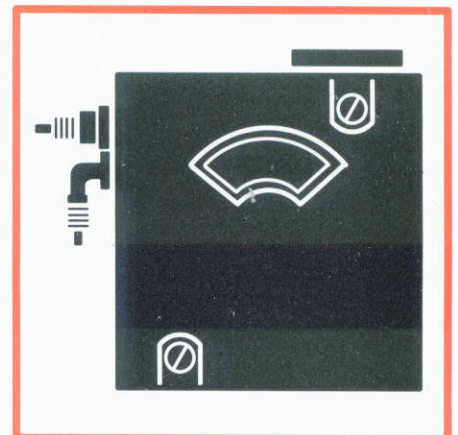
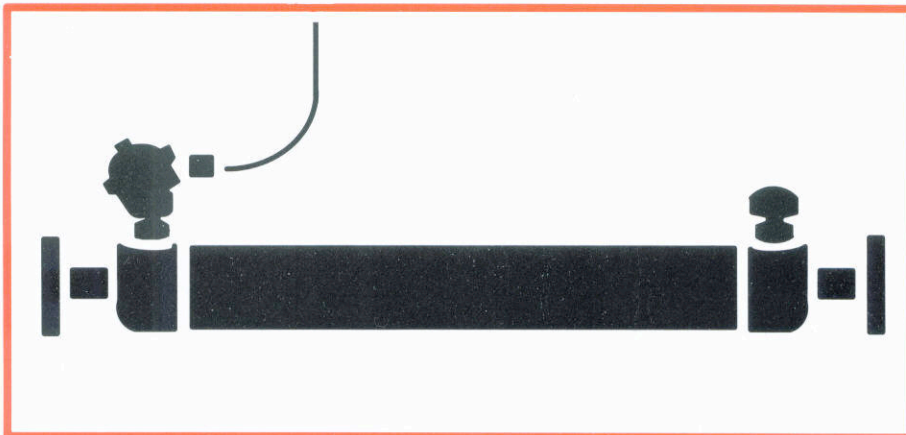
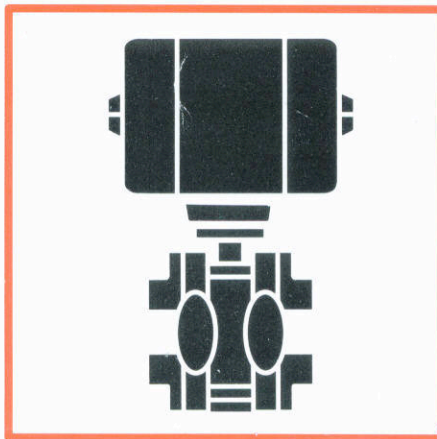
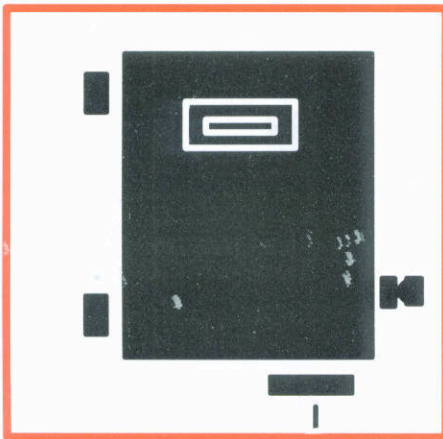
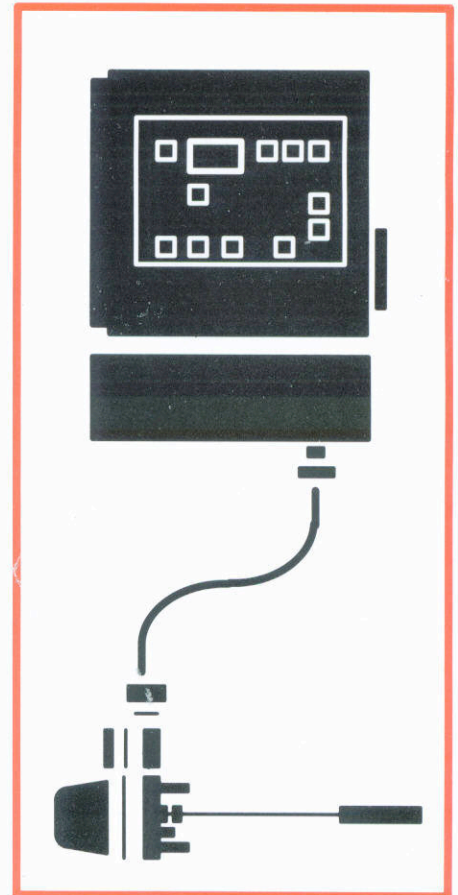
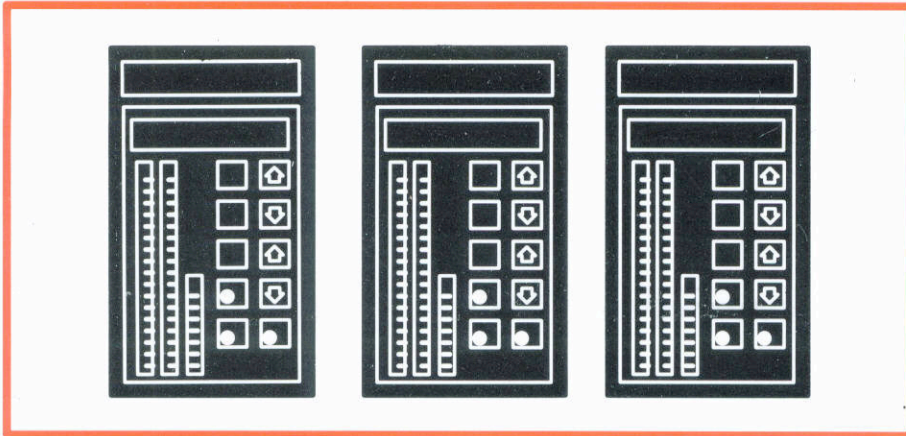


Smart Temperature Transmitter Type EQN



WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices which could result in property damage.

NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL MAINTAIN OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING AND FOLLOWING THE PROPER **Bailey Controls** INSTRUCTIONS AND MANUALS, OTHERWISE INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA AROUND SUCH EQUIPMENT. PRUDENT PRACTICE DICTATES THAT SIGNS SHOULD BE POSTED IN THE VICINITY OF THE EQUIPMENT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT.

POSSIBLE PROCESS UPSETS

MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

AVERTISSEMENT

MANUELS D'OPERATION

NE PAS METTRE EN PLACE REPARER OU FAIRE FONCTIONNER CE MATERIEL SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS REGLEMENTAIRES DE **Bailey Controls** TOUTE NEGLIGENCE A CET EGARD POURRAIT ETRE UNE CAUSE D'ACCIDENT OU DE DEFAILLANCE DU MATERIEL.

PERTURBATIONS DE LA FREQUENCE RADIOPHONIQUE

LA PLUPART DES EQUIPEMENTS ELECTRONIQUES SONT SENSIBLES AUX PERTURBATIONS DE LA FREQUENCE RADIO. DES PRECAUTIONS DEVRONT ETRE PRISES LORS DE L'UTILISATION DE MATERIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRECAUTIONS A PRENDRE DANS CE CAS SOIENT SIGNALEES AUX ENDROITS VOULUS DANS VOTRE USINE.

PERTES ROCEDE RENVERSEMENTS

L'ENTRETIEN DOIT ETRE ASSURE PAR UN PERSONNE QUALIFIE ET EN CONSIDERATION DE L'ASPECT SECURITAIRE DES EQUIPEMENTS CONTROLES PAR CE PRODUIT. L'ADJUSTMENT ET/OU L'EXTRATION DE CE PRODUIT LORSQU'IL EST INSERE A UN SYSTEME ACTIF PEUT OCCASIONNER DES A-COUPS AU PROCEDE CONTROLE. SUR CERTAINS PROCEDES, CES A-COUPS PEUVENT EGALEMENT OCCASIONNER DES DOMMAGES OU BLESSURES.

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Preface

Purpose

This publication is for the use of technical personnel responsible for installation, operation and maintenance of the Bailey Type EQN Smart Temperature Transmitter.

Associated Documents

Smart Temperature Transmitter, Type EQN25/26, Product Specification C-E51-79.

Type STT02 Smart Transmitter Terminal, Product Instruction I-E21-28.

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Page No.			Change No.
iii	through	ix	Original
1	through	38	Original

When an update is received, insert the latest changed pages and dispose of superseded pages.

NOTE: On an update page, the changed text or table is indicated by a vertical bar in the outer margin of the page adjacent to the changed area. A changed figure is indicated by a vertical bar in the outer margin next to the figure caption. The date the update was prepared will appear under the page number.

SAFETY SUMMARY

GENERAL WARNINGS

HAZARDOUS LOCATIONS

The equipment used herein may be used only in those classes of hazardous locations identified on the nameplate. L'équipement décrit par cette notice ne peut être installé que dans les emplacements spécifiés sur la plaque signalétique de l'appareil.

NAMEPLATE RATINGS

Do not at any time exceed the ratings listed on the nameplate. On ne doit en aucune circonstance dépasser les valeurs nominales figurant sur la plaque d'identification.

SPECIFIC WARNINGS

WARNING

The output of this equipment changes to a fixed value during start-up and failure conditions. These values must be selected by the user to insure safe operation. (Page 16)

WARNING

System maintenance must be performed only by qualified personnel and only after securing equipment controlled by the circuit. Altering or removing components from an active circuit may upset the process being controlled. (Page 29)

CAUTION

Do not remove or force amplifier assembly completely out of housing. This will cause damage to the pins and connectors at P₁, P₂ and the sensor lead connector. (Page 29)

WARNING

Substitution of components may impair suitability for use in a hazardous location. (Page 37)

WARNING

Disconnecting or reconnecting wiring or removing or inserting printed circuit boards is not considered normal operation. These operations should only be done if power has been removed from all wiring or if the flammable atmosphere is known not to be present. (Page 33)

WARNING

Intrinsically safe installations in Class II or III locations or explosion proof or dust-ignition proof installation require that the assembly be kept tight while circuits are live unless the location is known to be non-hazardous at the time. (Page 38)

AVERTISSEMENT

La sortie de cet appareil adopte une valeur fixe lors de la mise sous tension et de certaines conditions de pannes. Ces valeurs fixes doivent être sélectionnées par l'utilisateur pour assurer une sécurité d'opération lorsqu'elles surviennent. (Page 16)

AVERTISSEMENT

L'entretien du système doit être effectué par des personnes compétentes et uniquement à partir du moment où les éléments contrôlés par le circuit ont été isolés. Le fait d'enlever ou d'altérer les composants d'un circuit sous tension peut perturber le processus contrôlé. (Page 29)

ATTENTION

Ne pas retirer complètement l'assemblage des composants de l'amplificateur de son boîtier. Ceci endommagerait les broches et les connexions P₁ et P₂ ainsi que le connecteur des fils de la sonde. (Page 29)

AVERTISSEMENT

La substitution de composants peut rendre l'émetteur inadéquat à l'utilisation dans un environnement dangereux. (Page 37)

AVERTISSEMENT

Le débranchement ou le rebranchement des fils et le retrait ou l'insertion des cartes de circuits imprimés n'entrent pas dans les procédures normales. Dans le cas où l'atmosphère est inflammable, on ne doit effectuer les procédures ci-dessus que si l'alimentation a été interrompue. (Page 37)

AVERTISSEMENT

En ce qui concerne l'installation anti-explosion et anti-ignition provoquée par la poussière dans des endroits de Classe II ou III, il est indispensable que l'assemblage soit tenu étanche pendant que les circuits sont électrisés, à moins que cet endroit ne présente aucun danger à ce moment-là. (Page 38)

Introduction

Product Description

The Bailey Type EQN Smart Transmitter is a high performance temperature transmitter which accepts single/dual RTD inputs, thermocouple inputs or millivolt inputs. The transmitter outputs a 4 to 20 milliamp signal. It can be placed in a digital Field Bus Mode for direct communications to the Bailey INFI 90™ Strategic Process Management System or to the NETWORK 90® Distributed Control System. The electronics package uses the latest microcomputer technology, allowing the user to calibrate and troubleshoot the transmitter from either a local or remote location. The transmitter continuously runs through a series of self-diagnostics, monitoring configuration integrity, reference voltages, transmitter temperature and input circuitry. An onboard temperature sensor provides reference junction compensation for thermocouple measurements.

