Gold Series Thermal Dispersion Airflow Measurement Technology

Advantage II
Gold Series
by Ebtron

GOLD SERIES
TECHNICAL MANUAL

Installation, Operation and Maintenance Technical Manual

GTx116

"Plug & Play" Transmitters

Combination RS-485 and Dual Analog output models: GTC116-P, GTC116-F & GTC116-B
Combination Ethernet and Dual Analog output models: GTM116-P, GTM116-F & GTM116-B
LonWorks® output models: GTL116-P, GTL116-F & GTL116-B

Document Name: TM_GTx116_R7E

TM_GTx116_R7E

c UL us
LISTED
All Models

C E

European Union
Shipments
Models GTC116 and GTE116

BTL®

Models GTC116 and GTM116

Part Number: 930-0000

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Insert latest changed pages (in bold text); remove and dispose of superseded pages.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 **54.**

Page No	Revision *	Description of Change	Date
1, 2	**R7E**	**Updated title and List of Effective Pages revision to R7E**	**08/27/2013**
7	**R7E**	**Corrected dimensions for mounting hole spacing and case height**	**08/27/2013**
5, 6, 14, 15	R7D	Removed JCI-N2bus	05/15/2013
10	R7D	Changed Air Flow to Airflow	05/15/2013
17, 24	R7D	Added new BACnet objects and modified MODBUS Register map	05/15/2013
18	R7D	Changed BACnet Ethernet to BACnet IP	05/15/2013
25	R7D	Added page to accommodate changes	05/15/2013
32	R7D	Added Location Text menu item to Initialization menu	05/15/2013
38	R7D	Changed Setup menu Kp factor from 9.999 to 99.999	05/15/2013
40	R7D	Added unit and circuit board serial number menu items to Diagnostics menu	05/15/2013
40, 44	R7D	Added note stating that traverse sensor data is now averaged for more stable readings	05/15/2013
26-54		Renumbered pages to accommodate added page (25)	05/15/2013
31,32,35-38	R7C	Added clarification text to menus - no structural changes	02/08/2013
23, 24	R7B	Added notes regarding port numbers for BACnet and Modbus operation	06/11/2012
Multiple	R7A	Updated all GTE116 references to GTM116 to reflect new dual analog + ethernet output capabilities; added Altitude Adjustment	05/16/2012
All	R7A	Incorporated all prior changes, renumbered/reissued all pages as R7A	05/16/2012
15	R6A	Added MODBUS Parity submenu and Network Wiring Specification	01/03/2012
17	R6A	Modified MODBUS default communications note	01/03/2012
31, 33	R6A	Modified INT TIM and ALRM DEL max range to 900 seconds	01/03/2012
Multiple	R6A	Removed all GTN related sections and references	01/03/2012
All	R6A	Incorporated all prior changes, renumbered/reissued all pages as R6A	01/03/2012
20	R5D	Added note in Table 6 for MODBUS communications (8/1/None)	09/23/2011
10	R5C	Updated GTC layout drawing to show analog output fuses	07/08/2011
32	R5B	Added note regarding Output Full Scale FS1 value and Setup Menu	06/22/2011
43	R5B	Modified "quantity of samples" text for consistency among products	06/22/2011
3, 4	R5A	Update Table of Contents	02/03/2011
12	R5A	Added Figure 9 and Alarm Types and Examples text	02/03/2011
49	R5A	Added alarm output and notes to GTC116 wiring diagram	02/03/2011
5-11, 13-50	R5A	Updated all affected figure references, re-issued as revision R5A	02/03/2011
10-12, 14-17, 19-22, 27-28, 30, 35-36, 38-40, 42-43, 45-46	R4C	Corrected Figure number references	01/28/2011
5	R4B	Added in resolution for 0-10/0-5VDC analog outputs	12/02/2010
1 through 48	R4A	Removed all GTA116 analog card references. Re-issued as revision R4A	9/28/2010
44, 45	R3C	Added MANUAL ADJUSTMENT OF FACTORY OFFSET/GAIN CALIBRATION	6/07/2010
46-50	R3C	Renumbered pages for additional material	6/07/2010
17	R3B	Corrected COMM Menu entry method	02/26/2010
20	R3B	Added GTC Modbus baud rate notes	02/26/2010
47, 48	R3B	Added wiring diagrams	02/17/2010
1 through 48	R3A	Complete revision - Advantage II features including firmware and GTC116 Combination Analog/RS-485 network option	12/08/2009
16	R2E	Changed HTN104 reference to GTN116 (6 places)	10/15/2009
12	R2D	Correction to Analog Conversion Table for Unidir'l Airflow (LPS)	4/15/2009
30, 32	R2C	Update menu item order for firmware 5.05 revision	3/31/2009
6, 10, 13, 18, 21 7-9, 11, 14-17, 19-20, 22-40,	R2B	Added status LED's and legends	2/18/2009
12	R2B	Added K factor source data in Table 3	2/18/2009
41-43	R2B	Revised troubleshooting tables for status LED nomenclature	2/18/2009
1-44	R2A	Major Revision - Firmware Release	11/18/2008
1-44	R1A	Initial Document Release	10/22/2008

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Thermal Dispersion Airflow Measurement

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.

The GTx116 transmitter (Figure 2) includes a 16 character LCD display for airflow, temperature and system configuration and diagnostics. Field configuration is accomplished through a simple four-button interface on the main circuit board. Individual sensor airflow and temperature measurements can be displayed from the diagnostic mode and are beneficial as an HVAC system diagnostic tool. A programmable alarm feature (models GTC116 and GTM116 only) can be set for low limit or high limit with hysteresis, or can be set as a dead band alarm with upper and lower setpoint alarms as a percentage of flow. The alarm output can be configured as active low (0VDC) or active high (5VDC/10VDC). The alarm feature can also be set to allow internal fault detection circuitry that monitors transmitter and sensor status to provide a trouble alarm output in the event of a fault. The airflow output signal can be filtered, and a process low limit can be set to force the output to zero when airflow falls below a user defined value. These features are important for outside air intake applications typically affected by transient wind gusts at low airflow rates. A Field Calibration Wizard feature (GTC116, GTM116 only) can be engaged for one or two point field calibration in applications where field calibration or adjustment is required. The GTx116 transmitter is available in analog and a full range of network versions.

LISTED
All Models

European Union Shipments
Models GTC116 and GTE116

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Models GTC116 and GTM116

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 and Push-button user interface for simple field configuration and diagnostics.
- Programmable alarm feature for low limit, high limit, and adjustable deadband alarm output (models GTC116 and GTM116 only).
- Independent airflow and temperature output.
- Analog output signals and network protocols interface with all building automation systems.
- Expansion port allows for connection to *EBTRON* accessory devices such as the *EB-Link* Infra-Red adapter for real time duct traverses to your PDA.

Network Connectivity Solutions

BACnet®

LONWORKS®

Modbus

Ethernet

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 channels
- A/D Converter: 12-Bit

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

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

Enclosure
- Aluminum

User Interface
- Pushbutton and LCD display

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

Output to Host Controls
GTC116, GTM116: (Combination Dual Analog Output + Network models):

Analog Output: Isolated dual 0-10VDC / 0-5VDC (resolution 0.010 / 0.020% FS) or 4-20mA **and:**

for **GTC116**: Dual analog plus RS-485 Output at 76.8 kbps max BACnet®, Modbus
or
for **GTM116**: Dual Analog plus 10-BaseT Ethernet, BACnet, Modbus, and TCP/IP

GTL116: LonWorks® Free Topology Transceiver (no analog output)

Airflow Output Adjustments:
- Field Calibration Wizard (GTC116, GTM116)
- Offset/gain
- Airflow Output Signal Filter with adjustable flow buffer and integration buffers 0 (off) to 99%
- Airflow Low Limit Cutoff: Forces output to zero below defined value
- Alarm Output features for low limit, high limit, dead band flow alarms or transmitter/sensor faults

System Diagnostics
- Sensor/transmitter diagnostics mode and alarm output option

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

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GTx116 TRANSMITTER FEATURES

Output signal terminal connection to fused and protected output cards *(Note: not used when optional network cards are installed.)*

LCD contrast

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

High accuracy A/D converter

Gold plated interconnects to optional output cards

Positive locking cable receptacles with gold interconnects

Power switch

Switching power supply conserves energy and reduces heat

Pushbutton interface simplifies field configuration *(Note: devices are plug and play and generally do not require configuration.)*

Expansion port

Multiplexers can independently measure up to 32 sensor voltages (16 sensing points per location)

Gold plated interconnects to sensor input receptacles

Figure 2. GTx116 Transmitter Features

ORDERING GUIDE - 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
C   Combination - Analog (0-5VDC / 0-10VDC or 4-20mA) and RS-485 (BACnet®, Modbus)

M   Combination - Analog (0-5VDC / 0-10VDC or 4-20mA) and 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
Combination Analog / RS-485 Model GT**C**116	Analog: Linear 0-5VDC[1] / 0-10VDC or 4-20mA	Yes	Yes	Yes
	RS-485: BACnet®-MS/TP, Modbus-RTU	Yes	Yes	Yes
Combination Analog / Ethernet Model GT**M**116	Analog: Linear 0-5VDC[1] / 0-10VDC or 4-20mA	Yes	Yes	Yes
	BACnet® Ethernet			
	BACnet®-IP	Yes	Yes	Yes
	Modbus-TCP			
	TCP/IP			
LonWorks® - Model GT**L**116	Free Topology Transceiver	Yes	Yes	Yes

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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.

GTx116 Mechanical Dimensions

NOTES:
1) MEASUREMENTS IN BRACKETS ARE IN MILLIMETERS.
2) IF UNIT HAS 2 PROBE CONNECTIONS THEN IT IS A TYPE "A" UNIT. IF UNIT HAS 4 PROBE CONNECTIONS THEN IT IS A TYPE "B" UNIT.

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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.

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 (unless traverse data is desired - see note below). 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   TYPE B TRANSMITTER

Accepts 1 or 2 probes up to 8 sensors each.   Accepts 1 to 4 probes up to 4 sensors each.

Figure 6. Type A and Type B Transmitter Detail

Align Small Key and Slot

Align Large Key and Slot

Cable End Plug   Transmitter Receptacle   Squeeze and Pull to Remove **DO NOT TWIST!**

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.

GTC116 - COMBINATION ANALOG/RS-485 TRANSMITTER SETUP

The GTC116 Combination card option allows simultaneous analog outputs and RS-485 differential bus/line transceiver outputs designed to integrate with various network protocols. The *EBTRON* Combination card plugs directly onto the main circuit board as shown in Figure 8.

GTC116 - ANALOG OUTPUT OUTPUT WIRING AND SETUP

Analog output connections are made at the top left of the transmitter main circuit board OUTPUT connector as shown in Figure 8. Independent 12-bit (4096 discrete states) linear analog outputs are provided for airflow at OUT1, and for temperature (or alarm) at OUT2, each with over voltage and over current protection. The GTC116 Combination output card plugs directly onto the main circuit board as shown below. Airflow and temperature outputs are field selectable for either 0-5/0-10VDC or 4-20 mA. The temperature output at OUT2 can be set as an active high or active low alarm output. Outputs are galvanically and optically isolated from the main power supply to permit simple integration with virtually all building automation systems.

To wire the analog output signals, 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 (or alarm) 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 (or alarm) output is at terminal 2.

⚠ When configured for a 4-20mA output, the GTC116 is a "4-wire" device. The host controls should not provide any excitation voltage to the output of the GTC116.

