* card and/or the transmitter.

Real-time duct traverses can be accomplished quickly and easily using the GTx116 transmitter equipped with the ***EB-Link*** option. Individual airflow and temperature data can be returned directly to your PDA (Palm® or Microsoft® Windows Mobile® operating system). This data can also be returned over BACnet® or Modbus when probes are connected to a type GTN116, RS-485 transmitter.

This invaluable feature is ideal for balancers and commissioning agents that desire "on-the-fly" airflow and temperature traverses. The advantages of using permanently installed GP1 probes include nearly instantaneous traverse data (no sampling error over time), accurate and repeatable measurement and ease of report creation using the Microsoft® Excel® spreadsheet provided by ***EBTRON***. In addition, traverses do not require additional holes in the duct. Permanently mounted devices also eliminate cumbersome equipment and ladders that must normally be carried around the job site.

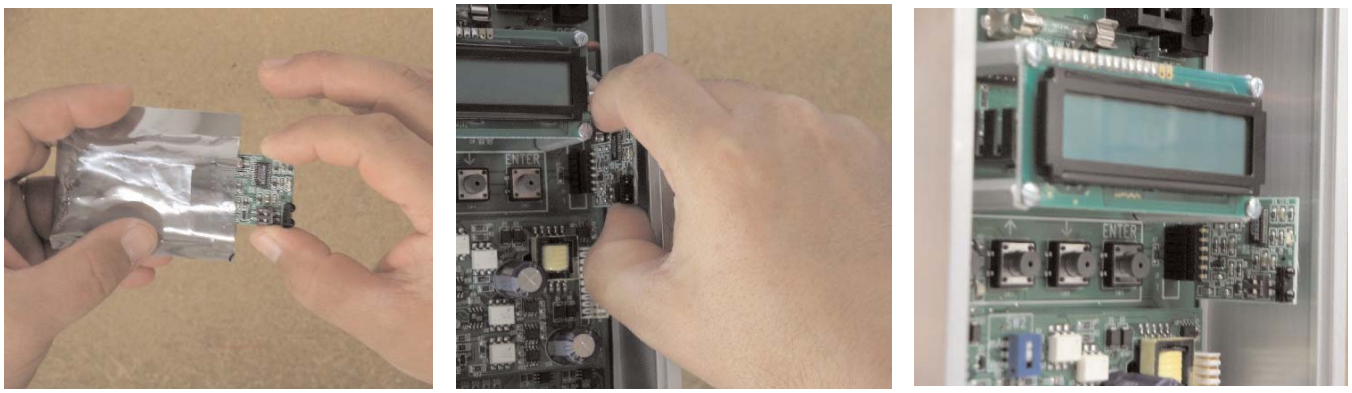


Figure 20. *EB-Link* Installation Detail

EB-Link Card Installation

The ***EB-Link*** card must be installed on the GTx116 main board in order to access sensor data with your PDA. If the ***EB-Link*** card is ordered separately from the transmitter, it should be installed after the transmitter is mounted.

To install the ***EB-Link*** option card, slide the cover up and off of the transmitter enclosure. Turn the power switch, SW1, to the "OFF" position on the transmitter main circuit board. Observe ESD precautions when handling and installing the ***EB-Link*** card. Touch a grounded object, such as a metal duct, before removing the ***EB-Link*** card from the anti-static package. Remove the ***EB-Link*** card from the anti-static package, being careful not to touch exposed components or circuit board traces (hold the card by the edges as indicated on left frame of Figure 20). With the components facing in towards the center of the main circuit board, carefully plug the ***EB-Link*** card into the header connector labeled J5 on the right hand side of the transmitter just below the LCD display (center frame, Figure 20). Do not press on any components. The card should stand on its own when properly installed (right frame of Figure 20).

Figure 21. *EB-Link* Communication Detail

Obtaining and Installing *EB-Link* Software

The ***EB-Link*** software can be downloaded as a compressed zip file free of charge at www.ebtron.com/eblink. Versions are available for both the Palm® and Microsoft® Windows Mobile® operating systems.

The download includes all of the files necessary for your PDA as well as a Microsoft® Excel® spreadsheet for converting the PDA files to a Test and Balance report. The Microsoft® Excel® spreadsheet also allows for the pre-configuration, review or modification of GTx116 transmitter setup parameters.

The latest version of the software, as well as installation, operation and descriptions of all *EB-Link* functions are contained in the readme.txt file that is provided with the download.