The transmitter can be configured to measure temperature from RTD inputs (two-wire, three-wire or dual two-wire) up to 325 ohms. The input can be calibrated and displayed in degrees Celsius, Fahrenheit, Kelvin or ohms. RTD linearization can be programmed to either the 100 ohm platinum DIN 385 calibration or the SAMA 392 calibration.

The transmitter can also be configured to accept thermocouple inputs (IPTS B,C,E,J,K,N,R,S,T). The output of the transmitter can be selected to be linear with temperature (linearize the thermocouple input) or linear with input (representing the non-linear thermocouple). Millivolt input can also be accepted and the input is displayed in millivolts.

The transmitter will detect any open sensor inputs (thermocouples, mV and RTD's).

Communication with the Type EQN Transmitter can be accomplished with the handheld Smart Transmitter Terminal, STT02. Output monitoring and configuration, reranging, diagnostic checks, and calibration checks can be remotely performed.

An optional Liquid Crystal Display (LCD) is available for local transmitter output indication.

INFI 90 – trademark of the Babcock & Wilcox Company
Network 90 – registered trademark of Babcock & Wilcox Company



A0699

FIGURE 1 – Type EQN Smart Temperature Transmitter and Type STT02 Smart Transmitter Terminal

TABLE 1 – Specifications (Typical)

Inputs	Single/Dual RTD (platinum element ice point resistance): Any value from 0 to +325 ohms. Thermocouple: IPTS 1968 (International Practical Temperature Scale of 1968) Type B,C,E,J,K,N,R,S,T. Millivolt: -20 to +100 mV.
Input Types and Ranges	See Table 2.
Outputs	Point-to-Point Mode: 4 to 20 mA. Field Bus Mode: Poled digital process variable.
Accuracy	See Table 2.
Humidity Limits	0 – 100% continuous when covers are installed properly and conduit is sealed.
Power Supply Effect	± 0.005% of calibrated span per volt (Point-to-Point Mode). 0.00% of calibrated span per volt (Field Bus Mode).
Stability (Reference Conditions)	RTD Mode: ± 0.3°C (± 0.54°F) per 12 months. T/C Mode: ± 2.0°C (± 3.6°F) per 12 months. Millivolt Mode: ± 0.04 mV per 12 months. RTD Ohms Mode: ± 0.12 ohms per 12 months.
Total Temperature Effect Error (± 50°F [28°C] change from reference condition 80°F [27°C])	RTD Mode: ± 0.15°C (± 0.27°F). T/C Mode: ± 1.0°C (± 1.8°F). Millivolt Mode: ± 0.02 mV. RTD Ohms Mode: ± 0.06 ohms.
Response Time (Process Variable)	Analog Mode: 500 milliseconds maximum. Digital Mode: Process variable reported up to 10 times a second
Damping	Continuously adjustable from 0.00 to 32.00 seconds.
Common Mode Voltage	250 V isolation.
Common Mode Rejection Ratio	120 dB minimum (up to 120 Hz).
Turn-On Time	4 seconds maximum.
Fail-Safe	T/C, mV or RTD Modes: Upscale, downscale, or fixed upon open T/C, mV input or open leg of RTD.
Power Supply Requirements	13 to 42 VDC. Field Bus Mode: 4.0 mA maximum (per Transmitter) Point-to-Point Mode: 4–20 mA

Environmental Specifications

Temperature limits	Operating: -13 to +185°F (-25 to +85°C) transmitter will operate within specifications. -40 to +212°F (-40 to +100°C) transmitter will operate without damage to the unit. Storage: -60 to +212°F (-51 to +100°C).
Temperature Limits for Unit with Optional LCD	Operating and Visibility limits: +32 to +122°F (0 to +50°C). Exceeding these limits will cause the LCD display to go blank. Transmitter will remain functional. When limits return to within the acceptable range, display will be restored. Storage: -4 to +158°F (-20 to +70°C).
Mounting Position Effect	None. Refer to Figures 6 and 7 for mounting dimensions.
Load Resistance Range	Refer to Figure 2.
Hazardous Locations	See CERTIFICATION at the end of this section.
Enclosure Classification	NEMA 4X. Indoor and Outdoor.
RFI Effect	±1.0% of calibrated span for 20 to 1000 MHz at 30 V/m field intensity.

Options and Accessories

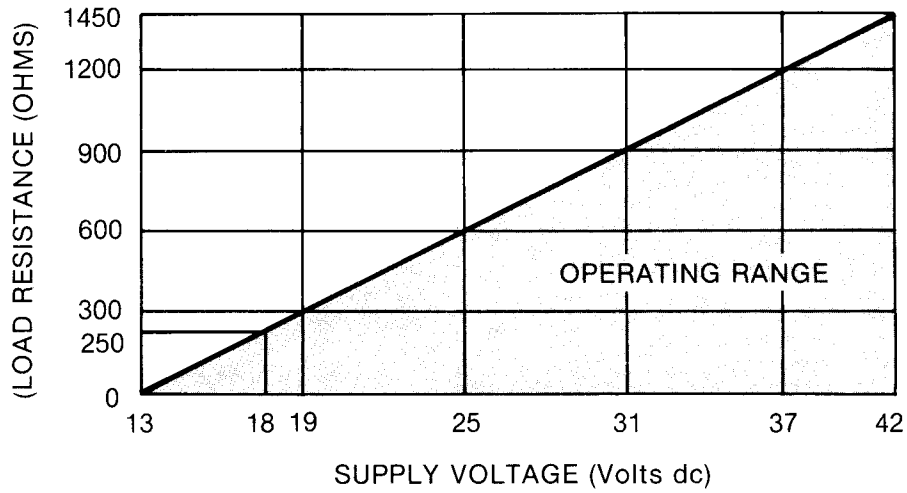
Field Bus Module (IMFBSOI)	Allows interface of smart instruments to Bailey's INFI 90 system. Routes 15 channels of direct digital communications back to the field instruments.
STT02 Smart Transmitter Terminal	Handheld communication device that allows the user to configure, troubleshoot, or simply verify the operation of the transmitter from a local or remote location. Order by Nomenclature: STT02.
Transient Suppressor	Suppresses switching and lightning induced transients; mounts internally or externally; Part No. 1947359-1.
LCD Meter	(See NOMENCLATURE for selection.) Integral circuit board providing 12 digit alphanumeric liquid crystal display output signal as percent of span or in engineering units (display accurate to 0.1% of span) can be rotated in 90 degree increments to yield best viewing orientation.
Remote Mounting Brackets	Mounting brackets available for pipe or wall mounting; two brackets required, Part Nos. 6682603-1 and 6637013-1. Refer to Figure 6 for remote mounting dimensions. Brackets included unless the transmitter is supplied with an integral mounted thermowell.
Tag Options	Part No. 1993318-1: Mylar, adhesive backed aluminum finish. Part No. 487436-2: Stainless steel, specify wire attached or permanently affixed. Customer may specify 4 lines of 12 upper case characters.

Certification

Certifications by Factory Mutual Research (FM), Standards Association of Australia (SAA), and Canadian Standards Association (CSA) are pending as follows:

<p>Nonincendive (Nonsparking)</p> <p>CSA Classes I, II, III; Div 2; Groups A-G</p> <p>FM Class I, II, III; Div 2; Groups A-G</p> <p>SAA Ex n, Zone 2, Group IIC</p>
<p>Intrinsically Safe (when used with appropriate barriers per Bailey Drawing B222611)</p> <p>CSA Classes I, II, III; Div 1; Groups A-G, T4</p> <p>FM Classes I, II, III; Div 1; Groups A-G, T6</p> <p>SAA EW ia, Zone 0; Group IIC, T6</p>
<p>Explosionproof (Flameproof)</p> <p>CSA Class I; Div 1; Groups B-D</p> <p>*FM Class I; Div 1; Groups B-D</p> <p>SAA Ex d; Zone 1; Group IIB</p>
<p>Dust-ignitionproof</p> <p>CSA Classes II, III; Div 1; Groups E-G</p> <p>*FM Classes II, II; Div 1; Groups E-G</p> <p>SAA Ex; Zone 1; DIP 13 Enclosures IP65</p>

* FM approval received for Explosionproof and Dust-ignitionproof categories.



MINIMUM COMMUNICATION VOLTAGE — 18 VOLTS WITH A 250 OHM LOAD.

A0579

FIGURE 2 – Load Limits

TABLE 2 – Input Ranges and Types

Sensor Type	Input Ranges	Min./Max. Span	Accuracy	
			2,3 Wire	Dual
RTD 2 or 3 Wire			Two-Point Calibration	
*Platinum 100 DIN 385 Alpha = 0.00385	-200 to +650°C (-328 to +1202°F)	10/850°C (18/1530°F)	±0.1°C (±0.18°F)	±0.2°C (±0.36°F)
Platinum 100 SAMA Alpha = 0.00392	-200 to +650°C (-328 to +1202°F)	10/850°C (18/1530°F)	±0.1°C (±0.18°F)	±0.2°C (±0.36°F)
RTD Ohms				
Ohms Input	0 to 325 Ohms	4/325 Ohms	±0.04 Ohms	±0.08 Ohms

TABLE 2 – Input Ranges and Types (continued)

Sensor Type	Input Ranges	Min./Max. Span	Accuracy
Thermocouple (IPTS 1968)			
Type B	+200 to +1320°C (+392 to +2408°F)	200/1120°C (360/2016°F)	±1°C (±1.8°F)
Type C	0 to +2300°C (=32 to +1470°F)	35/2300°C (63/4138°F)	±1°C (±1.8°F)
Type E	-100 to +1000°C (-148 to +1832°F)	20/1100°C (36/1980°F)	±1°C (±1.8°F)
Type J	-180 to +760°C (-292 to +1400°F)	20/940°C (36/1692°F)	±1°C (±1.8°F)
Type K	-130 to +1370°C (-202 to +2498°F)	15/1500°C (27/2700°F)	±1°C (±1.8°F)
Type N	0 to +1300°C (+32 to +2372°F)	20/1300°C (36/2340°F)	±1°C (±1.8°F)
Type R	0 to +1700°C (+32 to +3092°F)	50/1700°C (90/3060°F)	±1°C (±1.8°F)
Type S	0 to +1700°C (+32 to +3092°F)	50/1700°C (90/3060°F)	±1°C (±1.8°F)
Type T	-200 to +400°C (-328 to +751°F)	15/600°C (27/1080°F)	±1°C (±1.8°F)
Millivolt			
mV Input	-20 to +100 mV	+2 mV/+120 mV	±0.02 mV

*JETPORT stock unit is set to 0° to +100°C (0° to 212°F), Platinum 100 ohms, 385 curve.