ANALOG OUTPUT
1: Airflow
2: Temperature/Alarm
COM - Common
(For RS-485, see separate output below)

Power Switch

LCD Display

SW1
Airflow Output Signal Select
VDC: 0-5/0-10 VDC
mA: 4-20 mA

SW2
Temperature/Alarm Output Signal Select
VDC / mA
4-20 mA or 0-5/0-10 VDC

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

Combination Analog/ RS-485 Output Card P.N. 800-1825

Analog Output Fuses
F1=Airflow
F2=Temperature
UL listed 0.125 Amp
P.N. 800-1105
(10 Pack)

RS-485 OUTPUT COM*
(For Analog Output, see separate output above)
NET –
NET +

TERMINATION DIP Switch

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

Termination DIP Switch Detail Shown in **No Termination** Position

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

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*CAUTION
⚠ The common for the ANALOG and the RS-485 outputs must be at the same potential.
For **ISOLATED** RS-485 output, **COM** connection **MUST BE CONNECTED** to network common.
For **NON-ISOLATED** output, **COM** connection **MUST BE CONNECTED** to the common ground that other network devices are using (typically the ground side of the 24VAC supply - L2 of the POWER terminals). Refer to **RS-485 Network Wiring Connections** paragraph for additional detail.

Figure 8. GTC116 Combination Analog/RS-485 Transmitter Interior Detail

GTC116 - ALARM FEATURES

The analog temperature output (OUT2) of the GTC116 transmitter can be set to operate as a programmable alarm and can be programmed to provide an alarm output for low limit, high limit or deadband out of range flows or pressure values. The alarm output can be programmed as an active high or active low signal at the analog Temperature output (OUT2) at the maximum or minimum range of the analog output scale selected in Setup menus (Figures 18 and 19). The alarm can also be set to monitor transmitter and sensor probe status and provide an alarm in the event of a fault condition. Detailed set up of the Alarm feature is shown in the Setup Menus.

⚠️ 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 19 and 20 for Setup menu selections.

Alarm Indications

Table 3 details the alarm types available from the GTC116, and Figure 9 shows examples of each alarm type. Alarm type is selected within the Setup menu under the "ALR TYP=" entry.

Table 3. GTC116 Alarm Types and Notifications

ALARM TYPE	LOCAL LCD DISPLAY ALARM/NOTIFICATION	ALARM (OUT2) INDICATION
LO LIMIT ALARM **"ALR TYP=LO"**	Display continuously alternates between "LOW ALARM" and the actual reading for 2 seconds each.	Output is active high or active low to maximum or minimum analog value as determined by SETUP Menu selection (Figures 19 and 20).
HI LIMIT ALARM **"ALR TYP=HI"**	Display continuously alternates between "HIGH ALARM" and the actual reading for 2 seconds each.	
DEADBAND ALARM **"ALR TYP=DEADB"**	Display continuously alternates between "LOW ALARM" or "HIGH ALARM" (depending input signal) and the actual reading for 2 seconds each.	
TROUBLE **"ALR TYP=TRBL"**	Display continuously alternates between "TROUBLE" and the actual reading for 2 seconds each.	

Lo Limit Alarm - "ALR TYP = LO"

The lo limit alarm is activated when the monitored value falls below a selected set point. The alarm set point is determined by the "ASP=" value. Once active, the alarm is cleared when the monitored value rises above the ASP by the magnitude established by the "HYS=" value (as a percentage of the ASP set point value).

Figure 9 shows an example of the lo limit alarm with alarm setpoint and alarm hysteresis values. In this example, a full scale range of 10,000 CFM is set ("FS1=10000CFM"), and Lo Limit Alarm is selected ("ALR TYP=LO"). An Alarm Set Point of 5,000CFM is set ("ASP= 5000CFM"), and an Alarm Hysteresis value of 20% is set ("ALRM HYS=20%"). The alarm is active when the monitored value falls below the ASP lo limit of 5,000 CFM, and remains active until the monitored value rises 20% above the ASP set point. Setpoint + hysteresis value = 5,000 + (0.20 x 5,000) = **6,000CFM**.

High Limit Alarm - "ALR TYP = HI"

The high limit alarm is activated when the monitored value rises above a selected set point. The alarm set point is determined by the "ASP=" value. Once active, the alarm is cleared when the monitored value falls below the ASP by the magnitude established by the "HYS=" value (as a percentage of the ASP set point value).

Figure 9 shows an example of the high limit alarm with alarm setpoint and alarm hysteresis values. In this example, a full scale range of 10,000 CFM is set ("FS1=10000CFM"), and High Limit Alarm is selected ("ALR TYP=HI"). An Alarm Set Point of 5,000CFM is set ("ASP= 5000CFM"), and an Alarm Hysteresis value of 20% is set ("ALRM HYS=20%"). The alarm is active when the monitored value rises above the ASP hi limit of 5,000 CFM, and remains active until the monitored value falls 20% below the ASP set point. Set point - hysteresis value = 5,000 - (0.20 x 5,000) = **4,000CFM**.

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Deadband Alarm - "ALR TYP = DEADB"

The deadband alarm is activated when the monitored value is outside of a defined deadband, set as a percentage of the alarm set point. The Alarm Set point is established by the "ASP=" value, and the deadband operating range is expressed as a percentage above or below the set point established by the "HYS=" value.

Figure 9 shows an example of the deadband alarm, with alarm setpoint and alarm hysteresis values. As shown, a full scale range of 10,000 CFM is set ("FS1=10000CFM") and the Deadband Alarm type is selected ("ALR TYP=DEADB"). An Alarm Set Point of 5,000CFM is set ("ASP= 5000CFM") and the Alarm Hysteresis is set to 20% ("ALRM HYS=20%"). The alarm is active when the monitored value is above or below 20% of 5,000CFM.(or a range of 4,000 to 6,000CFM). The alarm remains active until the monitored value returns to a value within the 4000-6000 CFM Deadband range.

Figure 9. GTC116 Alarm Output Types and Examples

GTC116 - ANALOG OUTPUT TYPE SELECTION AND SETUP

The analog output signal type at OUT1 (airflow) and OUT2 (temperature) can be individually set for mA or VDC output via switches SW1/SW2 (Figure 8) **and** by selecting the 4-20mA, 0-5¹VDC or 0-10VDC ranges in Setup menu options ***OUT1=** / ***OUT2=** settings (Figures 19 and 20). 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.

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GTC116 - Converting Analog Output Signal Values to Airflow and Temperature

Since the accuracy of the GTC116 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 4 lists specific conversion factors for analog voltage or current options for each sensor type.

Table 4. GTC116 Converting Analog Output Values to Airflow/Temperature

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

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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):

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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):

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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):

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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.

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GTC116 - 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 GTC116 transmitter to verify proper conversion of the output signals from the GTC116 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.

GTC116 - TRANSMITTER SETUP FOR RS-485 NETWORK OPERATION

For RS-485 operation, network connections are made on the GTC116 Combination board as shown in Figure 8, and set up is as follows. Network protocol, MS/TP address, device instance number and baud rate options are all selected within the GTC116 COMM menu shown in Figure 10. Transmitter termination must be configured via the **TERM** dip switch shown in Figure 8 prior to power up. Therefore, wiring to the RS-485 network will be accomplished following configuration of the Termination DIP switch. The transmitter is shipped from the factory with the default protocol set to BACnet MS/TP (Master), network address 2, (as well as MS/TP Device Instance 2), baud rate of 76,800 (MODBUS protocol 19,200) and No Termination. The following paragraphs detail alarm features, initial transmitter termination setting, wiring and set up for RS-485 operation of the GTC116 transmitter.

GTC116 - RS-485 Network Options and Communications Menu Settings

The GTC116 transmitter must be configured for proper RS-485 network operation and termination prior to power up. The transmitter is shipped from the factory with the protocol set for **BACnet MS/TP Master, address 2, MS/TP Device ID 2, Baud rate of 76,800** and **no termination.** Initial RS-485 communications settings are accomplished within the GTC116 Communications Setup menu shown in Figure 10. Termination is set up by the TERM DIP switch SW3 located on the Combination card shown in Figure 8.

GTC116 - Setting Transmitter Termination for RS-485 Network

The GTC116 is shipped with the Termination switch set for No termination, which is the recommended setting for devices installed on the network bus anywhere EXCEPT at the ends of the bus/segment. *EBTRON* recommends the following termination strategy for devices connected at the ends of the network bus/segment:

The device at one end of the network should be terminated with "End of Line" (or 120 ohm standard) termination, and the device at the other end should be terminated with "Fail Safe Bias" termination. This method will provide proper network termination and will ensure that the bus is in a known state during idle-line conditions (when no devices are driving the bus). *EBTRON* GTC116 transmitters include all three termination options for "No Termination", "End of Line" (standard 120 ohm) or "Fail-safe Bias" (recommended at one end of the bus). Termination is selected by setting the TERMINATION DIP switch SW3" (Figure 8) on the Combination board.

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

GTC116 - Setting RS-485 Network Protocol

Transmitter protocol can be set for MS/TP or MODBUS as shown in the GTC116 COMM setup menu (Figure 10). Tables 5 and 6 list the specific features of each protocol.

GTC116 - Setting Transmitter Address

The GTC116 is factory set to an address of 2. Each transmitter must be assigned a **unique** address between 1 and 255 (127 BACnet) prior to power up by setting the address in the GTC116 COMM setup menu (Figure 10).

GTC116 - Setting Baud Rate

The GTC116 transmitter is set at the factory for an MS/TP baud rate of 76,800 baud and can be changed if necessary using the GTC116 Communications menu (Figure 10). For MODBUS operation, baud rate is factory set at 19,200 but is adjustable as shown in the GTC116 Communications setup menu (Figure 10).

GTC116 - Setting Device Instance Number

The GTC116 is factory set with a Device Instance Number of 2. The Device Instance Number can be set as shown in the GTC116 COMM setup menu (Figure 10). The Device Instance Number can also be changed to any number between 1 and 4,194,302 by writing to the Device Object's Object Identifier Property over the network.

GTC116 - Resetting Communications Options to Factory Default Values

Communications options can be reset to factory default values (asterisk) * values using the GTC116 Comm Default menu option as shown in Figure 10.

Figure 10. GTC116C COMM (Communications) Setup Menu

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GTC116 - RS-485 NETWORK WIRING CONNECTIONS

Refer to the Figure 8, and the following paragraph for network wiring considerations.

RS-485 Network Cable Specifications

The RS-485 network cable shall be shielded twisted pair with a characteristic impedance of 100 to 130 ohms. Distributed capacitance between conductors shall be less then 100 pF per meter. Distributed capacitance between conductors and shield shall be less then 200 pF per meter. The maximum recommended length of a network segment is 1200 meters with AWG 18 cable.

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 GTC116 is not the first or last device, set the on-board termination DIP switches for NO TERMINATION. If the GTC116 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. In addition, when the Analog Output is concurrently used with the RS-485 Output, the Common connection for both Analog and RS-485 Outputs must be at the same potential.

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 GTC116 is not the first or last device, set the on-board termination DIP switches for NO TERMINATION. If the GTC116 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 GTC116 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 GTC116 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 8). In addition, when the Analog Output is concurrently used with the RS-485 Output, the Common connection for both Analog and RS-485 Outputs must be at the same potential.

Tables 5 and 6 list the specific values provided for each communication protocol.

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Table 5. GTC116 RS-485 BACnet Object List

BACnet®
BACnet MS/TP

OBJECTS

Type, ID	Name	Default Units	Notes
Device, 2	GTC116		
Analog Input, 1	Airflow	FPM	FPM
Analog Input, 2	Diff. Pressure	in.w.c.	in.w.c.
Analog Input, 3	Temperature	°F	°F
Analog Value, 1	Area	sq.ft.	sq.ft.
Analog Value, 2	Traverse Status		SEE NOTE
Analog Value, 3	Flow Insert 01	FPM	Only if AV2=1 or 3
↕	↕	↕	↕
Analog Value, 18	Flow Insert 16	FPM	Only if AV2=1 or 3

Type, ID	Name	Default Units	Notes
Analog Value, 19	Temp Insert 01	°F	Only if AV2=2 or 3
↕	↕	↕	↕
Analog Value, 34	Temp Insert 16	°F	Only if AV2=2 or 3

NOTE for Traverse Status - AV2 (Analog Value, 2):
Default value is '0' which disables traverse objects.
'1' = Flow Traverse Objects only enabled.
'2' = Temperature Traverse Objects only enabled.
'3' = Both Flow and Temperature Traverse Objects enabled.

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

---

Table 6. GTC116 RS-485 Modbus Register Map

Modbus
Modbus RTU

Default communincation is 8 Data Bits, 1 Stop Bit, Even Parity and can be changed in the COMM SETUP menu.