Real-time duct traverses can be accomplished quickly and easily using the GTx116 transmitter equipped with the ***EB-Link*** option. Individual airflow and temperature data can be returned directly to your PDA (Palm® or Microsoft® Windows Mobile® operating system). Data can also be returned over BACnet® or Modbus when probes are connected to a GTN116, RS-485 transmitter.

Figure 22. Typical PDA Display of *EB-Link* Initial Data Acquisition Screen

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NOTE

If traverse data is desired, ensure that probes are installed using the mounting convention specified in Figure 19. Proper installation simplifies sensor location decoding during data analysis.

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Real Time Duct Traverses Using your PDA

Simply slide the GTx116 cover up and off of the GTx116 transmitter enclosure and point your PDA to the ***EB-Link*** sensor located on the lower right side of the LCD display as shown in Figure 21 (note: the ***EB-Link*** card option must be installed). The acquisition of data takes less than 10 seconds to complete. After acquiring data (Figure 22), you can display individual or average airflow and/or temperature data on your PDA. Saved data (stored as a comma separated value CSV file) can also be downloaded to your PC for creation of individual test and balance reports using the software of your choice, or with the Microsoft® Excel® spreadsheet that ***EBTRON*** has included with the PDA software.

Note: On rectangular ducts, the ***EBTRON*** Excel® balance report will always show the traverse data starting at the top left position of the duct when viewing from upstream of the flow station, regardless of the orientation of the probes, when the probes are installed as indicated in the configuration diagrams of Figure 19. On round/oval ducts, the balance report will always show traverse data in columns, starting with probe number one.

FIELD ADJUSTMENT OF FACTORY CALIBRATION

The factory calibration should not require adjustment if the sensor probes are installed in accordance with published installation guidelines. However, some installations may not meet placement guidelines or commissioning requirements may dictate field adjustment. Field adjustment may improve the "installed accuracy" of GTx116-F systems when determining volumetric flow rates. Only the Output 1 signal, airflow rate, can be adjusted. Make sure that the reference device and technique used to determine the airflow rate in the field are suitable for such measurement. Select a location that is acceptable for the device being used as the reference, recognizing that this may not be the location where the ***EBTRON*** airflow station is installed. The inherent accuracy of field measurement will not be better than ±5% of reading and can often exceed ±10%. Do not adjust the output of the GTx116 if the difference between the transmitter and the field measurement is less than 10%. The GTx116 firmware can be adjusted for Output 1 signal "gain" and "offset". To adjust the output signal "gain", the "Off-Gain" override must be set to "*OFF-GAIN1=ON" from the Setup Menu. The adjustments affect both the LCD display and output signal. When "*OFF-GAIN1=OFF" is set, adjusting the output signal "offset" and/or "gain" will not affect the output of the transmitter.

Procedure for 1 Point Field Adjustment

Select an airflow rate that represents a valid operating condition for the system. Set fan speed, dampers and VAV boxes to a fixed speed or position when measurements are taken. Complete the following worksheet to determine the gain setting to be set on the transmitter.

Direct Entry of Gain factor Method(most accurate):

1. Enter the setup menu and set "*OFF-GAIN1=OFF". This is the factory default setting and disables any adjustments, returning the unit to its original factory calibration.
2. _____ Record the transmitter output by taking the visual reading from the transmitter LCD. Readings can be taken by the host controls if the output signal conversion has been confirmed. Time averaging the data will improve field recalibration.
3. _____ Record the reference reading. Make sure that the unit of measure (FPM, CFM, MPS or LPS) is identical for both the transmitter and the reference. If the unit of measure is velocity (FPM or MPS), make sure that the reference airflow measurement was corrected for the area where the measurement was taken.
4. _____ Calculate the gain factor (m): **m=line 3/line 2.**
5. Enter the setup menu and set "*OFF-GAIN1=ON".
6. Set "*OG1MODE=1" to enable direct entry of gain and offset values.
7. Set "*GAIN1={value calculated in line 4}".
8. Confirm that "*OFFSET1=0.00".
9. Press the "ESC" button until you return to the normal operating mode. Field adjustment is complete.

Visual Entry of Gain factor Method:

1. Enter the setup menu and set "*OFF-GAIN1=ON".
2. Set "*OG1MODE=2" to enable "live" entry of gain and offset values.
3. Make sure that the unit of measure (FPM, CFM, MPS or LPS) is identical for both the transmitter and the reference. If the unit of measure is velocity (FPM or MPS), make sure that the reference airflow measurement was corrected for the area where the measurement was taken. Use the "UP" and "DOWN" arrows until the LCD display matches the reference reading. Press "ENTER" to save the new gain value.
4. Press the "ESC" button until you return to the normal operating mode. Field adjustment is complete.