Nomenclature

EQN2 <input type="checkbox"/> TEMPERATURE TRANSMITTER, SIGNAL CONVERTER, OR MILLIVOLT	
_____ CONVERTER 4 TO 20 MA OUTPUT SIGNAL, THERMOCOUPLE OR RTD INPUT	
	INTEGRAL METER 5 No Meter 6 Digital Meter

NOTE: Stocked units will be factory calibrated for platinum 100 ohm, RTD 385 curve at 0 to +100 ° C. A stocked unit can be factory modified for a specific range, in which case the range and type of input must be specified as part of the engineering data.

Theory Of Operation

General

The Type EQN Smart Transmitter provides an output signal in response to temperatures detected by either a thermocouple or single/dual resistance temperature detector (RTD). It can also be programmed to receive standard thermocouple inputs following IPTS 1968 calibrations, mV inputs, or RTD inputs following DIN and SAMA calibrations and user-defined RTD curves. The transmitter can also be used as a millivolt to milliamp converter. A traditional 4 to 20 milliamp signal or a digitally transmitted signal proportional to the measured temperature is available and software selectable.

Refer to Figure 3 for a block diagram of the electronics. Hardware jumpers are used to select either millivolt, RTD, or thermocouple inputs. All inputs are fed into a voltage-to-pulse converter. Reference junction compensation is provided by using a temperature transducer. The output of the temperature transducer is fed into the voltage-to-pulse converter for reference junction compensation.

The voltage-to-pulse converter outputs a variable duty cycle pulse which the microcomputer can understand. The

microcomputer uses all inputs from the voltage-to-pulse converter and calculates an output based on the variable duty cycle pulse inputs. Transformers provide input/output isolation.

The output of the microcomputer is fed into an active multiple pole low pass filter. The filter outputs a dc voltage level proportional to the duty cycle of the pulse input. This dc level controls the output transistor which controls the 4 to 20 mA signal.

The outputs for the millivolt, single RTD or dual RTD mode are based on zero and span points set during calibration. The dual RTD mode output is the calculated difference between the two RTD inputs ($T_1 - T_2$).

The microcomputer communicates directly to the optional LCD display for display data. There is no display error (digital-to-analog conversion) which is typically associated with analog displays.

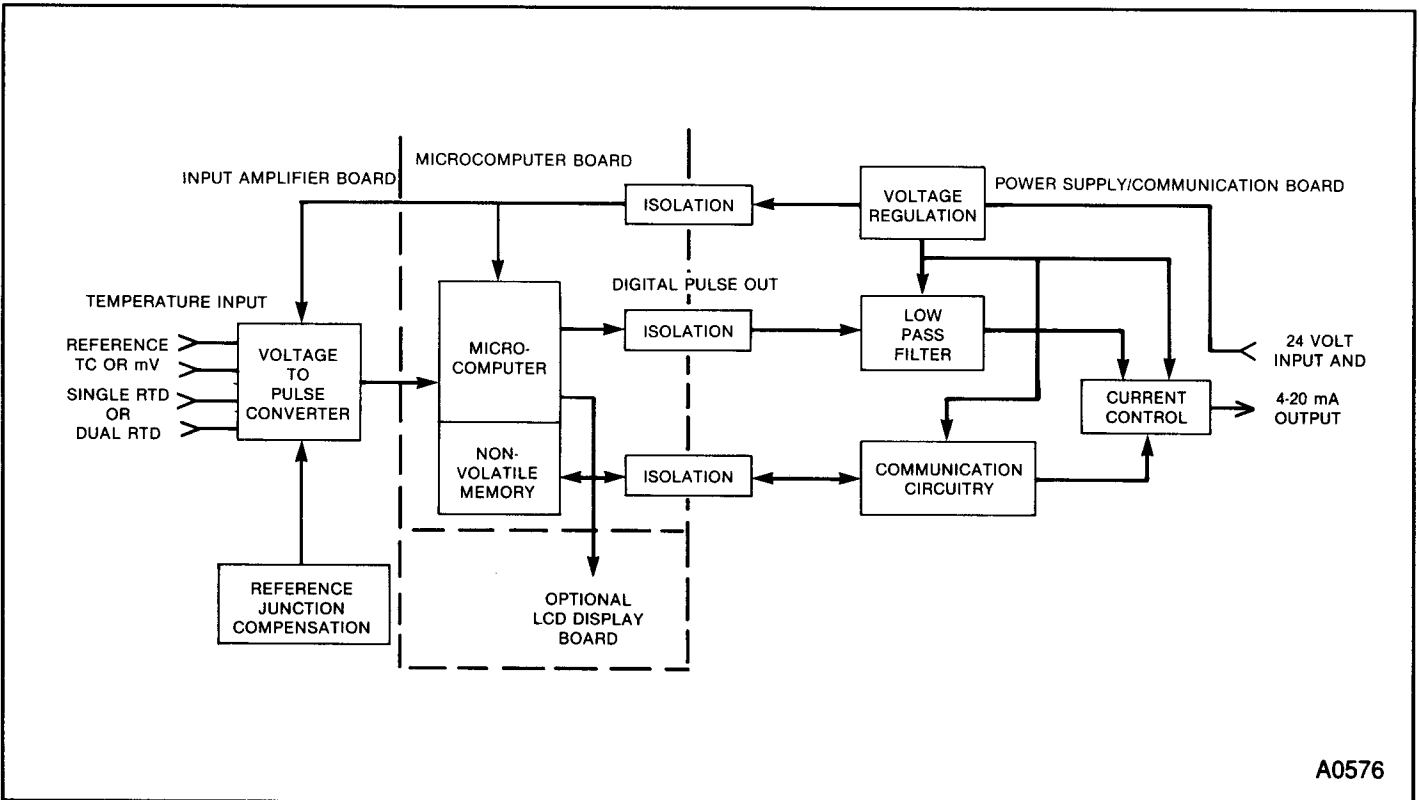


FIGURE 3 – Block Diagram of Type EQN Transmitter Electronics

A0576

Transmitter Electronics Assembly

Input Circuit

The input circuit consists of a differential input multiplexer, and a voltage-to-pulse converter.

Multiplexer. The multiplexer sequentially selects one of four available inputs. One of these inputs is used as a reference. Another is used to read the temperature sensor input for cold junction compensation. The two other inputs are used for single or dual RTD inputs. One of these inputs is also used for a thermocouple or millivolt input.

Converter. The output of the multiplexer is applied to the high input impedance differential amplifier of the voltage-to-pulse converter. Conversion is performed by the voltage-to-pulse converter and the microcomputer's timer system. The microcomputer selects the input to be converted. A pulse will appear on the output of the converter and on the timer input pin. As the pulse input goes high the 16 bit timer value is captured and temporarily stored. The input captured is then set to trigger on the falling edge of the pulse and the end of the pulse time is captured. The difference between this value and the value previously stored is the duration of the pulse and is directly proportional to the input signal.

The voltage-to-pulse converter outputs a variable duty cycle pulse which the microcomputer chip can understand. The microcomputer handles all inputs from the voltage-to-pulse converter and calculates an output based on the variable duty cycle pulse inputs. The microcomputer uses EEPROM eliminating the need for a battery in the electronics. Input/output isolation (250 V) is provided using transformers.

Calculations

The calculations performed on the input signal are multiplication/division and addition/subtraction. The calculations include correction for zero, span, and ambient temperature, calculation of output duty cycle times (see D/A conversion), and linearization of thermocouple inputs.

Digital-to-Analog Conversion

The microcomputer controls the 4 to 20 mA loop current by a variable duty cycle pulse output. This variable duty cycle pulse is generated by the microcomputer's timer system. The pulse output is then fed to an active multiple pole low-pass filter with a cutoff frequency that is much lower than the frequency of the pulse. The output of the low-pass filter is an average voltage level which is proportional to the duty cycle of the pulse input. The dc voltage level is then used to control the output transistor which controls the 4 to 20 mA. In the digital mode, the microcomputer "locks" the current output below 4 mA.

This method of conversion was chosen because it does not require a digital-to-analog converter integrated circuit and, therefore, has low power consumption.

LCD Display

The optional LCD display is alphanumeric with 12 characters. The microcomputer updates the display every second. The type of data to be displayed can be selected using the STT02 terminal.

Communications

Point-to-Point Mode

Communication between the transmitter and a remote terminal is accomplished by attaching the STT02 anywhere along the signal wires. No adapters, jacks or plugs are necessary. An ac voltage imposed on the signal wires allow communications between the transmitter and the STT02 Terminal. Since the communication signal is a high frequency ac, its dc average is zero and has no effect on the output of the transmitter. Two different frequency levels are used to transmit a logic 0 or a logic 1. This enables the Type EQN Transmitter to be located up to 1 mile (1.6 Km) from the STT02 Terminal and provides excellent noise immunity for remote communications. A minimum of 250 ohms loop resistance is necessary to support communication capabilities (Figure 4).

Field Bus Mode

The user programs the transmitter, via the STT02 Handheld Terminal, to be in the digital field bus mode by selecting a bus address for the transmitter. The microcomputer sets the output of the transmitter to below 4 mA for low power consumption. The transmitter provides a digital process variable signal and reports its output (in percent) up to ten times a second for control purposes. In the field bus mode, up to fifteen transmitters can be monitored on a single pair of wires from the control system (Figure 5). A fully populated field bus slows the response for each transmitter to three output updates per second per each transmitter. Changes to transmitter parameters are normally done using the IMFBS01 Slave. The STT02 can talk to a transmitter while the process is running, but cannot change any parameter until the transmitter has been brought off line from the Slave (IMFBS01).

NOTE: Refer to the IMFBS01 Instruction Manual for detailed information on wiring practices, the length/type of wiring to use, and the maximum distance between transmitters on the bus.