Function	Address	Type	Units	Description	Range/Value
02	10001	boolean		Trouble Status	0:OK, 1:Trbl
04	30001-30002	float	FPM	Airflow 1	0 to 15,000
04	30003-30004	float	in.w.c.	Pressure 1	-2.5 to +2.5
04	30005-30006	float	°F	Temperature	1 -20 to +160
04	30007	word		Sensor Type	1 = Probe, 3 = Bleed, 255 = Fan
04	30008	word		Connector C1 Sensors	0 to 8
04	30009	word		Connector C2 Sensors	0 to 8
04	30010	word		Connector C3 Sensors	0 to 8
04	30011	word		Connector C4 Sensors	0 to 8
04	30012-30043	float	FPM	Airflow Traverse	0 to 15,000
04	30012-30013	float	FPM	Insert 1 Flow	0 to 15,000
04	30042-30043	float	FPM	Insert 16 Flow	0 to 15,000
04	30044-30075	float	°F	Temperature Traverse	-20 to +160
04	30044-30045	float	°F	Insert 1 Temp	-20 to +160
04	30074-30075	float	°F	Insert 16 Temp	-20 to +160
04	300202	word		Float word order	0: high word first; 1: low word first

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GTM116 COMBINATION ANALOG/ETHERNET TRANSMITTER SETUP

The GTM116 Combination Analog/Ethernet card option allows simultaneous analog outputs and 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 GTM116 Combination Analog/Ethernet output card plugs directly onto the main circuit board as shown in Figure 11. The transmitter must be configured for proper protocol. The transmitter is factory shipped with the protocol set for BACnet/IP. Protocol selection is accomplished in the COMM setup menu shown in Figure 13.

GTM116 - ANALOG OUTPUT WIRING AND SETUP

Analog output connections are made at the top left of the transmitter main circuit board OUTPUT connector as shown in Figure 11. Independent 12-bit (4096 discrete states) linear analog outputs are provided for airflow at OUT1, and for temperature (or alarm) at OUT2, each with over voltage and over current protection. The GTM116 Combination output card plugs directly onto the main circuit board as shown below. Airflow and temperature outputs can be set independently for either 0-5/0-10VDC or 4-20 mA. The temperature output at OUT2 can also be set as an active high or active low alarm output. Outputs are galvanically and optically isolated from the main power supply to permit simple integration with virtually all building automation systems.

To wire the analog output signals, 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 (or alarm) to the small, three position output terminal labeled "**OUTPUT**" on the upper left hand side of the main circuit board as indicated in Figure 11. Airflow output is at terminal 1, and temperature (or alarm) output is at terminal 2.

⚠ When configured for a 4-20mA output, the GTM116 is a "4-wire" device. The host controls should not provide any excitation voltage to the output of the GTM116.

ANALOG OUTPUT
1: Airflow
2: Temperature/Alarm
COM: Common
(For Ethernet, see separate RJ45 output below)

SW1 - Airflow
SW2-Temperature/Alarm
Analog Output
Signal Type Select
VDC: 0-5/0-10 VDC
mA: 4-20 mA

Analog Output Fuses

F1=Airflow
F2=Temperature/Alarm

UL listed 0.125 Amp
P.N. 800-1105
(10 Pack)

Power Switch

LCD Display

ACTIVITY (green) indicates transmitter health/status
(Green 1 second flash normal; 2 second flash for fault)

TRAFFIC (green) indicates ethernet traffic

LINK (green) indicates ethernet link status

Combination Analog/ Ethernet Output Card
P.N. 800-5026

RJ45 Ethernet Output

Figure 11. GTM116 Combination Analog/Ethernet Transmitter Interior Detail

GTM116 - ALARM FEATURES

The analog temperature output (OUT2) of the GTM116 transmitter can be set to operate as a programmable alarm, to provide an alarm output for low limit, high limit or deadband out of range flows or pressure values. The alarm output can be programmed as an active high or active low signal at the analog Temperature output (OUT2) at the maximum or minimum range of the analog output scale selected in Setup menus (Figures 19 and 20). The alarm can also be set to monitor transmitter and sensor probe status and to provide an alarm in the event of a fault condition. Detailed set up of the Alarm feature is shown in the Setup Menus.

> ⚠ To change the analog output signal type at OUT1 or OUT2, the corresponding switch (SW1/SW2) settings <u>AND</u> the Setup menu *OUT1= / *OUT2= settings must <u>ALL</u> agree. Refer to Figure 11 for SW1/SW2 and Figures 19 and 20 for Setup menu selections.

Alarm Indications

Table 7 details the alarm types available from the GTM116, and Figure 12 shows examples of each alarm type. Alarm type is selected within the Setup menu under the "ALR TYP=" entry.

Table 7. GTM116 Alarm Types and Notifications

ALARM TYPE	LOCAL LCD DISPLAY ALARM/NOTIFICATION	ALARM (OUT2) INDICATION
LO LIMIT ALARM **"ALR TYP=LO"**	Display continuously alternates between "LOW ALARM" and the actual reading for 2 seconds each.	Output is active high or active low to maximum or minimum analog value as determined by SETUP Menu selection (Figures 19 and 20).
HI LIMIT ALARM **"ALR TYP=HI"**	Display continuously alternates between "HIGH ALARM" and the actual reading for 2 seconds each.	
DEADBAND ALARM **"ALR TYP=DEADB"**	Display continuously alternates between "LOW ALARM" or "HIGH ALARM" (depending input signal) and the actual reading for 2 seconds each.	
TROUBLE **"ALR TYP=TRBL"**	Display continuously alternates between "TROUBLE" and the actual reading for 2 seconds each.	

Lo Limit Alarm - "ALR TYP = LO"

The lo limit alarm is activated when the monitored value falls below a selected set point. The alarm set point is determined by the "ASP=" value. Once active, the alarm is cleared when the monitored value rises above the ASP by the magnitude established by the "HYS=" value (as a percentage of the ASP set point value).

Figure 12 shows an example of the lo limit alarm with alarm setpoint and alarm hysteresis values. In this example, a full scale range of 10,000 CFM is set ("FS1=10000CFM"), and Lo Limit Alarm is selected ("ALR TYP=LO"). An Alarm Set Point of 5,000CFM is set ("ASP= 5000CFM"), and an Alarm Hysteresis value of 20% is set ("ALRM HYS=20%"). The alarm is active when the monitored value falls below the ASP lo limit of 5,000 CFM, and remains active until the monitored value rises 20% above the ASP set point. Setpoint + hysteresis value = 5,000 + (0.20 x 5,000) = **6,000CFM**.

High Limit Alarm - "ALR TYP = HI"

The high limit alarm is activated when the monitored value rises above a selected set point. The alarm set point is determined by the "ASP=" value. Once active, the alarm is cleared when the monitored value falls below the ASP by the magnitude established by the "HYS=" value (as a percentage of the ASP set point value).

Figure 12 shows an example of the high limit alarm with alarm setpoint and alarm hysteresis values. In this example, a full scale range of 10,000 CFM is set ("FS1=10000CFM"), and High Limit Alarm is selected ("ALR TYP=HI"). An Alarm Set Point of 5,000CFM is set ("ASP= 5000CFM"), and an Alarm Hysteresis value of 20% is set ("ALRM HYS=20%"). The alarm is active when the monitored value rises above the ASP hi limit of 5,000 CFM, and remains active until the monitored value falls 20% below the ASP set point. Set point - hysteresis value = 5,000 - (0.20 x 5,000) = **4,000CFM**.

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Deadband Alarm - "ALR TYP = DEADB"

The deadband alarm is activated when the monitored value is outside of a defined deadband, set as a percentage of the alarm set point. The Alarm Set point is established by the "ASP=" value, and the deadband operating range is expressed as a percentage above or below the set point established by the "HYS=" value.

Figure 12 shows an example of the deadband alarm, with alarm setpoint and alarm hysteresis values. As shown, a full scale range of 10,000 CFM is set ("FS1=10000CFM") and the Deadband Alarm type is selected ("ALR TYP=DEADB"). An Alarm Set Point of 5,000CFM is set ("ASP= 5000CFM") and the Alarm Hysteresis is set to 20% ("ALRM HYS=20%"). The alarm is active when the monitored value is above or below 20% of 5,000CFM.(or a range of 4,000 to 6,000CFM). The alarm remains active until the monitored value returns to a value within the 4000-6000 CFM Deadband range.

Figure 12. GTM116 Alarm Output Types and Examples

GTM116 - ANALOG OUTPUT TYPE SELECTION AND SETUP

The analog output signal type at OUT1 (airflow) and OUT2 (temperature) can be set independently for mA or VDC output via switches SW1/SW2 (Figure 11) and by selecting the 4-20mA, 0-5VDC or 0-10VDC ranges in Setup menu options *OUT1= / *OUT2= settings (Figures 19 and 20). 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.

GTM116 - Converting Analog Output Signal Values to Airflow and Temperature

Since the accuracy of the GTM116 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 8 lists specific conversion factors for analog voltage or current options for each sensor type.

Table 8. GTM116 Converting Analog Output Values to Airflow/Temperature

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

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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) Bidirectional Airflow (LPS) (-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.*

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

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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):

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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):

TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	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.

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GTM116 - Sending a Test Output 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 GTM116 transmitter to verify proper conversion of the output signals from the GTM116 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 cancel the Test Output and return to normal operating mode.

GTM116 - TRANSMITTER SETUP FOR ETHERNET NETWORK OPERATION

An RJ45 network connector is provided on the GTM116 Ethernet/Analog combination board as shown in Figure 11. The user can manually select network protocol (BACnet/IP or BACnet Ethernet - MODBUS TCP is always enabled), IP address and device instance number, or can set the GTM116 to automatically configure itself when used on a network/segment with a DHCP server. By default, the DHCP setting is OFF (***DHCP=OFF**) for manual device configuration, with BACnet IP protocol (**BAC MODE=IP**), static **IP address** of **10.0.0.100**, subnet **mask** of **255.255.255.0**, and **gateway** set for **10.0.0.010**. These values can be changed within the COMM menu (Figure 13) as described below.

When IP configuration is complete, confirm IP communications locally by "pinging" the assigned GTM116 IP address and observing 5 rapid blinks of the **ACTIVITY** LED (Figure 11). For example, "**ping 10.0.0.100**" for the GTM116 factory default IP address of **10.0.0.100**. and observe 5 blinks of the GTM116 **ACTIVITY** LED for each ping received.

GTM116 - Ethernet Network Options and Communications Menu Settings

To access the GTM116 COMM Setup menu, simultaneously depress and release the UP and DOWN arrow buttons on the GTM116 so that it displays IP/SI UNITS, and then depress the DOWN arrow button to navigate to the ETHERNET SET menu as shown in Figure 13. Depress the ENTER button and navigate (to the right) to the desired menu item using the UP/DOWN arrow keys as shown, and as described below. The ESC button will back out (to the left) of each menu step.

<u>NOTE FOR MANUAL IP SETTINGS (*DHCP=OFF):</u>
In order to change GTM116 IP settings, DHCP must first be disabled. While in the COMM menu, navigate to the DHCP menu item, and ensure that *DHCP= OFF is set.

GTM116 - Selecting Static or Dynamic IP Settings

For automated device configuration on a network/segment with a properly operating DHCP server, set ***DHCP=ON** as shown in Figure 13. Then, set ***BAC MODE=** for BACnet/IP (factory default) or BACnet Ethernet operation, and set ***DI=** device instance number (factory default=2) as described below. No additional device configuration is required.

For manual device configuration of the GTM116, set menu item *DHCP=OFF (factory default) as shown in Figure 13. When manually changing IP settings (*DHCP=OFF), the display will blink the 3-digit address segment that is under change. Change the blinking segment by pressing the UP or DOWN buttons to arrive at the desired segment setting. Depress the ENTER key to set this segment and to move the blinking cursor to the next (right) segment. Set this segment as before, using the UP or DOWN arrow buttons, and then depress ENTER to store and move to the next (right) segment. Repeat this until the last segment has been selected, and then depress ENTER to store the new address setting.