Procedure for 2 Point Field Adjustment

Select the minimum and maximum airflow rate that the airflow station will encounter as a valid operating condition for the system. Set fan speed, dampers and VAV boxes to a fixed speed or position when measurements are taken. Complete the following worksheet to determine the gain and offset settings to be set on the transmitter.

1. Enter the setup menu and set "*OFF-GAIN1=OFF". This is the factory default setting and disables any adjustments, returning the unit to its original factory calibration. MEASUREMENTS MUST BE RECORDED IN FPM (MPS for S.I. units).
2. Set the minimum airflow rate.

3. _____ Record the transmitter airflow rate by taking the visual reading from the transmitter LCD. Readings can be taken by the host controls if the output signal conversion has been confirmed. Time averaging the data will improve field recalibration.
4. _____ Record the reference airflow rate. Make sure that the unit of measure has been converted to FPM (MPS for S.I. units). Make sure that the reference airflow measurement was corrected for the area where the measurement was taken.
5. Set the maximum airflow rate.

6. _____ Record the transmitter airflow rate.

7. _____ Record the reference airflow rate.

8. _____ Calculate the gain factor (m): **m=(line 7 - line 4)/(line 6 - line 3).**

9. _____ Calculate the offset factor (b): **b=(line 4 - (line 8 x line 3).**

If more than 2 points are available, perform a linear regression on the data to determine gain and offset.

10. Enter the setup menu and set "*OFF-GAIN1=ON".
11. Set "*OG1MODE=1" to enable direct entry of gain and offset values.
12. Set "*GAIN1={value calculated in line 8}".
13. Set "*OFFSET1={value calculated in line 9}".
14. Press the "ESC" button until you return to the normal operating mode. Field adjustment is complete.

Adjusting the Low Limit Cutoff

The low limit cutoff forces the output signal for the airflow rate to zero whenever the airflow rate calculated falls below the specified low limit value. This feature is useful on outside air intakes that often indicate false airflow rates, induced by transient wind gusts, when the intake damper is closed and there is no net flow across the damper. Readings of 100 FPM or more are not uncommon on many outside air intake applications when the intake damper is closed and are a result of air movement in the intake plenum (not a malfunction in the airflow measuring device). Setting the low limit to a value significantly below the control setpoint and higher than the threshold flow for false wind readings simplifies control and interpretation of the airflow rate signal on many applications. To set the low limit cutoff, enter the Setup menu and set "*LL1={desired value in FPM (MPS in S.I.)}".

Adjusting the Digital Output Filter

The digital output filter is useful for dampening signal fluctuations resulting from transient wind gusts on outdoor air intakes or excessive turbulence generated from duct disturbances. The digital output filter range can be set between 0 (OFF) and 99%. Increasing the filter percentage limits the allowable change of the output signal. To change the amount of filtering, enter the Setup menu and set "*FILTER1={desired value}".

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Fluctuations in airflow output signal are normal. *EBTRON* does not recommend use of the dampening filter in control devices, since dampening true fluctuations will result in poor control and a larger operating dead-band.

MAINTENANCE

When the transmitter and probes are installed in accordance with ***EBTRON*** guidelines, instrument difficulties are rare. Issues can be easily resolved by viewing Diagnostic data from the Diagnostic Menu (Figure 17) and by proceeding through the following troubleshooting guides (Tables 19 through 23). All devices come with a 3–Year Warranty on Parts and Factory Labor, as well as lifetime, toll-free customer support. Customer support is available Monday through Friday from 8:00 AM to 4:30 PM ET, at 800-2*EBTRON* (232.8766). ***EBTRON*** Diagnostic Customer Service forms are available on-line at www.ebtron.com. These forms are designed to assist us in quickly responding to and accurately diagnosing your specific issue and will greatly expedite its resolution. A sketch of the installation location, along with a control sequence of operations is very useful and is recommended to help us diagnose any issue you may encounter. Fax the completed information to 843.756.1838 before you call, and have it available when speaking with our Customer Service representative. Address all correspondence to the ***EBTRON*** Customer Service Department. Additional information is also available from your local ***EBTRON*** representative.