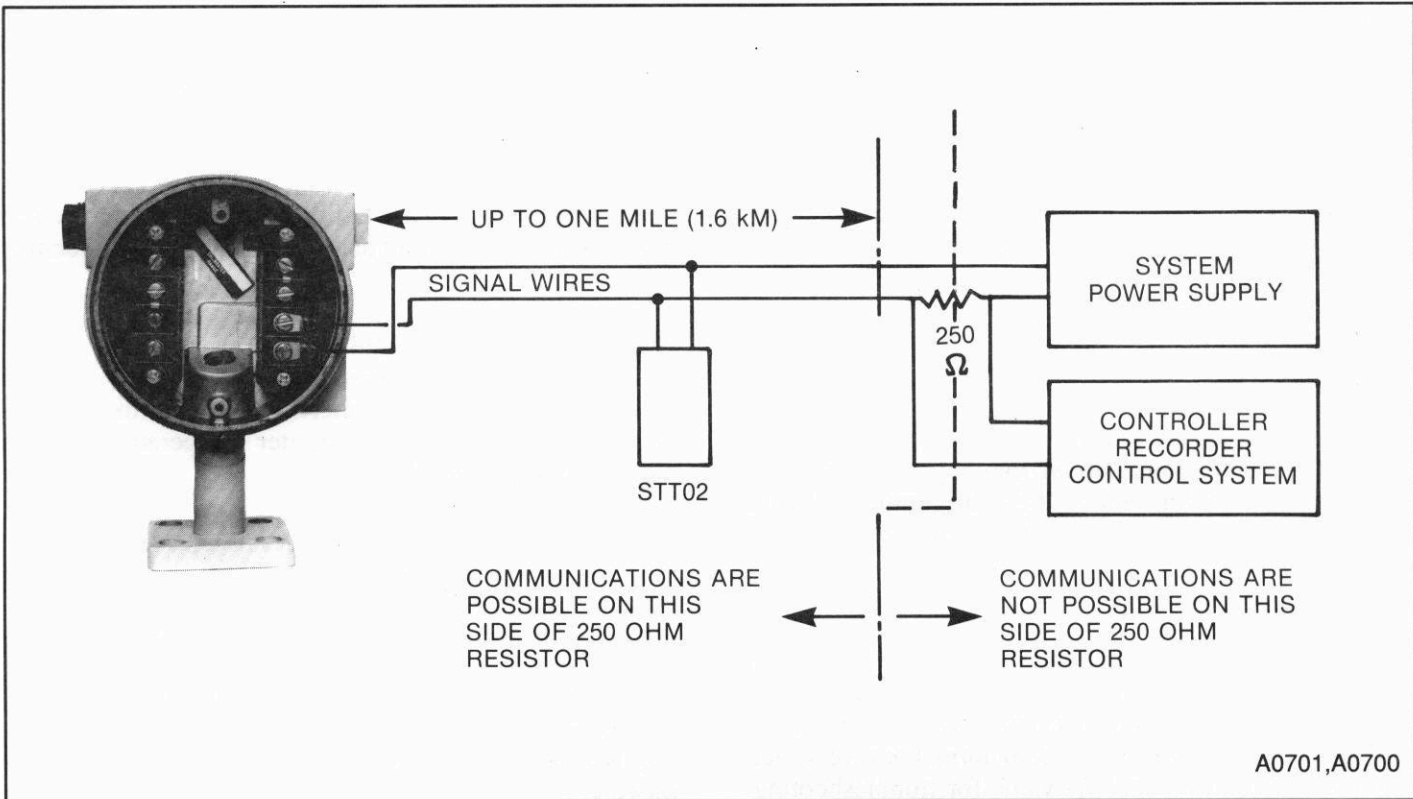


FIGURE 4 – Point-To-Point Communications

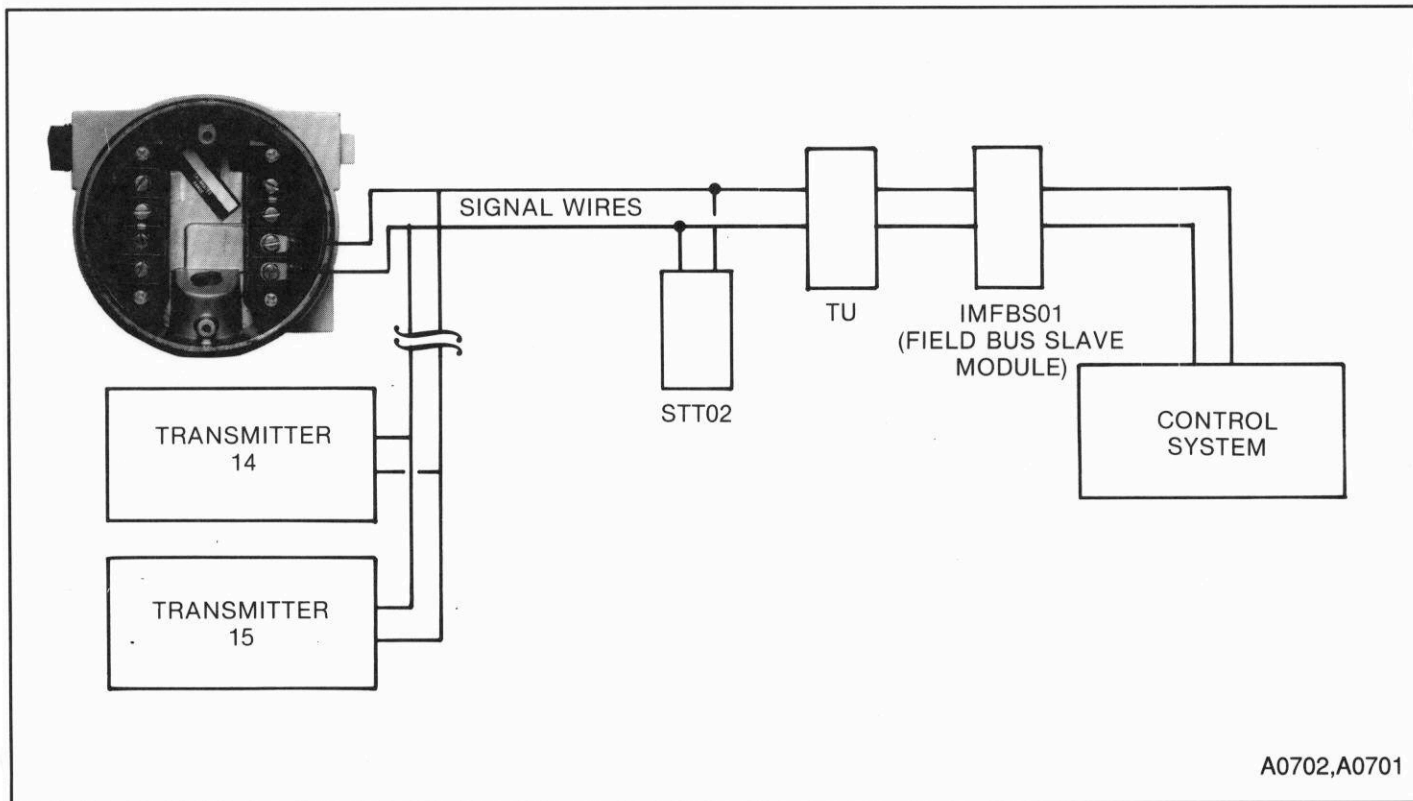


FIGURE 5 – Field Bus Communications

Internal Power Supply

The power supply is a low power switching type. It operates with a minimum of 13 VDC across the transmitter's signal wiring. The power supply and the transmitter are protected against power reversals.

Transmitter Software Functions

The Type EQN Transmitter understands and responds to communication, output and calibration commands received from the STT02 Terminal.

Communication commands permit the user to monitor the input, (in temperature units), the output (in percent or secondary engineering units), the configuration, and the status of the transmitter. The user can also change ranges, input engineering units, ID tags and addresses in the transmitter configuration.

The output commands allow the user to define the output as linear with respect to the input or as a function generator that follows a six segment curve which is programmed by the user. The output can be set to normal or reverse acting and/or fixed to a specific value for troubleshooting purposes. Other commands allow the output to be set to a

user-selected value upon transmitter failure and power up. A damping adjustment command is also available.

The calibration commands that the transmitter responds to allow the user to bench calibrate the transmitter (which includes setting the input and output ranges), and rerange the transmitter.

Temperature Compensation

The output of a temperature sensor is monitored and used to provide reference junction compensation on thermocouple inputs. This transmitter temperature can be monitored using the STT02.

Diagnostics

Continuous self-diagnostic results are available through the STT02 Terminal. Areas monitored are configuration integrity, reference voltage, transmitter temperature and input circuitry failure. The modular amplifier design allows the diagnostics to identify the malfunctioning electronic section. The diagnostics also indicate if the user is making a calibration error. Refer to Table 3, Error Messages.

Installation

Unpacking

1. Check for any obvious damage to the carton or its contents. If damage is evident, notify the carrier and your local Bailey Service Representative.
2. Remove all loose packing from the carton.
3. Carefully remove the transmitter from the carton. Check to make certain that both mounting brackets are included, a spring washer (used when installing a customer-supplied thermowell or temperature element) and an instruction manual.
4. If the transmitter is to be stored prior to installation, pack in the original container, if possible. Store in an area free of corrosive vapors and extremes in temperature and humidity with all covers secured tightly and wiring inlets sealed.

NOTE: Storage temperatures must not exceed the following limits: -60°F to $+212^{\circ}\text{F}$ (-51°C to $+100^{\circ}\text{C}$).

Mounting

The Type EQN Transmitter may be mounted directly at the point of measurement (Figure 6). No mounting bracket is required. When remote mounting is required for either accessibility to the transmitter or high temperature applications (Figure 7), two mounting brackets are available. Part No. 6637013-1 is used for wall mounting. If pipe mounting is required, universal mounting bracket Part No. 6682603-1 must be used in conjunction with the wall mounting bracket listed above.

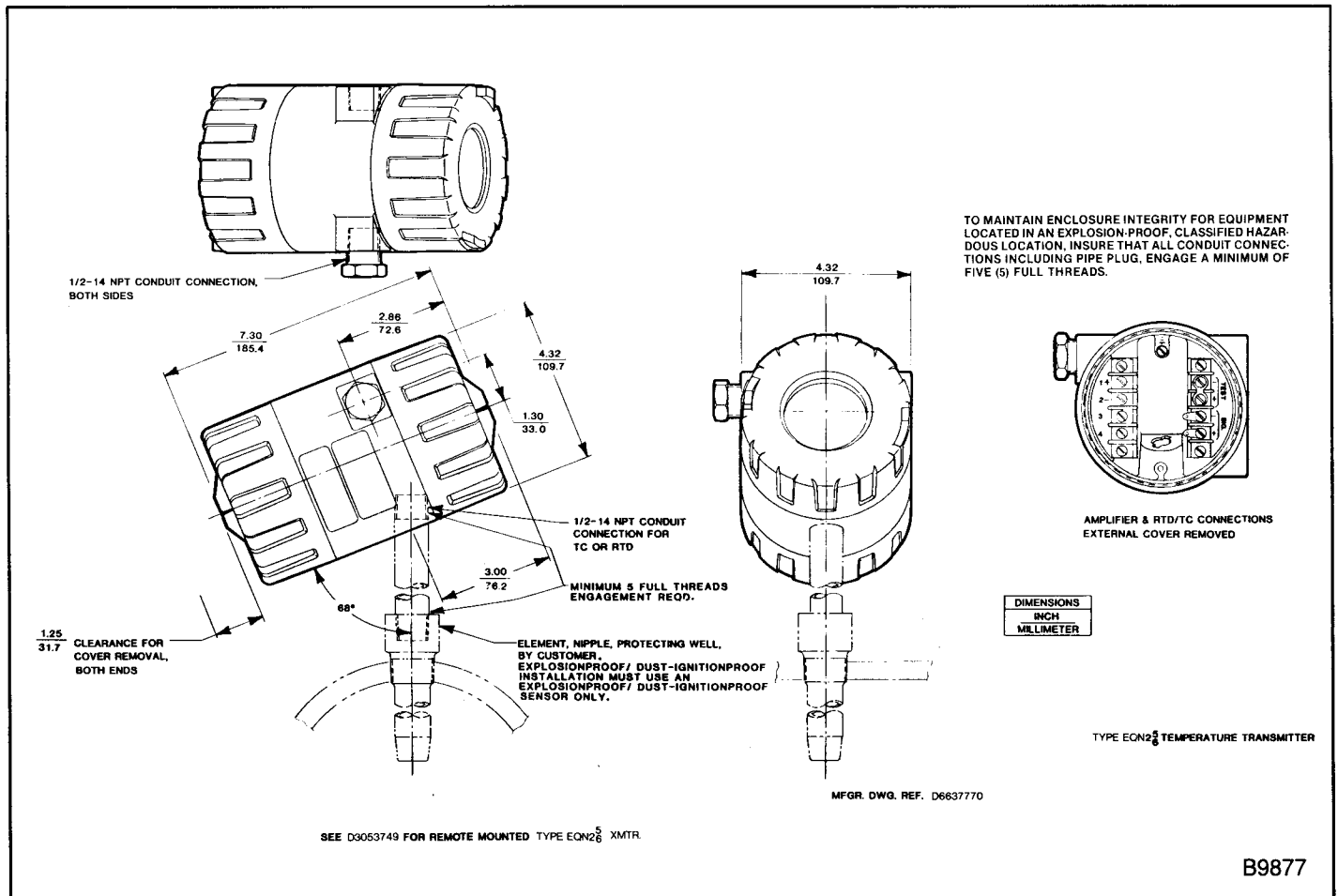


FIGURE 6 – External and Mounting Dimensions (Local)