GTM116 - Setting Ethernet Transmitter IP Address

The GTM116 is factory set with an IP address of **10.0.0.100**. Each transmitter must be assigned a unique address on the network/segment it is connected to. To change the IP address, navigate to the ***IP=10.0.0** menu item as shown in Figure 13 and set segments as previously described. (See note above regarding ***DHCP=OFF**).

GTM116 - Setting Subnet Mask

To change this value, navigate to the ***MASK=255.2...** menu item as shown in Figure 13, and set new segment values as previously described. (See note above regarding ***DHCP=OFF**).

GTM116 - Setting Gateway IP

To change this value, navigate to the ***GATE=10.0.0...** menu item as shown in Figure 13, and set new segment values as previously described. (See note above regarding ***DHCP=OFF**).

BACnet Ethernet
BACnet IP
NOTE: For BACnet IP operation, use port 47808.

Table 9. GTM116 BACnet Object List

OBJECTS

Type, ID	Name	Default Units	Notes
Device, 2	GTC116		
Analog Input, 1	Airflow	FPM	FPM
Analog Input, 2	Diff. Pressure	in.w.c.	in.w.c.
Analog Input, 3	Temperature	°F	°F
Analog Value, 1	Area	sq.ft.	sq.ft.
Analog Value, 2	Traverse Status		SEE NOTE
Analog Value, 3	Flow Insert 01	FPM	Only if AV2=1 or 3
↕	↕	↕	↕
Analog Value, 18	Flow Insert 16	FPM	Only if AV2=1 or 3

Type, ID	Name	Default Units	Notes
Analog Value, 19	Temp Insert 01	°F	Only if AV2=2 or 3
↕	↕	↕	↕
Analog Value, 34	Temp Insert 16	°F	Only if AV2=2 or 3

NOTE for Traverse Status - AV2 (Analog Value, 2):
Default value is '0' which disables traverse objects.
'1' = Flow Traverse Objects only enabled.
'2' = Temperature Traverse Objects only enabled.
'3' = Both Flow and Temperature Traverse Objects enabled.

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

Table 10. GTM116 Modbus Register Map

Modbus
Modbus TCP

NOTE: For Modbus operation, use port 502. Modbus IP is always enabled regardless of *BAC MODE setting.

Function	Address	Type	Units	Description	Range/Value
02	10001	boolean		Trouble Status	0:OK, 1:Trbl
04	30001-30002	float	FPM	Airflow 1	0 to 15,000
04	30003-30004	float	in.w.c.	Pressure 1	-2.5 to +2.5
04	30005-30006	float	°F	Temperature	1 -20 to +160
04	30007	word		Sensor Type	1 = Probe, 3 = Bleed, 255 = Fan
04	30008	word		Connector C1 Sensors	0 to 8
04	30009	word		Connector C2 Sensors	0 to 8
04	30010	word		Connector C3 Sensors	0 to 8
04	30011	word		Connector C4 Sensors	0 to 8
04	30012-30043	float	FPM	Airflow Traverse	0 to 15,000
04	30012-30013	float	FPM	Insert 1 Flow	0 to 15,000
04	30042-30043	float	FPM	Insert 16 Flow	0 to 15,000
04	30044-30075	float	°F	Temperature Traverse	-20 to +160
04	30044-30045	float	°F	Insert 1 Temp	-20 to +160
04	30074-30075	float	°F	Insert 16 Temp	-20 to +160
04	300202	word		Float word order	0: high word first; 1: low word first

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TCP/IP

http://10.0.0.100
(or your custom IP address)

Table 11. GTM116 TCP/IP Example

GTE116 Data

Parameter	Value
Flow	**3094**
Pressure	**0**
Temperature	**89**

GTM116 - TRANSMITTER CUSTOM DATA ACQUISITION SOFTWARE APPLICATION

EBTRON offers free software to communicate with GTM116 Ethernet transmitters allowing users to write custom data acquisition software with Microsoft® Excel® using any 10/100 base-T Ethernet connection (RJ45). Software can be downloaded at www.ebtron.com/ethernet. Figure 14 shows a sample screen capture of the data.

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.