Table 19. General Troubleshooting (All GTx116 Systems)

Problem	Possible Cause	Remedy
No LCD display indication and the green Transmitter Status LED (D3) on the main circuit board is not illuminated.	Power switch not in the "ON" position.	Move the power switch to the "ON" position.
	Improper supply voltage to the power input terminal block.	Ensure that 24VAC power is connected to L1 and L2 of the POWER terminal block and that the voltage with the power switch in the "ON" position is between 22.8 and 26.4 VAC.
	Blown fuse.	Check power wiring. Ensure that multiple devices wired on a single transformer are wired "in-phase". Replace fuse only with a 1.5 amp, fast-acting fuse after the problem has been identified and corrected.
No LCD display indication and the green Transmitter Status LED (D3) on the main circuit board is flashing.	LCD contrast too low.	Turn “Contrast” potentiometer on the main circuit board "clockwise".
The LCD display is scrambled or there is no LCD display indication after touching the switches, LCD display or circuit board.	Static electricity.	Touch an earth-grounded object, such as a duct, to discharge static electricity then reset the power. Avoid direct contact with the LCD display or circuit board.
The LCD display indicates "No Probes".	The power switch on the transmitter was moved to the "ON" position before the sensor probes were connected.	Reset 24VAC power by moving the power switch from the "ON" to "OFF" position and then back to the "ON" position.
The LCD display indicates "DiffSensor Type".	Sensor probes have been mismatched.	Transmitters must have the same sensor type connected (GP1, GF1 or GB1 sensor probes).
The LCD display indicates "Too Many Sensors".	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The last digit of the flow rate unit is displayed as a lower case letter.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe’s hang tag, please call ***EBTRON***'s customer service department or visit us at www.ebtron.com.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The green Transmitter Status LED (D3) on the main circuit board is "ON" but not flashing.	The microprocessor is not running.	Reset 24VAC power by moving the power switch from the "ON" to "OFF" position and then back to the "ON" position.
The green Transmitter Status LED (D3) on the main circuit board is flashing at 1-second intervals.	No problem, normal operation.	No remedy required.
The green Transmitter Status LED (D3) on the main circuit board is flashing at 2-second intervals.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag, please call ***EBTRON***'s customer service department or visit us at www.ebtron.com.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
The transmitter indicates airflow when the HVAC system is not operating.	Sensors are sensitive and can measure very low air velocities. If a reading is indicated, there is airflow present where the airflow measuring station is located.	Do not attempt to adjust zero ("offset"). Doing so will result in an error in airflow measurement. The Low Limit airflow cutoff value can be set to force the output signal to zero.

Table 20. GTA116 Analog Transmitter Troubleshooting

Problem	Possible Cause	Remedy
No output signal can be measured at the OUTPUT terminal block of the GTA116 transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF", and then press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	Blown output fuse (output 1 and output 2 are fused and protected independently on GTA116 transmitters).	Make sure that power has not been connected to the output terminal block. Correct the problem and replace with 0.125 amp, fast acting fuse only.
		Make sure that the host control system is not configured for a 2-wire device (no excitation voltage should be present on the signals from the host controls). Correct the problem and replace with 0.125 amp, fast acting fuse only.
	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The output signal on the GTA116 transmitter fluctuates while the flow and/or temperature readings on the LCD are steady.	Electrical interference from other devices is creating noise in the signal wires to the host control system.	The output signal wiring must be shielded. Individually ground one or more of the following points: the signal wire shield at host controls; signal wire shield at the transmitter, or L2 of the power terminal block of the GTA116.
The LCD display does not match the readings indicated by the host control system.	The scaling in the host control system is incorrect.	Compare the current configuration of the transmitter with that of the host control system. Compare the minimum and full scale settings for each output by navigating through the Setup menu.

Table 21. GTN116 RS-485 Transmitter Troubleshooting

Problem	Possible Cause	Remedy
The host control system is unable to communicate with the GTN116 transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF" and press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	Network signal wiring is not properly connected to the GTN116 transmitter or the host controls.	Verify that the network signal wires from the host controls are connected to the proper terminals of the OUTPUT block. On the GTN116 transmitter OUTPUT terminal block, NET+ is for A, NET- is for B and COM for common.
	Network protocol is not properly set on the GTN116.	Set network protocol based on the network requirements and reset transmitter power. Refer to Figure 9 of this technical manual for PROTOCOL DIP switch settings.
	Network address is not properly set on the GTN116.	Set address based on network requirements and reset the transmitter power. Refer to Figure 9 of this technical manual for ADDRESS DIP switch settings. Note that each address must be unique for the network.
	Network termination is not properly set on the GTN116.	Set transmitter termination based on network requirements and reset the transmitter power. Refer to Figure 9 of this technical manual for TERMINATION DIP switch settings.
The LCD display does not match the readings indicated by the host control system.	The Area or K factor of the GTN116 transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the GTN116 transmitter with that of the host control system and make adjustments to ensure a match.
The returned value for airflow is zero when airflow is indicated on the LCD display of GTN116 transmitter.	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The status point from the GTN116 transmitter has a Trouble value.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag, please call ***EBTRON***'s customer service department or visit us at www.ebtron.com.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
There is no value for the differential pressure point.	Differential pressure is only available from transmitters that have ***EBTRON***'s Bi-directional Bleed Airflow Sensors connected.	If a differential pressure measurement is required, contact your local ***EBTRON*** Representative about ***EBTRON***'s Bi-directional Bleed Airflow Sensor.