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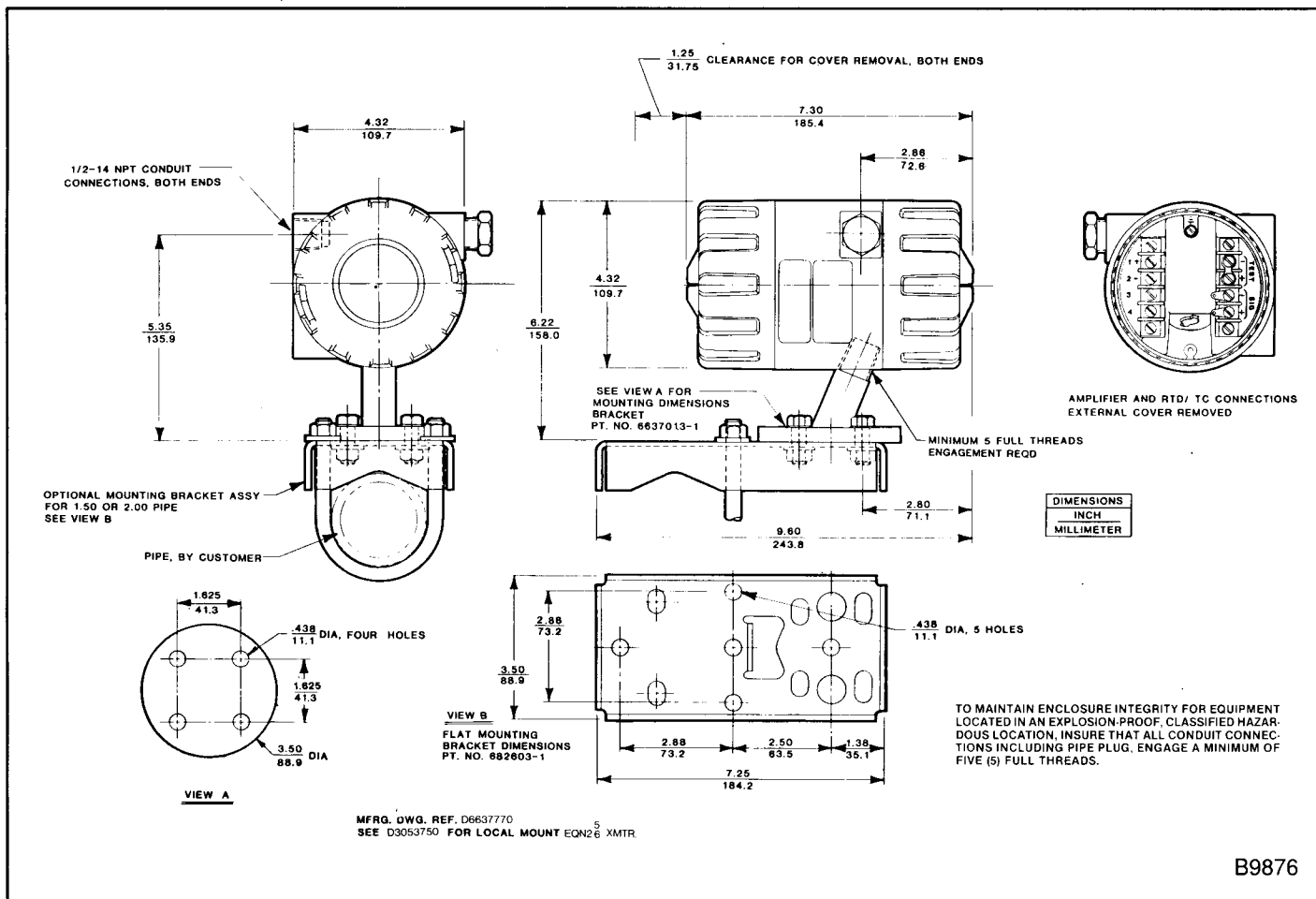


FIGURE 7 – External and Mounting Dimensions (Remote)

Wiring

Signal Wiring

Point-to-Point Mode (Analog). In the point-to-point mode of operation, complete the electrical connections in the typical two-wire 4 to 20 mA fashion. The signal terminals are located on the right-side in the amplifier housing (Figure 8) and will accept wire sizes up to 14 AWG. The housing is marked “SIG” for the signal connection point and also shows the polarity.

Signal wiring should not be run in conduit or open trays with power wiring or near heavy electrical equipment. Twisted shielded pairs are recommended for best results. Reverse polarity protection is built into the transmitter to protect it against accidental reversal of the field wiring connections.

All power is supplied over the signal leads by a standard 24 VDC system power supply. Maximum supply is 42 VDC. Minimum power supply voltage is determined by the loop resistance as follows:

Minimum Supply =

$$13 \text{ Volts} + 0.020 \times \text{Load Resistance (in ohms)}.$$

Minimum Supply for communications =

$$18 \text{ Volts with } 250 \text{ ohm resistor}.$$

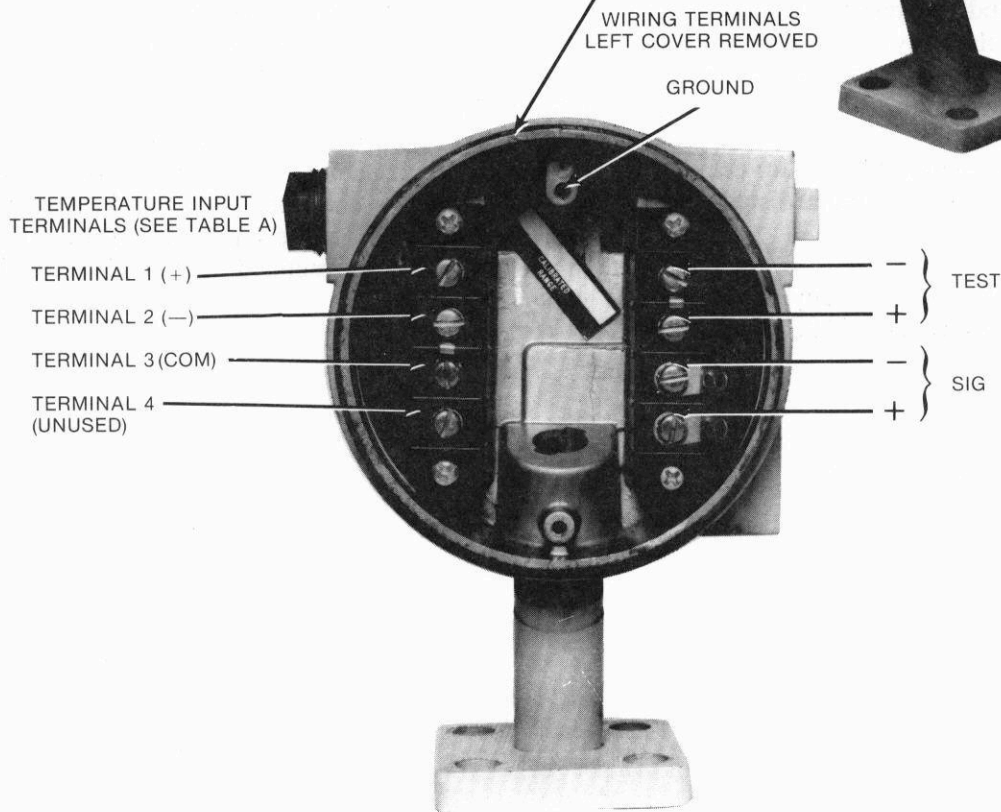
Load resistance must include any meters external to the transmitter, the wiring, and the system input (Figure 2). Power supply regulation is not critical as long as supply voltage remains above the minimum value required to drive the external load resistance.

To monitor loop current without disturbing the existing wiring, two terminals are marked “TEST” and are also marked for polarity (Figure 8). A jumper is placed across the TEST terminals during normal operation and is removed during testing.

NOTE: When removing this jumper, a minimum of 13.7 volts is required at the transmitter’s terminals.

TABLE A — TEMPERATURE INPUT MODE

Single RTD— (Two Wire)	Terminal 1 = RTD positive (+). Terminal 2 = RTD negative (-). Terminal 3 = Jumper Terminal 2 to Terminal 3.
Single RTD— (Three Wire)	Terminal 1 = RTD positive (+). Terminal 2 = RTD negative (-). Terminal 3 = Return Wire
Thermocouple— Input	Terminal 1 = Thermocouple positive (+). Terminal 2 = Thermocouple negative (-). Terminal 3 = Jumper Terminal 2 to Terminal 3.
Millivolt— Input	Terminal 1 = Millivolt positive (+). Terminal 2 = Millivolt negative (-). Terminal 3 = Jumper Terminal 2 to Terminal 3.
Dual RTD —	Terminal 1 = RTD 1 positive (+). Terminal 2 = RTD 1 negative (-). RTD 2 positive (+). Terminal 3 = Jumper Terminal 2 to Terminal 3.



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FIGURE 8 — Wiring for Applicable Input Mode

Field Bus Mode (Digital). In this mode, up to 15 transmitters can share a common set of signal wires. There is no 4 to 20 mA output from the transmitter. Each transmitter will draw less than 4 mA so that operation can be maintained. The process variable signal of each transmitter is a digitally poled variable. The Field Bus Module (IMFBS01) will sequentially ask each transmitter on the bus for its output. Each transmitter on the bus has its own unique address which is programmed during calibration (see **CALIBRATION** section in this manual). Using these addresses, the module knows which transmitter it is communicating with.

Each transmitter on the bus is wired to the control system by connecting the signal leads from the control system to the positive and negative “SIG” terminals of the transmitter (Figure 8). Connect the transmitters on the bus in parallel.

Minimum field bus power supply voltage is determined by the loop resistance as follows:

$$\text{Minimum supply} = 13 \text{ volts} + [(0.004 \times \text{number of transmitters on the bus}) \times \text{load resistance}].$$

Load resistance must include the resistance of the wire and the system input. Do not place any meters or measuring devices into the field bus loop because the transmitters do not output an analog process variable.

Refer to the IMFBS01 Instruction Manual for detailed information on wiring practices and maximum distance between transmitters on the bus.

The STT02 Terminal can be connected anywhere there is access to the signal leads. Since the STT02 also has its

own bus address, it can be connected to the field bus even while the control system is on line. Only one STT02 Terminal can be connected to the field bus at any one time. While the field bus is active (on-line), the STT02 can monitor any transmitter on the bus. If the user wishes to change a calibration or configuration parameter using the STT02, the transmitter must be brought off-line. Changes to transmitter parameters are normally done using the IMFBS01 Slave.

Temperature Input Wiring and Grounding

The temperature input wiring terminals are located on the left-side in the amplifier housing and will accept wire sizes up to 14 AWG (Figure 8). The terminals are marked “1+, 2-, 3 and 4”.

Connect the temperature input wiring to the temperature input terminals. Terminal 1 is positive, Terminal 2 is negative and Terminal 3 is common and varies according to the input mode selected. Terminal 4 is used for location of the jumper when not in use. Refer to Table A (Figure 8) for wiring configurations for the different input modes.

Temperature input wiring may be grounded to the case. Thermocouples may be grounded.

NOTE : Ensure that the temperature rating of the wire is sufficient for the operating temperature.

Grounding

Signal wiring may be either ungrounded (floating) or grounded at any one point in the signal loop. If more than one transmitter is connected to a single power supply, grounding should be at the supply. The Type EQN Transmitter case must be grounded. A ground terminal is provided (Figure 8).

Operation

General

The Type EQN Transmitter can be monitored and controlled using the Bailey Type STT02 Smart Transmitter Terminal. The STT02 can be connected anywhere there is access to the signal wires.