Figure 14. GTM116 Custom Data Acquisition Demo Screen

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GTM116 - 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® files 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
```

GTM116 - ETHERNET WIRING CONNECTIONS

Ensure that the transmitter network settings have been properly set up as previously described. Ensure that the power switch is in the "OFF" position. Connect the 10/100 base-T ethernet connection (RJ45) to the female connector on the output card as shown in Figure 11.

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GTL116 - LONWORKS TRANSMITTER SETUP

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 in Figure 15. 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 15. GTL116 LonWorks Transmitter Interior Detail

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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 12 through 18 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.

GTL116 - VELOCITY AND FLOW VARIABLES CONFIGURATION

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

Velocity and Flow Variables

Table 12. 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 13. 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.

GTL116 - PRESSURE VARIABLES AND CONFIGURATION

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

Pressure Variables

Table 14. 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 15. 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 16. 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.

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Temperature Configuration Properties

Table 17. 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.

GTL116 - 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 18 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 18. GTL116 LonWorks Node Temperature Variable

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

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GTx116 TRANSMITTER START-UP, INITIALIZATION AND SETUP MENUS

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 GTC116 and GTM116 default analog output signals are set to 4-20mA.   The output signal can be set to 0-5VDC/0-10VDC in the Setup menu. The GTC116, GTM116 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 16 below.

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

		* Factory Default/Current Setting			
Enter/Esc (move →) within first 10 seconds	Enter (move →) Esc (normal oper.)	Enter (move →) Esc (move ←)	Enter (action, move ←←) Esc (move ←←)		**ACTION**
GTX116 INITIALIZE	RESET ALL ↓	ARE YOU SURE?	YES ↓		Reset transmitter to initial "Factory Default Settings" for selected units of measure (*return to normal operating mode).
			NO ↑		No action.
	RESET SENSORS ↑↓	ARE YOU SURE?	YES ↓		Clears existing sensor data and download data from connected sensor probes (*return to normal operating mode).
			NO ↑		No action.
	*DISPLAY=ON ↑↓	SET DISPLAY?	DISPLAY=ON ↓		Display airflow and temperature.
			DISPLAY=OFF ↑		Display "EBTRON GTX116" at all times in lieu of airflow and temperature.
	*LCD TRB=ON ↑↓	SET LCD TRB?	LCD TRB = ON ↓		LCD indicates lower case for last digit of airflow units when error is detected.
			LCD TRB = OFF ↑		Disable LCD trouble indication. LED trouble indication (flash) remains enabled.
	*TESTOUT=0%↑↓	SET TESTOUT?	TESTOUT=0%↑↓		Sets both output signals between 0 and 100% of span. (GTC116 Transmitters only; Range 0 - 100%)
	*EXCABLE=0FT ↑↓	SET CABLE EXT?	EXCABLE=0FT ↑↓		Enter the exact length of the EXTENSION cable(s) if they have been added. **Important:** An equal length extension cable must be added to each sensor probe for proper operation! (Range 0 - 99 FT)
	*LOC= ↑	SET LOC TEXT?	LOC= ↑		Custom flow station location text: Blinking prompt shows selected character position. Use up and down arrows to select characters, then press **ENTER** to accept current character and move cursor forward (right); **ESC** moves the cursor back (left). You must enter 9 characters; insert space characters for text shorter than 9 characters.

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Figure 16. 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 17 details the System of Units menu. Note that the Setup Menus of Figures 19 and 20 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 19.

Figure 17. System of Units Menu

Table 19. 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_2O (Water column)	Pa	Pascals
F	Fahrenheit	C	Celsius

GTx116 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.

GTx116 LCD DISPLAY NOTIFICATIONS

Following a brief initialization at power up, the LCD display automatically displays airflow and temperature as all upper case (caps) characters. The display provides additional information on system status and alarm conditions as follows:

Last LCD Character Shown in Lower Case (Probe Malfunction)

If the last character of the flow rate units on the LCD display is lower case (for example **FPm** or **CFm**), this indicates that an improper/malfunctioning probe is connected to the transmitter. (Refer to Table 21 for troubleshooting detail).

All LCD Characters Shown in Lower Case (Field Cal Wizard Engaged-GTC116, GTM116)

For GTC116 and GTM116 models, when all characters of the flow rate units are displayed in lower case (for example cfm) the transmitter is operating in the Field Calibration Wizard mode (see FIELD ADJUSTMENTS - Field Calibration Wizard section of this manual). In addition, while in Field Calibration Wizard mode, an upper case last character indicates a probe malfunction. (Refer to Table 24 for additional troubleshooting details.)

LCD Blinks ** LOW ALARM **, ** HIGH ALARM ** or ** TRBL ALARM** (GTC116/GTM116 Only)

The LCD will alternately flash to indicate an active alarm condition for the type of alarm that has been set. The LCD displays airflow/temperature readings between the alarm notifications. Alarm will cease when the alarm is cleared. For additional alarm information, refer to the **GTC116** and **GTM116 Alarm Output Features** section of this document.

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Thermal Dispersion Airflow Measurement

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 20 shows the factory default settings for all compatible sensor probes.

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

Table 20. 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 (required for volumetric measurement)	0.00 sq.ft. (see note)	0.000 sq.meters (see note)
*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	GTC116 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	GTC116 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	GTC116 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	GTC116 output 2 signal (temperature)	4-20mA	4-20mA
*MS2=	ALL	GTC116 output 2 signal minimum scale	-20° F	-30° C
*FS2=	ALL	GTC116 output 2 signal full scale	160° F	70° C
*FLOW BUF=	ALL	Number of flow calculations to be averaged	30	30
*ALT=	ALL	Altitude for flow correction	0 ft	0 m
*OUT2 TYP =	ALL	Output 2 Type: Temperature/Alarm	TEMP	TEMP
*ALRM TYP =	ALL	GTC116 Alarm Type: **OFF**: Alarm feature is disabled. **DEADB**: Deadband Alarm is active outside of the range established by the Alarm set point (*ASP) and (*ALRM HYS) hysteresis settings. **HI**: High limit Alarm is active above the value set by Alarm set point (*ASP). **LO**: Low limit Alarm is active below the value set by Alarm set point (*ASP). **TRBL**: Alarm is active when fault is detected in transmitter or sensor probes.	OFF	OFF
*ASP =	ALL	Alarm Set Point: Flow rate set point to activate Alarm; (see *ALRM HYS for alarm range)	0 FPM	0 MPS
*ALRM HYS =	ALL	Alarm Hysteresis: Range in % of set point value (*ASP) where alarm is triggered.	15%	15%
*ALRM DEL =	ALL	GTC116 Alarm Delay: Time in seconds that the alarm condition must exist before alarm output is activated.	5s	5s
*ALRM OUT =	ALL	Alarm output type: Active MAX or MIN MAX= (5VDC/10VDC or 20mA*) or MIN= (0VDC or 4mA*) *Determined by SW1/SW2 and SETUP Menu settings.	MAX	MAX

Note: For volumetric measurements (CFM/LPS) the **GP1** Free Area **AR1** value is factory preprogrammed in the probe and at initial power-up is automatically read by the transmitter. For volumetric measurements (CFM/LPS) using Fan Inlet **GF1** or Bleed **GB1** sensors, the **AR1 value MUST be manually calculated and entered** in the transmitter .

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GTx116 CHANGING FACTORY DEFAULT SETUP MENU SETTINGS

Setup Menu Options

The GTx116 Transmitter is setup and tested at the factory to be fully operational when sensor probes are connected and power is applied (set the power switch to the "ON" position). The transmitter automatically determines the type of sensors connected and defaults to the factory settings. Factory settings can easily be changed using the *Main Menu* by simultaneously pressing and releasing the "UP" and "DOWN" buttons while the transmitter is in its normal operating mode. (Figures 19 and 20 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 19 and 20 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 GTC116 and GTM116 transmitters can be changed using setup menus of Figures 19 and 20.

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 19 and 20) 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 <u>must</u> 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 19 and 20). 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 Tables 4 and 8 for a complete listing of conversions for each of the analog outputs of the GTx116.

NOTE:

The full scale analog output (OUTPUT1) value is determined by the **FS1** setting within the *SETUP MENU*.

Locking the Configuration Settings

The GTx116 transmitter configuration settings can be locked within the *Lock Menu* by entering a user defined lock code between 1 and 9999. When locked, user settings can be changed only when the lock code is entered in the *Initialization, IP/SI Units* or *Setup Menus*. To access the *Lock Menu*, press "ESCAPE" and "UP" arrow simultaneously. The *Lock Menu* requires a code to be entered, then verified, for the lock to be enabled. Figure 18 (below) details the Lock menu

Press and release Escape/ ↑ during normal operation to select

	* Factory Default/Current Setting			
Esc/↑	Enter (move →)	Enter (move →)	Enter (normal operation)	
during normal operation	Esc (move ←)	Esc (move ←)	Esc (move ←←←)	**ACTION**
*LOCK=OFF	ENABLE LOCK?	ENT CODE= OFF ↑	VER CODE= ↑	Enter a code from 1 to 9999 to lock configuration settings without code entry. WARNING: Configuration cannot be accessed without the code. Record and save in a safe location!

Figure 18. 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*.

TM_GTx116_R7A

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

IP/SI UNITS ↓ — *see system of units menu*

SETUP ↑↓

GTC116 and GTM116 TRANSMITTERS ONLY

*LCD1 U/M=FPM ↓ — SET LCD1 UNITS? — LCD1 U/M=FPM ↓ — Displays airflow in FPM.