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Table 22. GTE116 Ethernet Transmitter Troubleshooting

Problem	Possible Cause	Remedy
The host control system or web browser is unable to communicate with the GTE116 transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF" and press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	There is no link to the network indicated by the LINK LED on the output card.	The LINK LED indicates a valid connection to the network when it is illuminated. If the LED is not on, verify network cabling and connections between the GTE116 and the network switch or hub.
	The network protocol has not been properly set on the GTE116.	Set network protocol based on your network requirements and reset transmitter power. Refer to Figure 10 of this technical manual for Protocol/Address DIP switch settings.
	The transmitter address has not been properly set on the GTE116.	Set the address based on your network requirements. Refer to Figure 10 of this technical manual for setting Protocol/Address DIP switch and entering.GTE116 transmitter address. Note that each address must be unique for the network.
The LCD display does not match the readings indicated by the host control system.	The area factor in the GTE116 transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the GTE116 transmitter with that of the host control system and make adjustments to ensure a match.
The returned value for airflow is zero when there is airflow indicated on the LCD display of the GTN116 transmitter.	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The status register from the GTE116 transmitter has a Trouble value.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag, please call ***EBTRON***'s customer service department or visit us at www.ebtron.com.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.
There is no value for the differential pressure point.	Differential pressure is only available from transmitters that have ***EBTRON***'s Bi-directional Bleed Airflow Sensors connected.	If a differential pressure measurement is required, contact your local ***EBTRON*** Representative about ***EBTRON***'s Bi-directional Bleed Airflow Sensor.

Table 23. GTL116 LonWorks Transmitter Troubleshooting

Problem	Possible Cause	Remedy
The host control system is unable to communicate with the GTL116 transmitter.	Output card is not securely mounted on main circuit board.	Turn the transmitter power "OFF" and press the output card firmly onto main circuit board. Turn the transmitter power back "ON".
	The network signal wiring is not properly connected to the GTL116 transmitter or the host controls.	Verify that network cabling from the host controls is connected to the proper terminals of the OUTPUT terminal block on the GTL116 transmitter. Wires should only be connected to positions 1 and 2 on the terminal block.
	The LonWorks® network database has not been configured for the GTL116 transmitter.	The LonWorks® network database may be pre-configured using the GTL116.XIF file available for download at www.ebtron.com or configured at installation time by direct LonWorks® parameter upload from the GTL116 transmitter.
The GTL116 transmitter is not providing values for any of the variables.	The required network configuration variables have not been set.	Certain network configuration variables must be set to enable the LonWorks® output card to request data from the GTL116 transmitter. Refer to the GTL116 - LonWorks® INTERFACE section of this technical manual for specific GTL116 variables and settings.
There is no value for the differential pressure variables.	Differential pressure is only available from transmitters that have ***EBTRON***'s Bi-directional Bleed Airflow Sensors connected.	If a differential pressure measurement is required, contact your local ***EBTRON*** Representative about ***EBTRON***'s Bi-directional Bleed Airflow Sensor.
The LCD display does not match the readings indicated by the host control system.	The area factor in the GTL116 transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the GTL116 transmitter with that of the host control system and make adjustments to ensure a match.
The returned value for airflow is zero when there is airflow indicated on the LCD display of the GTN116 transmitter.	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup menu until it is below the actual airflow reading.
The status variable from the GTL116 transmitter has a Trouble value.	The sensor detection system has detected one or more malfunctioning or missing sensors.	Check sensor probe cable connections. If sensor probe connections look OK and match the number of sensor probes indicated on each probe's hang tag, please call ***EBTRON***'s customer service or visit us at www.ebtron.com.
	A probe with 5 or more sensors has been connected to a 'Type B' transmitter with 4 receptacles.	Probes with 5 or more sensors are shipped with and require a 'Type A' transmitter with 2 receptacles.

STANDARD LIMITED PARTS WARRANTY

If any ***EBTRON*** product fails within 36 months from shipment, ***EBTRON*** will repair/replace the device free of charge as described in the company's warranty contained in ***EBTRON***'s *TERMS AND CONDITIONS OF SALE*. Defective equipment shall be shipped back to ***EBTRON***, freight pre-paid, for analysis.

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