Configuration

Configuration of the Transmitter using the STT02 Terminal includes defining an ID tag number, transmitter address, engineering units, damping constant, lower and upper range values and output parameters.

Use the CONFIGURE key and follow the step-by-step procedure in the STT02 Product Instruction, I-E21-28.

ID Tag

The ID Tag is a 12 character alphanumeric tag which can be programmed into the transmitter.

Transmitter Address

Point-to-Point Mode (Analog). If the user has selected the point-to-point mode, the Transmitter will put itself into the analog mode and provide a 4 to 20 mA output signal in proportion to the input. No transmitter address is required. When in an analog mode (point-to-point), do not connect the transmitter to a field bus; this arrangement will not support analog output devices.

Field Bus Mode (Digital). The transmitter address is used primarily for field bus transmitters. Each transmitter on the field bus must have a separate address. The address range is 1 through 15 and when programmed, the transmitter will place itself into the digital mode and will not output a 4 to 20 mA output signal in proportion to the input. The output will be "locked" below 4 mA.

Damping Adjustment

Damping is adjustable and provides time constant values from 0.00 to 32.00 seconds selected electronically by the STT02 Smart Transmitter Terminal. Damping adjustments have no effect on the calibration or accuracy of the transmitter but can be used to "smooth out" a fluctuating input signal.

Lower and Upper Range Values

Primary Lower and Upper Range Values. The transmitter's range may be set electronically to any value within $\pm 100\%$ of the upper range limit to suit a specific application need.

Secondary Lower and Upper Range Values. The transmitter secondary lower and upper range values can be set to any range within ± 9999 . These ranges can be monitored using the STT02 or can be displayed on the optional LCD display. The ranges are a function of the output of the device, therefore if a non-linear output is selected such as Function Generator, the LCD or STT02 display will be in non-linear units. These units will be a representation of the non-linear function generator.

Engineering Units

Primary Engineering Units. There are five possible primary engineering units to choose from: Celsius, Fahrenheit, Kelvin, millivolts or ohms. In the THERMOCOUPLE Mode, the user can select degrees Celsius, Fahrenheit or Kelvin. In the MILLIVOLT Mode, millivolts are the only primary engineering units available. In the RTD Mode, the user can select degrees Celsius, Fahrenheit or Kelvin. If using the RTD linearization, the transmitter provides linearization with temperature. If the user selects the RTD OHMS Mode (linear with input) the only primary engineering units available is ohms.

Secondary Engineering Units. Use the SPECIAL FEATURE key on the STT02 to program secondary engineering units. These units are in a free-form format of six characters. Any six characters can be programmed into the transmitter such as milliamperes (mA) or microvolts (μ V). These units are used in conjunction with the secondary lower and upper range values.

Local LCD Setup

The local LCD can be programmed to display output in percent or secondary engineering units or input in primary engineering units. Refer to the STT02 Product Instruction I-E21-28. Use the SPECIAL FEATURE key on the STT02 terminal to program this feature. If the variable to be displayed is outside the range on ± 9999 , the LCD will flash lines across the display area.

Output Parameters

The various output commands allow the user to define transmitter output type and action under normal operating conditions as well as the output value during start-up and/or diagnosed failure of the transmitter.

Output Type . The output of the transmitter should be specified as linear with respect to the input, or a function generator. If a function generator output is chosen, five

input and output points must also be specified as a percent of input versus a percent of output.

Output Action . A transmitter in the NORMAL ACTING Mode has an output that increases with increasing input. The output of a transmitter in the reverse acting mode decreases with increasing input. For system troubleshooting purposes, the transmitter output can be set to a constant and specified as percent of span input.

WARNING

The output of this equipment changes to a fixed value during start-up and failure conditions. These values must be selected by the user to ensure safe operation.

AVERTISSEMENT

La sortie de cet appareil adopte une valeur fixe lors de la mise sous tension et de certaines conditions de pannes. Ces valeurs fixes doivent être sélectionnées par l'utilisateur pour assurer une sécurité d'opération lorsqu'elles surviennent.

Start-up Conditions . On power-up, a two-second initialization period occurs during which the transmitter output is either 100% or 0% as defined by the user during configuration. Initialization low sets the output to 0% (4 mA) while initialization high sets the output to 100% (20 mA). The default initialization value is 0% (4 mA). After initialization, the output ramps up from 4 mA (0%) or down from 20 mA (100%) to the correct value.

Failure Conditions. If during its continual diagnostics, the microcomputer detects a problem that is fatal to the transmitter or system, the transmitter output will be set to a predetermined level. This level must be selected by the user during configuration. The default value is set low at 0% (4 mA).

NOTE: For a transmitter in the NORMAL ACTING Mode, 0% output would be 4 mA and 100% would be 20 mA. For a transmitter in the REVERSE ACTING Mode, 0% output would be 20 mA and 100% output would be 4 mA.

Get Configuration

To review a configuration once the transmitter has been configured, press the GET CONFIGURATION key on the STT02.

Configuration Lockout

The Type EQN Transmitter has a “lockout” feature that, once engaged, allows all transmitter functions to be moni-

tored but prevents the transmitter configuration or calibration from being altered. To use the “lockout” feature, change wire jumper J1 on the microcomputer board from pins 2 and 3 to pins 1 and 2 (Figure 9). To gain access to this board, refer to **Removing the Amplifier Assembly** in the **Maintenance/Repair** section of this manual.

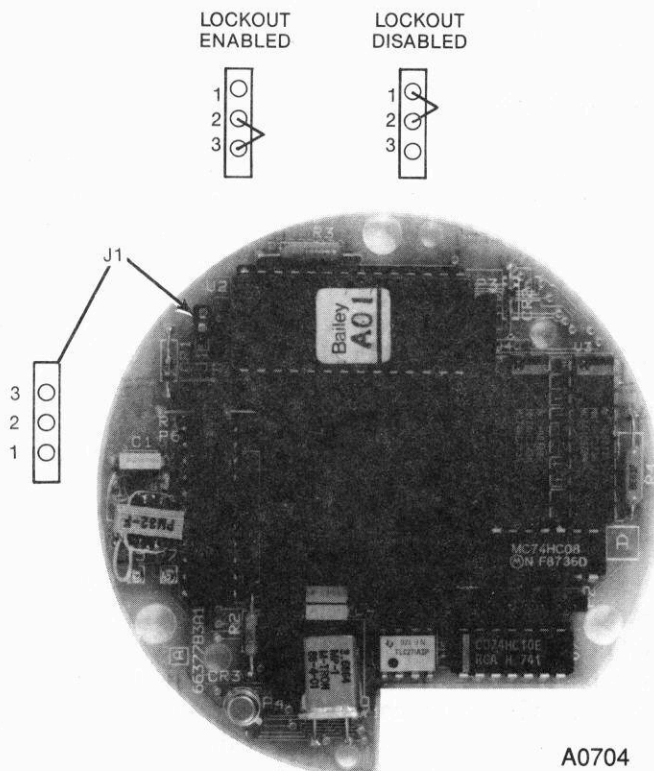


FIGURE 9 – Configuration Lockout Feature Jumper Location on Microcomputer Board

Monitor Input

To monitor transmitter input, use the OUTPUT key on the STT02 and select *Report Input* from the Output Menu (refer to the STT02 Product Instruction). The input is displayed in primary engineering units and is updated every second.

Monitor Output

To monitor transmitter output, select *Report Output* from the Output Menu on the STT02 (refer to STT02 Product Instruction). The output will be displayed as a percent of span input and is updated every second.

Monitor Transmitter Ambient Temperature

To display the ambient temperature of the electronics housing, press the SPECIAL FEATURE key on the STT02 and select *Monitor Temperature* . This temperature is also

used to cold junction compensate the thermocouple inputs. The temperature is displayed in degrees Celsius.

Monitor Secondary Engineering Units

To monitor the secondary engineering unit variable using the STT02, press the SPECIAL FEATURES key on the STT02 and select *Monitor Secondary Units*. The value will reflect the output of the transmitter but will be a percentage of the secondary lower and upper range value and displayed in secondary engineering units.

Fix Output

For system troubleshooting purposes, the transmitter output can be set to a constant and specified as a percent of span input. Select *Fix Output* from the Output Menu on the STT02 (refer to STT02 Product Instruction I-E21-28).

Transmitter Status Check

The status of the transmitter, determined from results of the continuous self-diagnostics, can be checked with the STT02. Refer to the TROUBLESHOOTING section of this manual for corrective action as needed.

Zero And Span Adjustments

Zero and span adjustments are performed using the STT02 Terminal. Press the CALIBRATE key, select the transmitter mode and then select *Bench Calib.* and follow the procedures.

Changing Transmitter Operating Mode

1. Remove cover from electronics side of housing.
2. To change mode selection, hardware jumpers J1 through J3 on the input board must be repositioned (Figure 10).
3. Refer to **Calibrating the Transmitter, Checking Input Board Jumpers** in the CALIBRATION section. Follow the procedures to gain access to the input board.
4. Refer to Figure 10 and locate the desired operating mode. Reposition jumpers J1 through J3 using needle nose pliers.

5. Insert amplifier assembly into housing making sure P1 (red) and P2 (black) pin connectors and the sensor lead connector are secure.

6. Refer to the CALIBRATION section and perform the calibration procedure that pertains to your new operating mode.

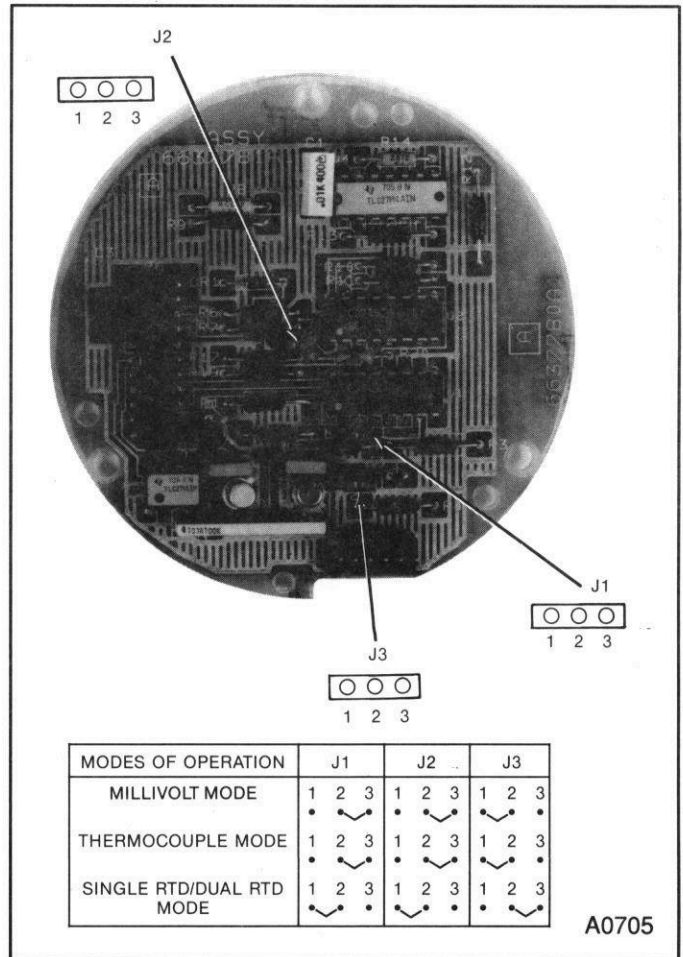


FIGURE 10 – Input Board Jumper Locations for Various Modes of Operation

Calibration

General

Fully calibrated Type EQN Transmitters may be ordered from the factory. If a calibration check is desired before placing the transmitter in service, refer to the **Calibration Check** procedure that is appropriate for your application. If the transmitter has been disassembled and parts have been replaced or it is necessary to change the zero and span points, calibrate the transmitter using the procedures in the **Calibrating the Transmitter** section.