LCD1 U/M=CFM ↑ — Displays airflow in CFM (user MUST input *AR1 Area below).

Visible only when LCD U/M=CFM
*AR1=0.000 SQF ↑↓ — SET AREA1? — AR1=0.00 SQF ↑ — Set area between 0.00 and 999.99 sq.ft. Area affects the LCD display reading and output when set for CFM

*OUT1 U/M=FPM ↑↓ — SET OUT1 UNITS ? — OUT1 U/M=FPM ↓ — Outputs airflow in FPM.

OUT1 U/M=CFM ↑ — Outputs airflow in CFM (user MUST input *AR1 Area above).

*OUT1=4-20mA ↑↓ — SET OUT1 ?** — OUT1=0-10V ↓ See ** Note — In addition, 'SW1' must be set to the VDC position to change airflow output to 0-10VDC.

**Note: If a selection is made that requires SW1 to be set, the LCD displays: "SET SW1 ON BOARD" — OUT1=0-5V ↑↓ See ** Note — In addition, 'SW1' must be set to the VDC position to change airflow output to 0-5VDC.

OUT1 = 4-20mA ↑ See ** Note — In addition, 'SW1' must be set to the mA position to change airflow output to 4-20mA.

FS1 units determined by OUT1U/M setting.
*FS1=5000FPM↑↓ *FS1=10000FPM for GF1* or *FS1=5000CFM ↑↓ *FS1=10000CFM for GF1* — SET FS1? — FS1=5000FPM↑↓ *FS1=10000FPM for GF1* or FS1=5000CFM ↑↓ *FS1=10000CFM for GF1* — Full scale analog output value from 100 to 15,000 for FPM (up to 999,999 for CFM) in increments of 1. Value must be ≥ **LL1** + 10, or if **LL1**= 0, value must be ≥ 100.

LL1 units determined by OUT1U/M setting.
*LL1=0FPM↑↓ *or* *LL1=0CFM — SET LL1? — *LL1=0FPM↑↓ *or* *LL1=0CFM — Low limit flow value - values below this result in a zero output. LL1 value must be ≤ **FS1** - 10. (Does not affect calibration.)

*OFF-GAIN1=OFF ↑↓ — SET OFF-GAIN1? — 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-GAIN1=ON
*O-G1MODE=1↑↓ — SET O-G1 MODE? — O-G1MODE=1 ↓ — **O-G1 Mode 1** displays the GAIN/OFFSET value while adjustment to measured flow is made.

Units of measure determined by LCD1 U/M setting. — O-G1MODE=2 ↑ — **O-G1 Mode 2** allows veiwing of GAIN/OFFSET value and measured flow while adjustment to GAIN/OFFSET value is made. While ↑ or ↓ is depressed, the GAIN/OFFSET value is displayed; and when released, measured flow is displayed.

O-G1MODE=3 ↑ — **O-G1 Mode 3** allows veiwing of measured flow value and GAIN/OFFSET value while adjustment to measured flow is made. While ↑ or ↓ is depressed, the measured flow is displayed; and when released, the GAIN/OFFSET value is displayed.

Visible only when OFF-GAIN1=ON
*GAIN1=1.000 ↑↓ — SET GAIN1? — GAIN1=1.000 ↑↓ / *Display alternates in accordance with O-G1 Modes 2 and 3.* — Press ↑ or ↓ to adjust displayed GAIN value between 0.001 and 99.999 in accordance with **OG-1 Mode** setting.

Visible only when OFF-GAIN1=ON
*OFFSET1=0 ↑↓ — SET OFFSET1? — OFFSET1=0 ↑↓ / *Display alternates in accordance with O-G1 Modes 2 and 3.* — Press ↑ or ↓ to adjust displayed OFFSET value between -9999 and 9999 in accordance with **OG-1 Mode** setting.

A — TO PART 2

B

Figure 19. Setup Menu Options: -P and -F Sensor Systems ("IP SYS")

TM_GTx116_R7C

TM_GTx116_R7A

EBTRON
Thermal Dispersion Airflow Measurement

Press and release ↑/↓ during normal operation to select

Figure 19. (sheet 2 of 2) Setup Menu Options: -P and -F Sensor Systems ("IP SYS")

The flowchart shows the following menu options and actions:

- ***FILTER1=0 ↑↓** → ADJUST FILTER1? → FILTER1=0 ↑ : Adjust dampening filter value from 0 (off) to 99%.

- ***FLOW BUF= 30 ↑↓** → SET FLOW BUF ? → BUFF SIZE = 30 ↑↓ : Set the number of flow calculations to be averaged: 1 to 1,000.

- ***ALT=0 ↑↓** → SET ALTITUDE? → *ALT=0FT ↑ : Set the altitude for flow correction from 0 to 18,000 ft.

- ***OUT2 TYP=TEMP↑↓** → SET OUT2 TYPE ? → OUT2 TYPE=TEMP↓ : Sets OUT2 to produce Temperature output. (See Alarm options beginning at "ALR TYP=" below.)
  - OUT2 TYPE=ALRM ↑ : Sets OUT2 to produce Alarm output.

- ***OUT2=4-20mA ↑↓** → SET OUT2 ?** → OUT2=0-10V ↓ See ** Note : In addition, 'SW2' must be set to the VDC position to change output to 0-10VDC.
  - **Note: If a selection is made that requires switch SW2 to be moved, the LCD displays: "SET SW2 ON BOARD"
  - OUT2=0-5V ↑↓ See ** Note : In addition, 'SW2' must be set to the VDC position to change airflow output to 0-5VDC.
  - OUT2 = 4-20mA ↑ See ** Note : In addition, 'SW2' must be set to the mA position to change airflow output to 4-20mA.

- ***TEMPMETH=AVG↑↓** → SET METHOD? → TEMPMETH=WAVG↓ : Uses velocity weighted average for temperature output (most accurate method for temperature control).
  - TEMPMETH=AVG ↑ : Uses standard arithmetic average for temperature output.

- *MS2 visible only when OUT2 TYP=TEMP
- ***MS2=-20 F ↑↓** → SET MS2? → MS2=-20 F ↑↓ : Set minimum scale analog output for temperature between -50º and 150º F in 1º F increments. MS2 ≤ FS2 - 10º F.

- *FS2 visible only when OUT2 TYP=TEMP
- ***FS2=160 F ↑** → SET FS2? → FS2=160 F ↓ : Set full scale analog output for temperature between -40º and 160º F in 1º F increments. FS2 ≥ MS2 + 10º F.

- *ALR TYPE menu visible only when "OUT2 TYPE=ALRM"
- ***ALR TYP=DEADB↑↓** → SET ALARM TYPE? → ALR TYP=DEADB ↓ : Deadband alarm; Alarm is active when airflow is beyond alarm hysteresis limits (*ALRM HYS) of alarm set point (*ASP) value.
  - ALR TYP=HI↓↑ : High limit alarm; Alarm sis active when airflow is greater than alarm set point (*ASP) value.
  - ALR TYP=LO ↓↑ : Low limit alarm; Alarm is active when airflow is less than alarm set point (*ASP) value.
  - ALR TYP=TRBL↓↑ : Trouble Alarm; Alarm is active when fault is detected in transmitter or sensor probes.
  - ALR TYP=OFF ↑ : This selection disables the alarm feature.

- The following sub-menus are NOT visible when "ALARM TYP=TRBL" or "ALARM TYP=OFF"
- ***ASP= 0FPM ↑↓** → SET ALARM SP? → ALRM= 0FPM ↑ : Set alarm set point value (0-999,999). Alarm is active beyond the sum of this limit **and** "ALRM HYS=" value.

- ***ALRM HYS= 15% ↑↓** → SET HYSTERESIS ? → ALRM HYS= 15% ↑↓ : Set Alarm Hysteresis % above and below the "ASP= " value in prior step for alarm to be active.

- ***ALRM DEL= 5s ↑↓** → SET ALARM DELAY ? → ALRM DEL= 5s ↑↓ : Time in seconds that monitored fault condition must exist before the alarm is activated from 1 to 900 seconds.

- ***ALRM OUT=MAX ↑** → SET METHOD? → ALRM OUT=MAX ↓ : Active HIGH alarm; Alarm sets the analog output to the maximum limit as determined by *OUT2= setting.
  - ALRM OUT=MIN ↑ : Active LOW alarm; Alarm sets the analog output to the minimum limit as determined by *OUT2= setting.

- COMM SETUP → SEE COMM SETUP MENU - - - > Applies to GTC116 Transmitters Only.

- ETHERNET SET → SEE ETHERNET SETUP MENU - - - > Applies to GTM116 Transmitters Only.

- DIAGNOSTICS ↑ → SEE DIAGNOSTIC MENU

GTC116 and GTM116 TRANSMITTERS ONLY

GTC116 AND GTM116 TRANSMITTERS

* 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

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TM_GTx116_R7C

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Press and release ↑/↓ during normal operation to select

* Factory Default/Current Setting

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

| IP/SI UNITS ↓ | *see system of units menu* |

SETUP ↑↓

*LCD1 U/M=FPM ↓	SET LCD1 UNITS?	LCD1 U/M=FPM ↓	Displays airflow in FPM.
		LCD1 U/M=CFM ↑↓	Displays airflow in CFM (user MUST input AR1 value as shown below).
		LCD1 U/M=iWC ↑	Displays Differential pressure in inches of water (user may input K_P factor below to correct for kit pressure losses).

Visible only when LCD1 or OUT1 U/M=CFM

*AR1=0.000 SQF ↑↓	SET AREA1?	AR1=0.00 SQF ↑	Set area between 0.00 and 999.99 sq.ft. Area affects the LCD display reading and output when set for CFM.

Visible only when LCD1 or OUT1 U/M=iWC

*K_P=1.000 ↑↓	SET K_P FACTOR ?	K_P=1.000 ↑↓	Set K_P factor between 0.000 and 99.999 for LCD display of corrected differential pressure.

*DIRECTION=BI ↑↓	SET DIRECTION ?	DIRECTION=BI ↓	Output will be bidirectional (+/- full scale selected).
		DIRECTION=UNI ↑	Output will be unidirectional (0 to full scale selected).

*OUT1 U/M=FPM ↑↓	SET OUT1 UNITS ?	OUT1 U/M=FPM ↓	Outputs airflow in FPM.
		OUT1 U/M=CFM ↑↓	Displays airflow in CFM (user MUST input AR1 value as shown above).
		OUT1 U/M=iWC ↑	Outputs Differential pressure in iWC (user may input K_P factor above to correct for kit pressure losses).

*OUT1=4-20mA ↑↓	SET OUT1 ?**	OUT1=0-10V ↓ See ** Note	In addition, 'SW1' must be set to the VDC position to change airflow output to 0-10VDC range.
		OUT1=0-5V ↑↓ See ** Note	In addition, 'SW1' must be set to the VDC position to change airflow output to 0-5VDC range.
		OUT1 = 4-20mA ↑ See ** Note	In addition, 'SW1' must be set to the mA position to change airflow output to 4-20mA range.

**Note: If a selection is made that requires SW1 to be set, the LCD displays: "SET SW1 ON BOARD"

FS1 units determined by OUT1U/M setting

*FS1=3000FPM ↑↓ *FS1=3000CFM ↑↓ *FS1=0.500iWC ↑↓ FS1 units determined by OUT1U/M setting.	SET FS1?	*FS1=3000FPM ↑↓ *FS1=3000CFM ↑↓ *FS1=0.500iWC ↑↓ FS1 units determined by OUT1U/M setting.	Set full scale analog output value between 100 and 15,000 for FPM (up to 999,999 for CFM) in increments of 1, or for pressure between 0.005 and 0.5 iWC at 0.001 iWC increments. Flow value must be ≥ LL1 + 10, or if LL1= 0, value must be ≥ 100. Pressure value must be ≥ LL1 + 0.005; or if 0, value must be ≥ 0.005.

LL1 units determined by OUT1U/M setting.

*LL1=0FPM ↑↓ *LL1=0CFM ↑↓ *LL1=0.000iWC ↑↓ LL1 units determined by OUT1U/M setting.	SET LL1?	*LL1=0FPM ↑ *LL1=0CFM ↑ *LL1=0.000iWC ↑ LL1 units determined by OUT1U/M setting.	For airflow: Set low limit flow value - velocity below this value will result in an output of zero. LL1 value must be ≤ FS1 - 10. For pressure: Set low limit differential pressure value - differential pressure below this value will result in an output of zero. (Does not affect calibration.) LL1 value must be ≤ FS1 - 0.005.

*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-G1 MODE?	O-G1MODE=1 ↓	**O-G1 Mode 1** displays the GAIN/OFFSET value while adjustment to measured value is made.
Units of measure determined by OUT1U/M setting.		O-G1MODE=2 ↑↓	**O-G1 Mode 2** allows veiwing of GAIN/OFFSET value and measured flow/pressure value while adjustment to GAIN/OFFSET value is made. While ↑ or ↓ is depressed, the GAIN/OFFSET value is displayed; and when released, measured flow/pressure value is displayed.
		O-G1MODE=3 ↑	**O-G1 Mode 3** allows veiwing of measured flow/pressure value and GAIN/OFFSET value while adjustment to measured flow/pressure value is made. While ↑ or ↓ is depressed, the measured flow/pressure value is displayed; and when released, the GAIN/OFFSET value is displayed.

GTC116 and GTM116 TRANSMITTERS ONLY

A   B

TO PART 2

Figure 20. Setup Menu Options: -B Sensor Systems ("IP SYS")

TM_GTx116_R7C

TM_GTx116_R7D

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Thermal Dispersion Airflow Measurement

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

Press and release ↑/↓ during normal operation to select

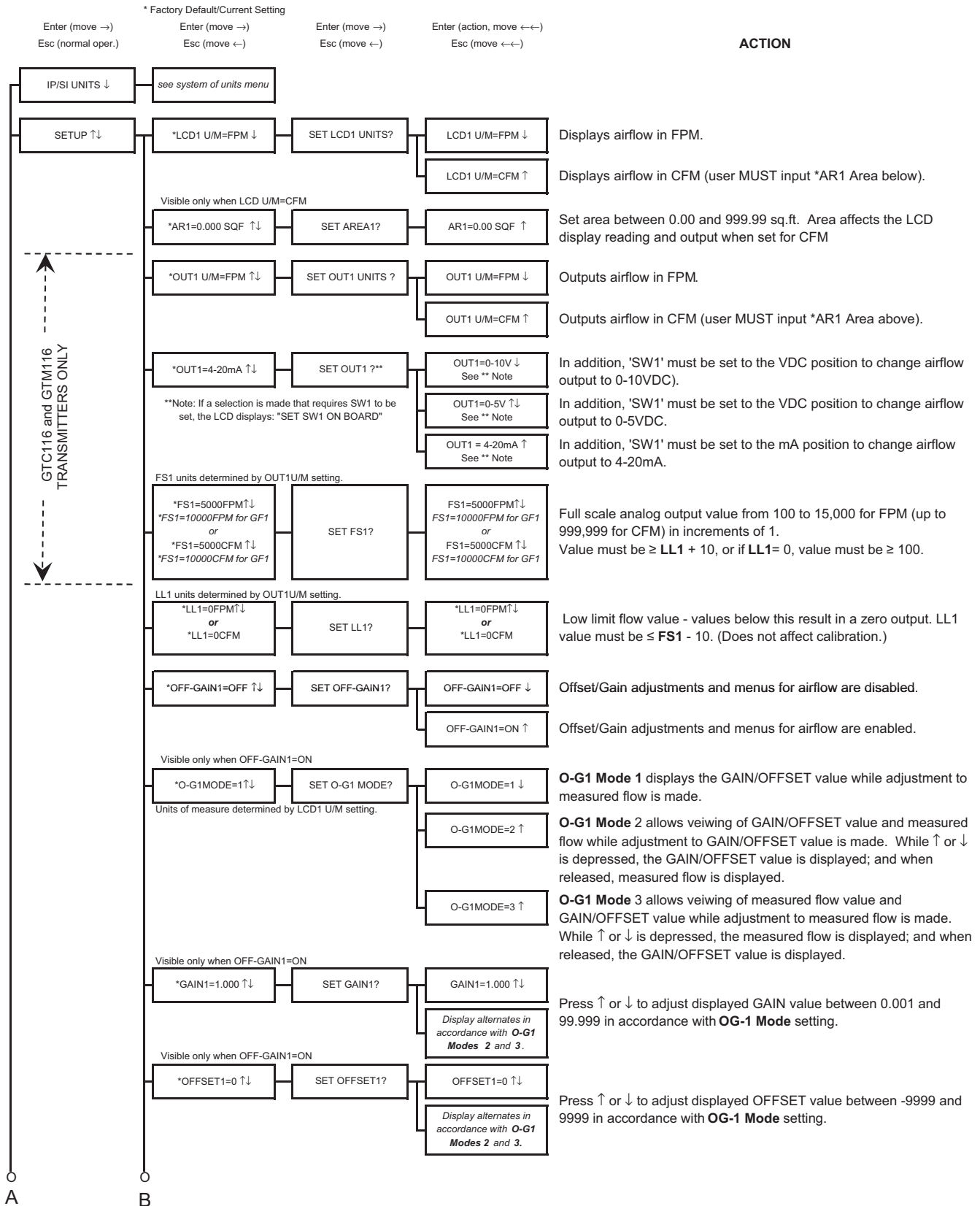* Factory Default/Current Setting

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

FROM PART 1

A ○   B ○

Visible only when OFF-GAIN1=ON

*GAIN1=1.000 ↑↓	SET GAIN1?	GAIN1=1.000 ↑↓

Display alternates in accordance with **O-G1 Modes 2** and **3**.

Press ↑ or ↓ to adjust displayed GAIN value between 0.001 and 99.999 in accordance with **OG-1 Mode** setting.

Visible only when OFF-GAIN1=ON

*OFFSET1=0 ↑↓	SET OFFSET1?	OFFSET1=0 ↑↓

Display alternates in accordance with **O-G1 Mode** setting. **Modes 2** and **3**.

Press ↑ or ↓ to adjust displayed OFFSET value between -9999 and 9999 in accordance with **OG-1 Mode** setting.

*FILTER1=0 ↑↓	ADJUST FILTER1?	FILTER1=0 ↑

Adjust dampening filter value from 0 (off) to 99%.

*FLOW BUF= 30 ↑↓	SET FLOW BUF ?	BUFF SIZE = 30 ↑↓

Set the number of flow calculations to be averaged from 1 to 1000.

*ALT=0 ↑↓	SET ALTITUDE?	*ALT=0FT ↑

Set the altitude for flow correction from 0 to 18,000 ft.

*OUT2 TYP=TEMP↑↓	SET OUT2 TYPE ?	OUT2 TYPE=TEMP↓

Sets OUT2 to produce Temperature output. (See Alarm options beginning at "ALR TYP=" below.)

OUT2 TYPE=ALRM↑

Sets OUT2 to produce Alarm output.

*OUT2=4-20mA ↑↓	SET OUT2 ?**	OUT2=0-10V ↓ See ** Note

In addition, 'SW2' must be set to the VDC position to change output to 0-10VDC.

**Note:
If a selection is made that requires switch SW2 to be moved, the LCD displays: **"SET SW2 ON BOARD"**

OUT2=0-5V ↑↓ See ** Note

In addition, 'SW2' must be set to the VDC position to change airflow output to 0-5VDC.

OUT2 = 4-20mA ↑ See ** Note

In addition, 'SW2' must be set to the mA position to change airflow output to 4-20mA.

*MS2 visible only when OUT2 TYP=TEMP

*MS2=-20 F ↑↓	SET MS2?	MS2=-20 F ↑↓

Set minimum scale analog output for temperature between -50º and 150º F in 1º F increments. MS2≤ FS2 - 10º F.

*FS2 visible only when OUT2 TYP=TEMP

*FS2=160 F ↑	SET FS2?	FS2=160 F ↓

Set full scale analog output for temperature between -40º and 160º F in 1º F increments. FS2 ≥ MS2 + 10º F.

*ALR TYPE menu visible only when "OUT2 TYPE=ALRM"

*ALR TYP=DEADB↑↓	SET ALARM TYPE?	ALR TYP=DEADB ↓

Deadband alarm; Alarm is active when airflow is beyond alarm hysteresis limits (*ALRM HYS) of alarm set point (*ASP) value.

ALR TYP=HI↓↑

High limit alarm; Alarm is active when airflow is greater than alarm set point (*ASP) value.

ALR TYP=LO ↓↑

Low limit alarm; Alarm is active when airflow is less than alarm set point (*ASP) value.

ALR TYP=TRBL↓↑

Trouble Alarm; Alarm is active when fault is detected in transmitter or sensor probes.

ALR TYP=OFF ↑

This selection disables the alarm feature.

The following sub-menus are NOT visible when "ALARM TYP=TRBL" or "ALARM TYP=OFF"

*ASP= 0FPM ↑↓	SET ALARM SP?	ALRM= 0FPM ↑

Alarm set point value (for flow: 0-999,999; for pressure: -9.999 to +9.999 iWC). Alarm is activated when measured value is beyond limits of this setting **and** "ALRM HYS" value.

*ALRM HYS= 15% ↑↓	SET HYSTERESIS ?	ALRM HYS= 15% ↑↓

Set Alarm Hysteresis % above and below the "ASP= " value in prior step for alarm to be active.

*ALRM DEL= 5s ↑↓	SET ALARM DELAY ?	ALRM DEL= 5s ↑↓

Time in seconds that monitored fault condition must exist before the alarm is activated (1-900 seconds).

*ALRM OUT=MAX ↑	SET METHOD?	ALRM OUT=MAX ↓

Active HIGH alarm; Alarm sets the analog output to the maximum limit as determined by *OUT2= setting.

ALRM OUT=MIN ↑

Active LOW alarm; Alarm sets the analog output to the minimum limit as determined by *OUT2= setting.

GTC116 and GTM116 TRANSMITTERS ONLY

COMM SETUP	SEE COMM SETUP MENU

Applies to GTC116 Transmitters Only.

ETHERNET SET	SEE ETHERNET SETUP MENU

Applies to GTM116 Transmitters Only.

DIAGNOSTICS ↑	SEE DIAGNOSTIC MENU

Figure 20 (sheet 2 of 2) Setup Menu Options: -B Sensor Systems ("IP SYS")

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TM_GTx116_R7C

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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. Simultaneously depress the up ↑ and down ↓ arrows to enter the GTx116 Setup Menu, and then navigate to the Diagnostic Menu as shown (Figures 19, 20).

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 21 details the Diagnostic Menu options.

Press and release ↑/↓ during normal operation to select

Enter (move →)	Enter (move →)	Enter (move ←)	
Esc (normal oper.)	Esc (move ←)	Esc (move ←)	COMMENTS

IP/SI UNITS ↓	see system of units menu	
SETUP ↑↓	see setup menus	

| DIAGNOSTICS ↑ | SYSTEM STATUS ↓ | PROBES={NUM} | {NUM} = 1 TO 4: normal
{NUM} = 0: error |
| | PROBE TYPE ↑↓ | 1 ={NAME} | {NAME}= TYPE OF SENSOR
PROBE (-P SENSOR)
FAN (-F SENSOR)
BLEED (-B SENSOR) |
| | | 4 ={NAME} | |
| | PROBE SN ↑↓ | 1 ={NUMBER} {STAT} | {NUMBER} = PROBE SERIAL NUMBER
{STAT} = TRUE (PROBE FOUND)
{STAT} = FALSE (PROBE NOT FOUND) |
| | | 4 ={NUMBER} {STAT} | |
| | SENSOR VOLTS ↑↓ | 1 ={VALUE1} {VALUE2} | {VALUE1} = FLOW SENSOR VOLTS
{VALUE2} = TEMPERATURE SENSOR VOLTS
ADDRESSING:1-4 |
| | | G ={VALUE1} {VALUE2} | |
| | SENSOR VEL ↑↓ | 1 ={VEL} | {VEL} = SENSOR VELOCITY
ADDRESSING:1-9, A-G |
| | | G ={VEL} | |
| | SENSOR TEMP ↑↓ | 1 ={TEMP} | {TEMP} = SENSOR TEMPERATURE
ADDRESSING:1-9, A-G |
| | | G ={TEMP} | |
| | AREA STATUS ↑↓ | AREA MATCH=* | *{TRUE} = WHEN ALL PROGRAMMED SENSOR **AREA VALUES ARE EQUAL**
*{FALSE} = WHEN ALL PROGRAMMED SENSOR **AREA VALUES ARE NOT EQUAL** |
| | UNIT: 123456 ↑↓ | | DISPLAY SERIAL NUMBER OF UNIT. |
| | BRD: 12345678 ↑ | | DISPLAY SERIAL NUMBER OF TRANSMITTER CIRCUIT BOARD. |

NOTE:
THE TRAVERSE SENSOR DATA FOR AIRFLOW AND TEMPERATURE SHOWN IS AVERAGED TO PROVIDE MORE STABLE READINGS.

TM_GTx116_R7D

Figure 21. Navigating through the Diagnostics Menu (all System of Units)

Viewing Sensor Data over BACnet or Modbus Networks

Airflow and temperature of individual sensors can also be read across BACnet or Modbus networks, 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 Maps Tables 6 and 10 located in the GTC116 and GTM116 Transmitter Setup sections 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 <u>used</u> 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 22). 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.

The probe that is connected to the left-most <u>used</u> 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 23):

        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. When a probe is disconnected and then plugged in to a different port, the transmitter will re-discover it within 15 seconds and make any necessary addressing adjustments.

TM_GTx116_R7A

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Connector Diagram
Figure 22. GTx116 Transmitter Connector Diagram

Figure 23. Recommended Probe Mounting and Connector Locations for Proper Decoding of Traverse and *EB-Link* Data

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 the new *EB-Link Reader* model EBR-1000 or to a Palm® or Microsoft® Windows Mobile® operating system PDA. This method reduces the data 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 (available only with the PDA software version) permits rapid transfer of preset transmitter setup configuration to another *EB-Link* equipped GTx116 transmitter. This is especially useful when multiple transmitters are to be set up or modified.

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 *EB-Link Reader* or PDA (using Palm® or Microsoft® Windows Mobile® operating system). The data can also be returned over BACnet or Modbus when probes are connected to a type GTC116 RS-485 networked transmitter.

This innovative 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 simple report generation using the Microsoft® Excel® spreadsheet provided by *EBTRON*. Performing duct traverses with permanently mounted EBTRON airflow probes eliminates the requirement to make additional sampling holes in the duct, and reduces the need to carry around the job site cumbersome equipment and ladders to accomplish them.

EB-Link Card Installation

⚠ 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.

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 24). 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 24). Do not press on any components. The card should stand on its own when properly installed (right frame of Figure 24).

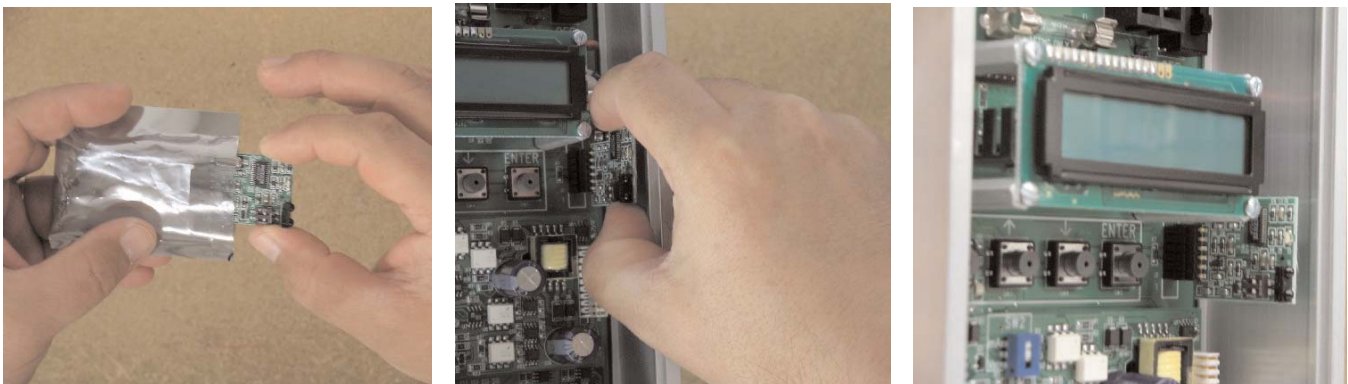**Figure 24.** *EB-Link* Installation Detail

Obtaining and Installing *EB-Link* Software

EB-Link software can be downloaded free of charge at www.ebtron.com/eblink. Versions are available for the *EB-Link Reader*, or for PDAs (for either the Palm® or Microsoft® Windows Mobile® operating systems) as shown in Figure 25. Figure 26 shows the *EB-Link* in use.

The software includes all of the files required for operation of the *EB-Link Reader* or for PDAs as well as a Microsoft® Excel® spreadsheet for converting the PDA files to a Test and Balance report.

EB-Link Reader Software

The *EB-Link Reader* software is designed for operation on Windows XP (or later) operating systems and permits file management and time synchronization for the EB-Link Reader.

The latest version of the *EB-Link Reader* software, as well as installation, operation and descriptions of all *EB-Link Reader* functions are contained in the *EB-Link Reader* Technical Documentation available at www.ebtron.com/eblink.

EB-Link Software for PDA Devices

The *EB-Link Software for PDA Devices* is designed for operation with PDA devices using the Palm® or Microsoft® Windows Mobile® operating systems. The software includes a Microsoft® Excel® spreadsheet that 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 GTC116, RS-485 transmitter.

Real Time Duct Traverses Using *EB-Link*

Simply slide the GTx116 cover up and off of the GTx116 transmitter enclosure and point your *EB-Link Reader* or PDA to the *EB-Link* sensor located just to the right and below the transmitter LCD display as shown in Figure 26 (note: the *EB-Link* card option must be installed). The acquisition of data takes less than 10 seconds to complete. After acquiring data, you can display individual or average airflow and/or temperature data on your *EB-Link Reader* or 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 that the traverse sensor data is averaged to provide more stable readings.

Note also that 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 23. On round/oval ducts, the balance report will always show traverse data in columns, starting with probe number one.

EB-Link Reader

EB-Link and PDA

Figure 25. *EB-Link Reader* and PDA Devices

EB-Link Reader Communication Detail

EB-Link PDA Communication Detail

Figure 26. Typical *EB-Link* Data Acquisition

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NOTE

⚠ **If traverse data is desired, ensure that probes are installed using the mounting convention specified in Figure 23. Proper installation simplifies sensor location decoding during data analysis.**

FIELD ADJUSTMENTS

ALTITUDE CORRECTION ADJUSTMENT

The Altitude Correction Adjustment allows for correction of airflow readings at the installed site altitude and more precise readings regardless on installed altitude. Refer to the SETUP MENUS of Figures 19 and 20 for the *ALT= menu item, and set this vale to the installation altitude.