Equipment Required

The following equipment is required for calibration of the Type EQN Transmitter:

1. Power Supply: 24 \pm 1 VDC output.
2. Resistor: 250 ohm, 1/2 watt minimum, \pm 0.1%.
3. Resistor: 250 ohm, 1/4 watt minimum, \pm 0.01% (RTD Mode only).
4. Digital Voltmeter (DVM): 4-1/2 digit display minimum.
5. Millivolt Standard: \pm 0.1% (millivolt source). (Millivolt or Thermocouple Mode only.)
6. Ice Point Cell (Thermocouple Mode only).
7. Resistor Decade Boxes (quantity 2): \pm 0.01% minimum accuracy (RTD Mode only).
8. Bailey STT02 Smart Transmitter Terminal.
9. Temperature Meter (for measuring room temperature): \pm 0.5°C accuracy.

Calibration Check

NOTE: Prior to any calibration check, make certain jumpers J1 through J3 on the input board are in the correct location for the operating mode desired. Refer to **MAINTENANCE/REPAIR** section, **Removing the Amplifier Assembly** for procedures to gain access to the input board. Refer to **OPERATION** section, **Changing Transmitter Operating Mode** and to Figure 10 for location of the jumpers and a table showing correct location.

Millivolt/SINGLE RTD/DUAL RTD

1. Connect the transmitter in a calibration setup (see Figure 11).
2. Connect the input to the transmitter (refer to Figure 12). Allow 15 minutes for the equipment to stabilize. Input the lower range value and check the output.

a. For the analog (point-to-point) mode, the lower range value should be 4 mA, \pm the accuracy specification listed in Table 2 for the type input being used. Record the output.

b. In the digital mode (field bus mode), the current output should be below 4 mA. 1) Press the OUTPUT key on the STT02. 2) Select *REPORT OUTPUT* from the Output Menu and observe the digital output. It should be within the accuracy spec listed in Table 2 for the type of input being used. Record the output. 3) If the output is not below 4 mA, the transmitter must be put into the digital mode using the CONFIGURE key on the STT02. Use the SEND key on the STT02 to send the configuration to the transmitter. Refer to STT02 Product Instruction I-E21-28 for the procedure.

3. Input the upper range value. Check and record the output.

a. **For the analog (point-to-point) mode**, the upper range value should be 20 mA \pm the accuracy specification listed in Table 2 for the type of input being used.

b. **In the digital mode of operation (field bus mode)**, the current output should be below 4 mA. 1) Press the OUTPUT key on the STT02. 2) Select *REPORT OUTPUT* from the Output Menu and observe the digital output. It should be within the accuracy spec listed in Table 2 for the type of input being used. If it is not, the transmitter must be calibrated. Refer to **Calibrating the Transmitter**.

4. If after checking and recording the lower and upper range values it is determined that calibration is necessary, refer to **Calibrating the Transmitter** section. Select the correct procedure for your application.

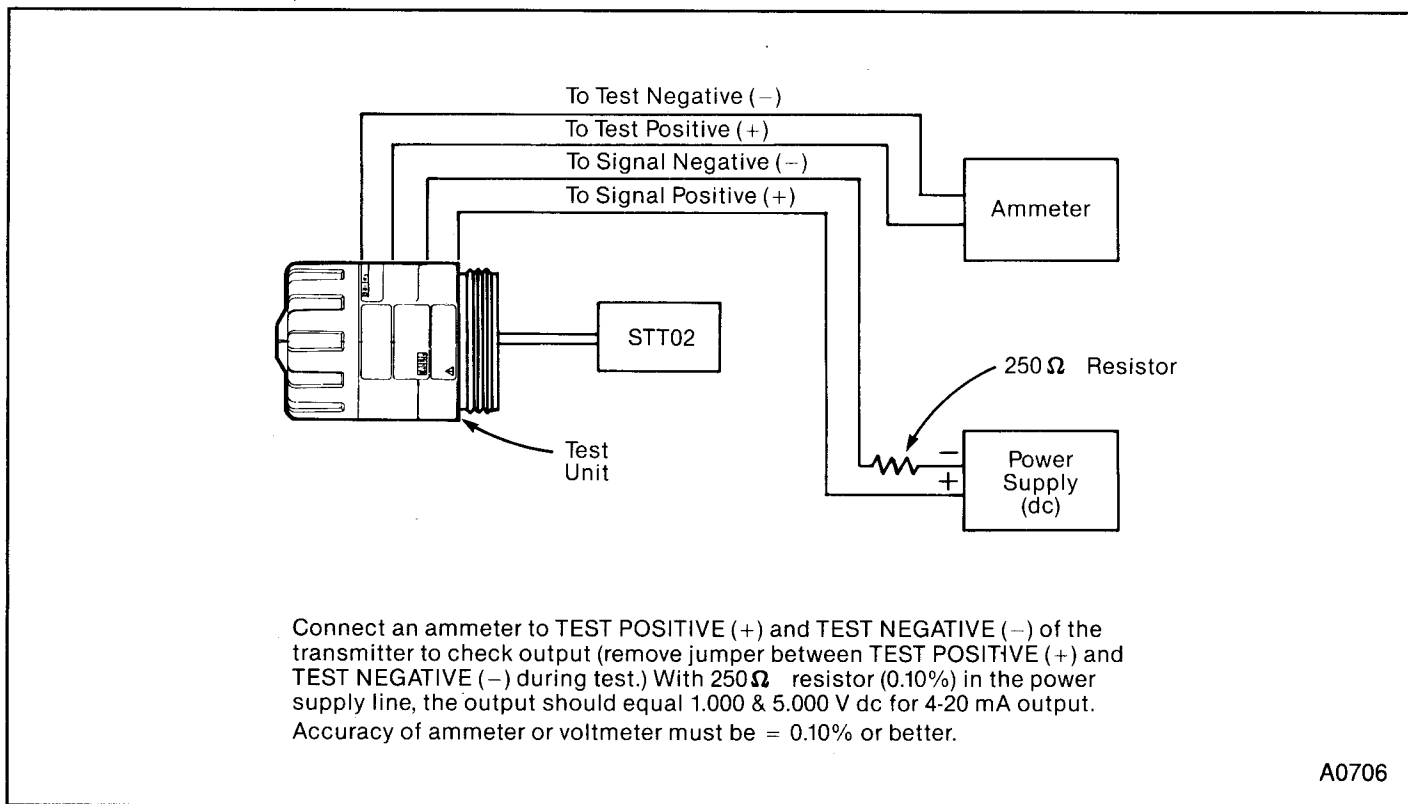


FIGURE 11 – Typical Calibration Setup

Thermocouple

1. Connect the transmitter in a calibration setup (Figure 10).

2. Connect the thermocouple test input to the transmitter (Figure 11). Allow one hour for the transmitter to reach room temperature if not already at room temperature.

3. Input the lower range value temperature signal. Check and record the output.

a. **For the analog (point-to-point) mode**, the lower range value should be 4 mA, \pm the accuracy specification listed in Table 2 for the type input being used.

b. **In the digital mode (field bus mode)**, the current output should be below 4 mA. 1) Press the OUTPUT key on the STT02. 2) Select *REPORT OUTPUT* from the Output Menu and observe the digital output. It should be within the accuracy specification listed in Table 2 for the type of input being used. 3) If the output is not below 4 mA, the transmitter must be put into the digital mode using the CONFIGURE key on the STT02. Use the SEND key on the STT02 to send

the configuration to the transmitter. Refer to STT02 Product Instruction I-E21-28 for the procedure.

4. Input the high range value temperature signal. Check and record the output.

a. **For the analog (point-to-point) mode**, the upper range value should be 20 mA \pm the accuracy spec listed in Table 2 for the type of input being used.

b. **In the digital mode (field bus mode)**, the current output should be below 4 mA. 1) Press the OUTPUT key on the STT02. 2) Select *REPORT OUTPUT* from the Output Menu and observe the digital output. It should be within the accuracy specification listed in Table 2 for the type of input being used. If it is not, the Transmitter must be calibrated. Refer to **Calibrating the Transmitter**.

5. If after checking and recording the lower and upper range values it is determined that calibration is necessary, refer to **Calibrating the Transmitter** section. Select the correct procedure for your application.

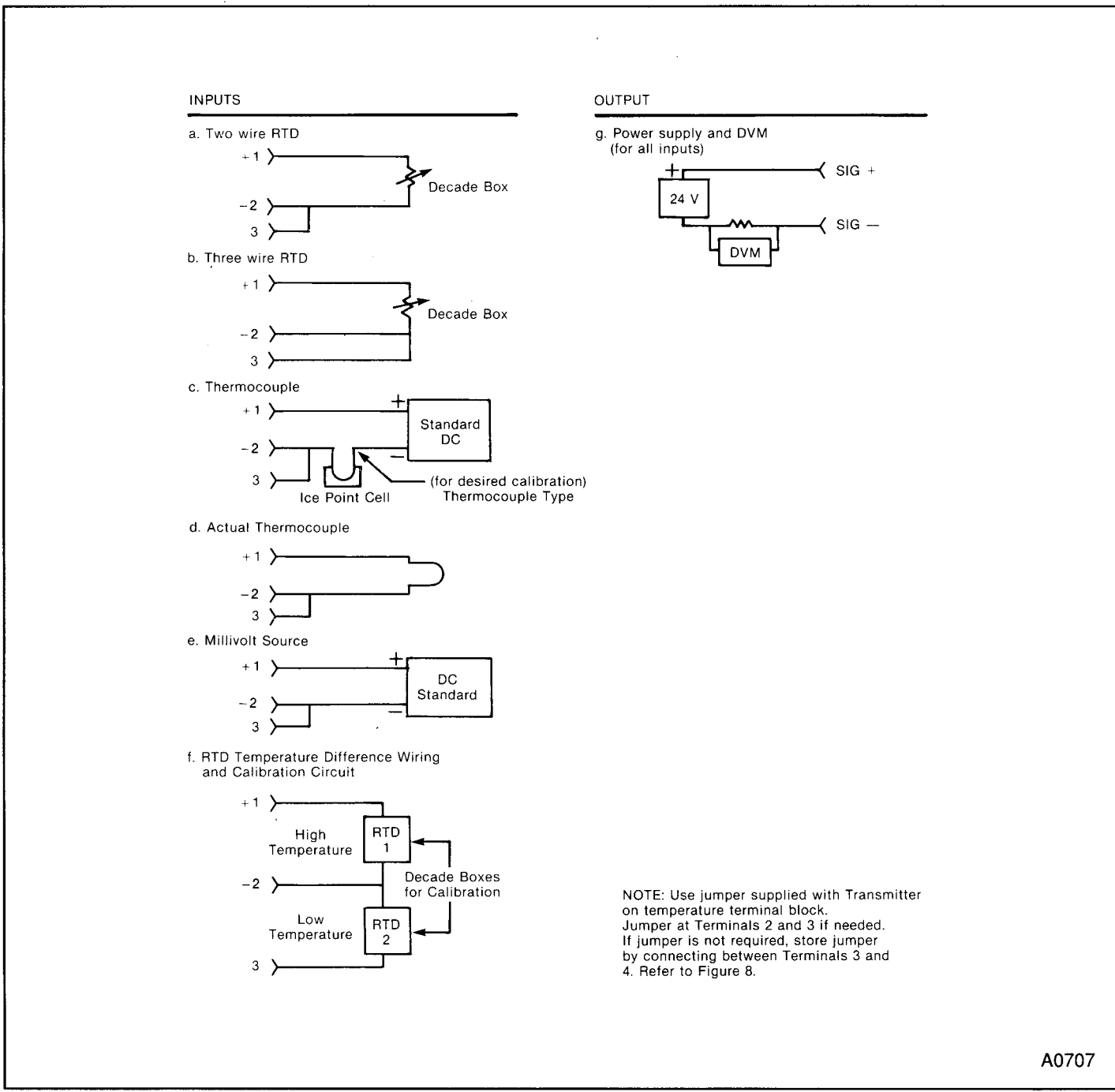


FIGURE 12 – Calibration Connections

Calibrating The Transmitter

All calibration is done electronically by the STT02 Smart Transmitter Terminal.