FACTORY CALIBRATION ADJUSTMENTS

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. Ensure 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 same 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%.

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 or 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 SI units)}" as shown in Figures 19 and 20.

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}" as shown in Figures 19 and 20.

⚠ Fluctuations in the airflow output signal are normal. *EBTRON's* laboratory research indicates that dampening true fluctuations will result in poor control and a larger dead-band of operation. Therefore, the use of the dampening filters in control devices is not recommended.

FIELD CALIBRATION WIZARD (GTC116/GTM116) - AUTOMATED ADJUSTMENT OF FACTORY CALIBRATION

Overview of the Field Calibration Wizard

The simple to use Field Calibration Wizard (available on models GTC116 and GTM116) provides a one or two point automated menu driven field adjustment to factory calibration of the OUTPUT 1 airflow rate signal. (Only OUTPUT 1 can be adjustable in this manner). The Field Calibration Wizard is most useful on larger duct sizes where the sensor density is lower, and the installed accuracy uncertainty is greater. The Field Calibration Wizard allows engineers, contractors and owners to use *EBTRON* stable and linear flow meters at a more affordable cost, when field adjustment is necessary or acceptable. This feature is especially valuable on outside air intake applications and in close-coupled installations where placement and/or sensor density may be inadequate to achieve specified "out of the box" accuracy.

Make sure that the reference measurement device and the technique used to determine the airflow rate in the field are suitable for such measurement. Select a location that is acceptable for the reference measurement device, recognizing that this may not be the location where the EBTRON airflow station is installed. The inherent accuracy of the field reference measurement will not be better than ±5% of reading and can often exceed ±10%. Do not adjust the transmitter output of the if the difference between the transmitter and the field reference measurement is under 10%.

In certain applications, manual adjustment of factory gain and offset calibration values can be performed as outlined in the MANUAL ADJUSTMENT OF FACTORY OFFSET/GAIN CALIBRATION section of this manual

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Engaging and Using the Field Calibration Wizard (GTC116, GTM116)

To engage the Field Calibration Wizard on models GTC116 and GTM116, simultaneously depress the "DOWN" and the "ENTER" buttons at any time during normal operation. Figure 27 provides details of the FIELD CAL WIZARD menu and how to use it in applications for one or two point adjustment of factory calibration. Note that the flow rate units of measure will be displayed in lower case letters on the LCD display, indicating that the transmitter is operating with the Field Calibration Wizard engaged. To disengage the Field Calibration Wizard, simultaneously depress the "DOWN" and the "ENTER" buttons at any time during normal operation and set Field Calibration Wizard OFF as shown in Figure 27.

Navigating through the Field Calibration Wizard Menu (GTC116, GTM116)

Field Cal Wizard

Press "↓" and "ENTER" keys simultaneously and release during normal operation to select Field Cal Wizard

Figure 27. Field Calibration Wizard Menu (GTC116/GTM116 - all System of Units)

MANUAL ADJUSTMENT OF FACTORY OFFSET/GAIN CALIBRATION

When the FIELD CALIBRATION WIZARD (models GTC116/GTM116 only) is not available, or can not achieve the desired results, manual adjustment of the factory calibration at one or two points can be performed. 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" does not affect the transmitter output.

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.

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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.

MAINTENANCE

When transmitter and probes are installed in accordance with *EBTRON* guidelines, instrument difficulties are rare. Issues may easily be resolved by viewing Diagnostic data from the Diagnostic Menu (Figure 21) and by proceeding through the following troubleshooting guides (Tables 21 through 25). Customer support is available Monday - Friday from 8 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 to assist us in accurately diagnosing issues and will greatly expedite their resolution. A sketch of the installation, along with the control sequence of operations is recommended to help us diagnose problems. Fax the information to 843.756.1838 before you call, and have it available when speaking with the Customer Service team. Address all correspondence to the *EBTRON* Customer Service Department. Additional information is also available from your local *EBTRON* representative.

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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Table 21. 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. (Also, on GTC116 and GTM116 when the Field Calibration Wizard is engaged, the last character of the flow rate units is displayed as an upper 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.

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Table 22. GTC116 and GTM116 - Analog Operation Transmitter Troubleshooting

Problem	Possible Cause	Remedy
No output signal can be measured at the OUTPUT terminal block of the GTC116/GTM116 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 GTC116/GTM116 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 GTC116/GTM116 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 GTC116/GTM116.
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 23. GTC116 RS-485 Transmitter Troubleshooting

Problem	Possible Cause	Remedy
The host control system is unable to communicate with the GTC116 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 GTC116 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 GTC116 transmitter OUTPUT terminal block, NET+ is for A, NET- is for B and COM for common.
	Network protocol is not properly set on the GTC116.	Set network protocol based on the network requirements and reset transmitter power. Refer to Figure 8 of this technical manual for PROTOCOL DIP switch settings.
	Network address is not properly set on the GTC116.	Set address based on network requirements and reset transmitter power. Refer to Figure 8 of this technical manual for setting the ADDRESS DIP switch. The address must be unique for the network.
	Network termination is not properly set on the GTC116.	Set transmitter termination based on network requirements and reset the transmitter power. Refer to Figure 8 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 GTC116 transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the 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 the GTC116 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 GTC116 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 24. GTM116 Ethernet Transmitter Troubleshooting

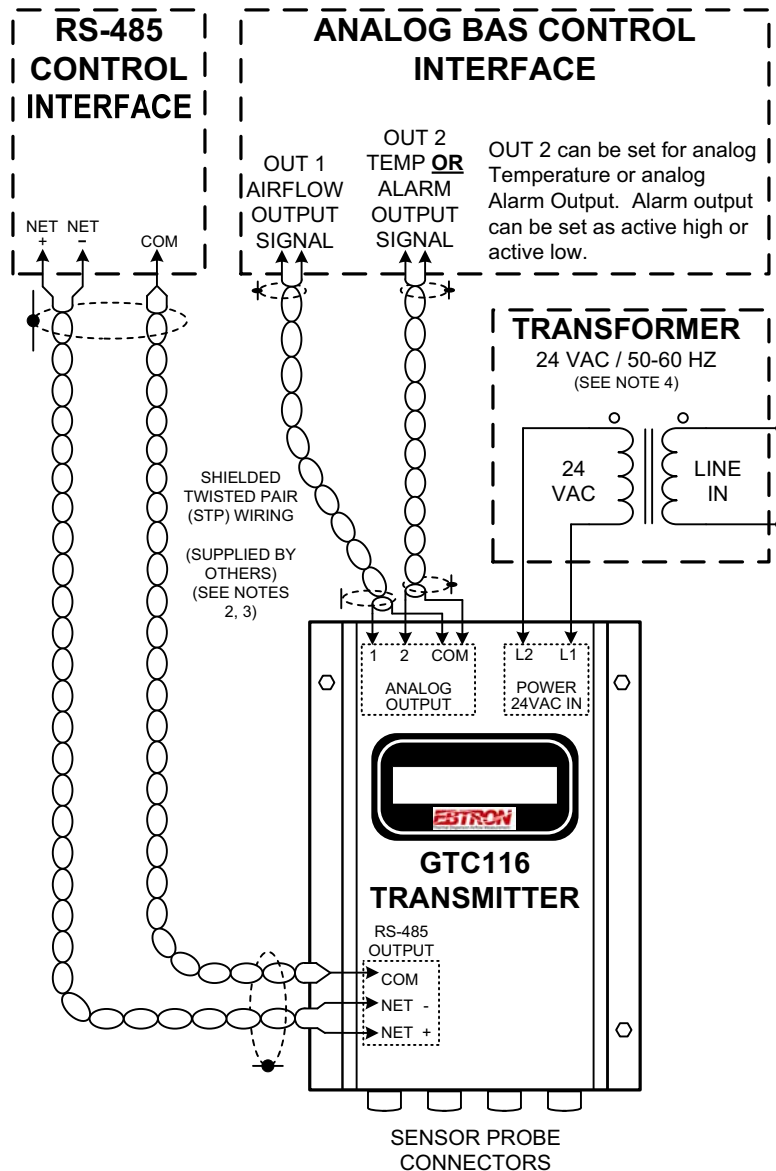| Problem	Possible Cause	Remedy
The host control system or web browser is unable to communicate with the GTM116 transmitter.	Verify that power is available to board (ACTIVITY LED is illuminated). If not verify that Output card is securely mounted on main circuit board.	Set transmitter power to "OFF" 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 LINK LED is not on, verify network cabling and connections between the GTM116 and the network switch or hub. If LINK LED is on, verify that traffic is flowing by observing the TRAFFIC LED. If LINK LED is on, but TRAFFIC LED is not, check for defective network cabling.
	The network protocol has not been properly set on the GTM116.	Set network protocol based on network requirements and reset transmitter power. Refer to Figure 11 of this manual for Protocol/Address DIP switch settings.
	The transmitter address has not been properly set on the GTM116.	Set the address based on your network requirements. Refer to Figure 11 of this technical manual for setting Protocol/Address DIP switch and entering.GTM116 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 GTM116 transmitter does not match that of the host controls.	Compare the value of the Area or K factor of the GTM116 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 GTM116 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 GTM116 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 25. 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 airflow is indicated on the LCD display of the GTL116 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.

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APPENDIX A - WIRING DIAGRAMS

GTC116 Combination Analog/RS-485 Output Transmitter Wiring Diagram

Figure A-1 is a typical wiring diagram for the GTC116 transmitter.

NOTES:
1. OUTPUT 2 CAN BE SET AS TEMPERATURE OR AS AN ALARM. ALARM CAN BE SET AS ACTIVE HIGH OR ACTIVE LOW.
2. CONNECT OUTPUT SIGNAL CABLE DRAINS TO EARTH GROUND AT ONE END OF EACH CABLE ONLY.
3. RS-485 COM CONNECTION MAY USE A SINGLE CONDUCTOR.
4. ON MULTIPLE TRANSMITTER INSTALLATIONS WITH A COMMON 24VAC SOURCE, WIRE 24 VAC POWER IN-PHASE TO THE SAME TERMINALS ON ALL TRANSMITTERS (e.g.: L1 to L1, L2 to L2).
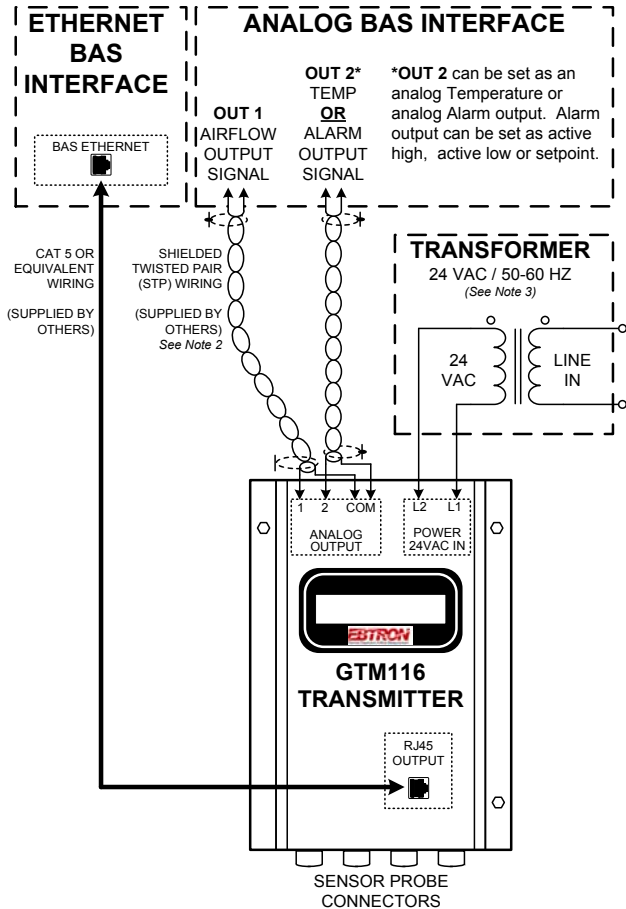
Figure A-1.
Model GTC116 Combination Analog/RS-485 Wiring Diagram

APPENDIX A - WIRING DIAGRAMS (cont'd)

GTM116 Combination Analog/Ethernet Output Transmitter Wiring Diagram

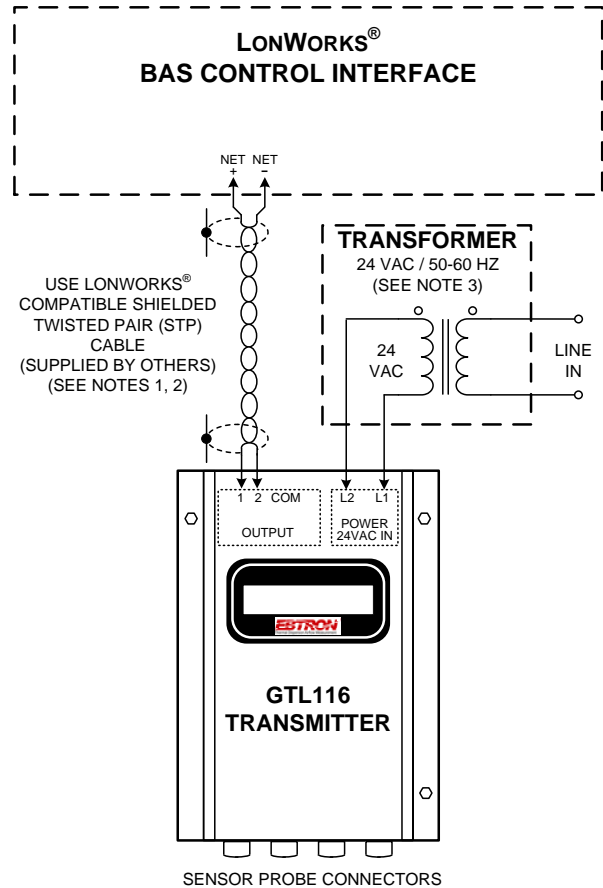Figure A-2 is a typical wiring diagram for the GTM116 transmitter.

NOTES:
1. OUTPUT 2 CAN BE SET AS TEMPERATURE OR AS AN ALARM. ALARM CAN BE SET AS ACTIVE HIGH, ACTIVE LOW OR SETPOINT.

2. CONNECT OUTPUT SIGNAL CABLE DRAINS TO EARTH GROUND AT ONE END OF EACH CABLE ONLY.

3. ON MULTIPLE TRANSMITTER INSTALLATIONS WITH A COMMON 24VAC SOURCE, WIRE 24 VAC POWER IN-PHASE TO THE SAME TERMINALS ON ALL TRANSMITTERS (e.g.: L1 to L1, L2 to L2).

Figure A-2.
Model GTM116
Combination Analog/Ethernet Wiring Diagram

GTL116 LonWorks Output Transmitter Wiring Diagram

Figure A-3 is a typical wiring diagram for the GTL116 transmitter.

NOTES:
1. REFER TO **LONWORKS® FTT-10A Free Topology Transceiver User's Guide** AVAILABLE AT www.echelon.com FOR LONWORKS® NETWORK WIRING SPECIFICATIONS AND TERMINATION REQUIREMENTS.

2. GTL116 CONNECTIONS AT TERMINALS 1 AND 2 (NET + and NET -) ARE NOT POLARITY SENSITIVE, AND THE COM CONNECTION IS NOT USED

3. ON MULTIPLE GTL116 TRANSMITTER INSTALLATIONS WITH A COMMON 24VAC SOURCE, WIRE 24 VAC CONNECTIONS IN-PHASE TO THE SAME TERMINALS ON ALL TRANSMITTERS (e.g.: L1 to L1, L2 to L2)

Figure A-3.
Model GTL116
LonWorks Wiring Diagram

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