NOTE: Prior to calibration, make certain jumpers J1 through J3 on the input board are in the correct location for the operating mode desired.

Checking Input Board Jumpers

1. Turn off power to transmitter.
2. Remove the cover from the electronics side of the transmitter housing.
3. Remove the three amplifier mounting screws holding the assembly in the housing.

4. Carefully lift the amplifier assembly and disconnect the sensor lead connector from the 6-pin connector header.
5. If you desire to totally remove the amplifier assembly from the housing, disconnect the filter leads from pin connectors P1 and P2 on the communications board.
6. Grasp the microcomputer board and gently pull from the electronics assembly to gain access to the input board jumpers.
7. Check jumper settings. Refer to Figure 10 for operating modes and jumper locations.
8. Once jumpers have been checked and changed if necessary, reassemble the amplifier assembly, reversing Steps 1 through 7.

Millivolt Mode Calibration

1. Remove cover from the field terminal side of housing.
2. Connect transmitter as shown in Figure 11.
3. Refer to Figure 12 for connection of millivolt source.
4. Turn on power supply and allow fifteen minutes for the equipment to stabilize before continuing.
5. Use the STATUS key on STT02 (refer to STT02 Product Instruction) to confirm that the transmitter is operational.
6. Use the GET CONFIGURATION key on the STT02 to verify that the Type EQN Transmitter is in the MILLIVOLT Mode. If the transmitter is not in the MILLIVOLT Mode, press the CONFIGURE key and select *Modify* on the STT02 (refer to STT02 Product Instruction) to change the configuration parameters. Use the SEND key on the STT02 Terminal to send the configuration to the transmitter.
7. Use the STT02 Terminal and adjust the transmitter by pressing the CALIBRATE key and selecting *Bench Calibration* from the Calibrate Menu. Refer to the STT02 Product Instruction for details on the bench calibration procedure.

Single/Dual Rtd Mode Calibration

1. Remove cover from field terminal side of housing.
2. Connect transmitter in calibration setup as shown in Figure 11.
3. Refer to Figure 12 for connection of RTD.

4. Turn on power supply and allow fifteen minutes for the equipment to stabilize before continuing.
5. Use the STATUS key on the STT02 to verify that the transmitter is operational.
6. Verify that the transmitter is in the correct mode by using the GET CONFIGURATION key on the STT02. If necessary, press the CONFIGURE key and select *Modify* on the STT02 (refer to STT02 Product Instruction) to change the configuration parameters. Use the SEND key on the STT02 Terminal to send the configuration to the transmitter.
7. Use the STT02 Terminal and adjust the transmitter by pressing the CALIBRATE key and selecting *Bench Calibration* from the Calibrate Menu. Refer to the STT02 Product Instruction for details on the bench calibration procedure.

In the single or three-wire RTD Mode, the user can calibrate the transmitter using a single resistor if a precision decade box is not available. Use the following procedure. This is an economical alternative to purchasing an expensive precision decade box.

1. Input zero (0.00) ohms as the low resistance value.
2. Use a 250 ohm, 0.01% resistor for the high resistance value.
3. Press the CALIBRATE key on the STT02 and select the *RTD Transmitter Mode*. Then select *Single RTD* or *Three Wire RTD*, whichever is applicable. Follow the instructions. Refer to STT02 Product Instruction.
4. Select *Rerange* and follow the procedure to rerange the transmitter to the desired range.
5. Accuracy will be slightly degraded ($\pm 0.2^{\circ}\text{C}$ or ± 0.08 ohms) in the single/three-wire RTD mode using this one-resistor calibration technique.

Thermocouple Mode Calibration

1. Remove cover from field terminal side of housing.
2. Connect the transmitter in a calibration setup as shown in Figure 10.

NOTE: Allow one hour for the transmitter to reach room temperature if not already at room temperature.

3. Connect a millivolt source to the transmitter for calibration of the transmitter's internal reference (refer to Figure 12).
4. Turn on the power supply and allow fifteen minutes for the equipment to stabilize before continuing.
5. Confirm that the transmitter is operational by using the STATUS key on the STT02.
6. Verify that the transmitter is in the correct THERMOCOUPLE mode by viewing the current configuration with the GET CONFIGURATION key on the STT02. If necessary, press the CONFIGURE key and select *Modify* on the STT02 (refer to STT02 Product Instruction) to change the configuration parameters. Use the SEND key on the STT02 Terminal to send the configuration to the transmitter.
7. Adjust the millivolt source to 0.000 ± 0.001 millivolts.
8. Press the CALIBRATE key on the STT02 and select *Bench Calibration* from the Calibrate Menu. Refer to STT02 Product Instruction for detailed bench calibration procedure.
9. Calibrate the low internal reference of the transmitter.
10. Adjust the millivolt source to 25.000 ± 0.001 millivolts.
11. Calibrate the high reference of the transmitter.
12. Measure the temperature of the transmitter (room temperature) in degrees Celsius. This measurement must be accurate to ± 0.5 degree Celsius to obtain good transmitter accuracy.
13. Calibrate the transmitter's internal temperature sensor by entering the value measured in Step 12.
14. Remove the millivolt source and connect the thermocouple calibration circuit to the transmitter (refer to Figure 12).
15. Verify the accuracy of the transmitter by adjusting the dc millivolt standard for your input. Compare the output with the millivolt output versus temperature tables for your specific thermocouple type. Use the IPTS 1968 thermocouple values as reference.
16. The transmitter is able to linearize thermocouple inputs within $\pm 1^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$). If the transmitter is within this specification, then it is calibrated correctly. In the non-linear mode, the transmitter will follow the non-linear nature of the thermocouple.
17. If the accuracy is not within $\pm 1^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$), repeat Steps 5 through 15.

Troubleshooting

Type EQN Transmitter Diagnostics Section

If the Type EQN Transmitter is unable to implement any command, the STT02 Terminal can be used to identify the problem. Pressing the STATUS key on the STT02 will display an error message. The error messages and the corrective action to take when the transmitter diagnostics detect a problem are listed in Table 3. Refer also to Figure 13,

Troubleshooting Flow Chart, for additional help in troubleshooting the transmitter.

NOTE: Refer to Figure 14 for location on any boards referenced in Table 3.

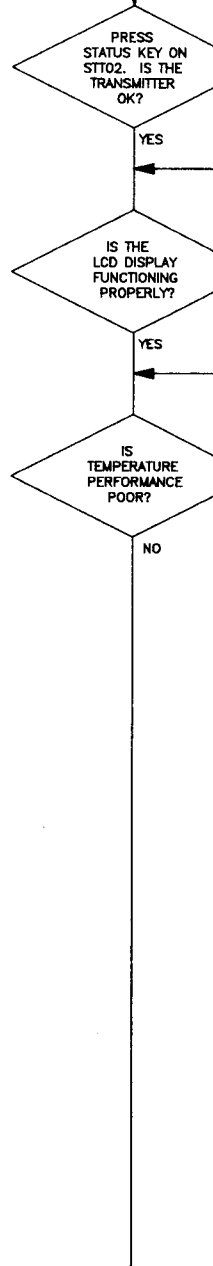
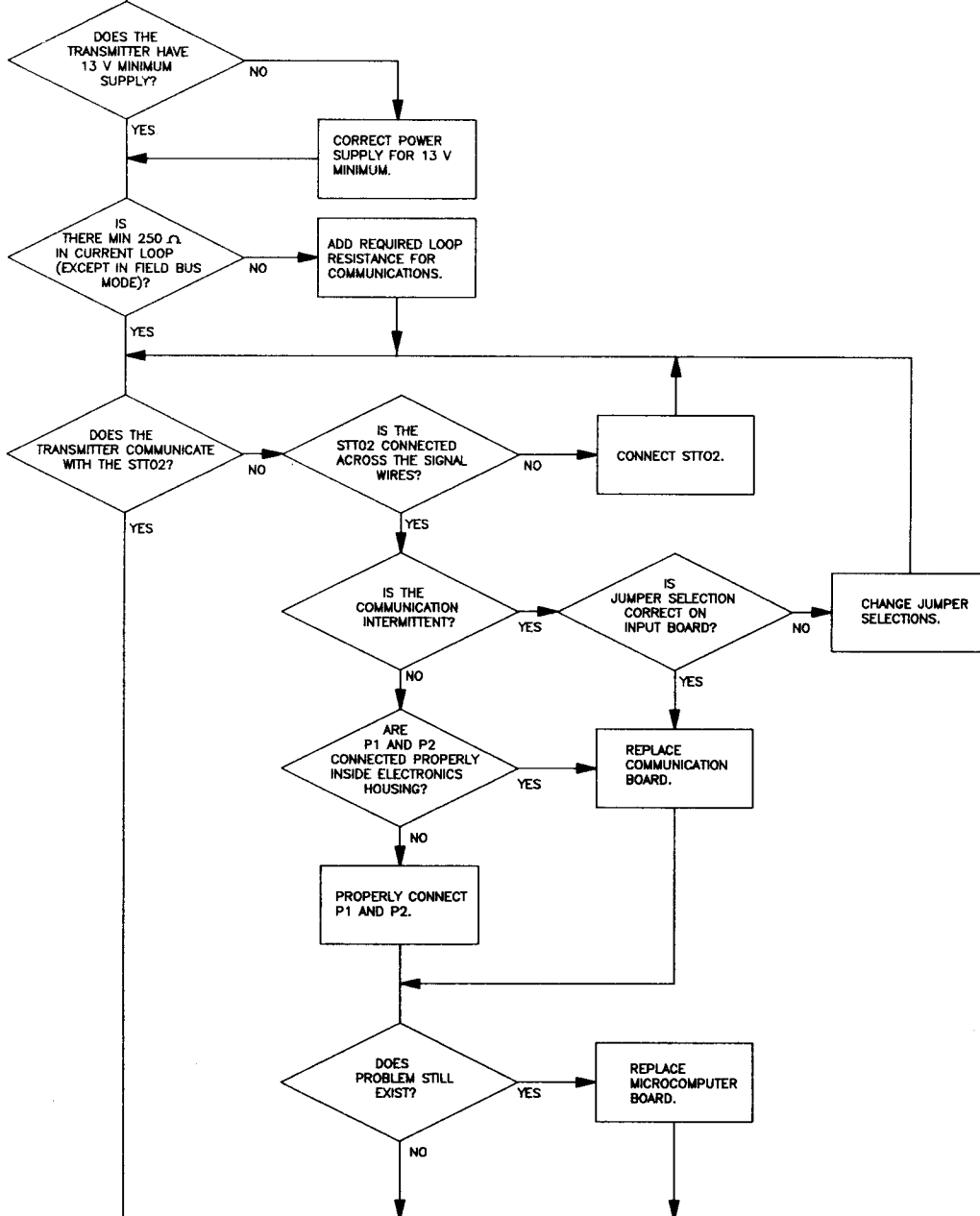
TABLE 3 – Error Messages

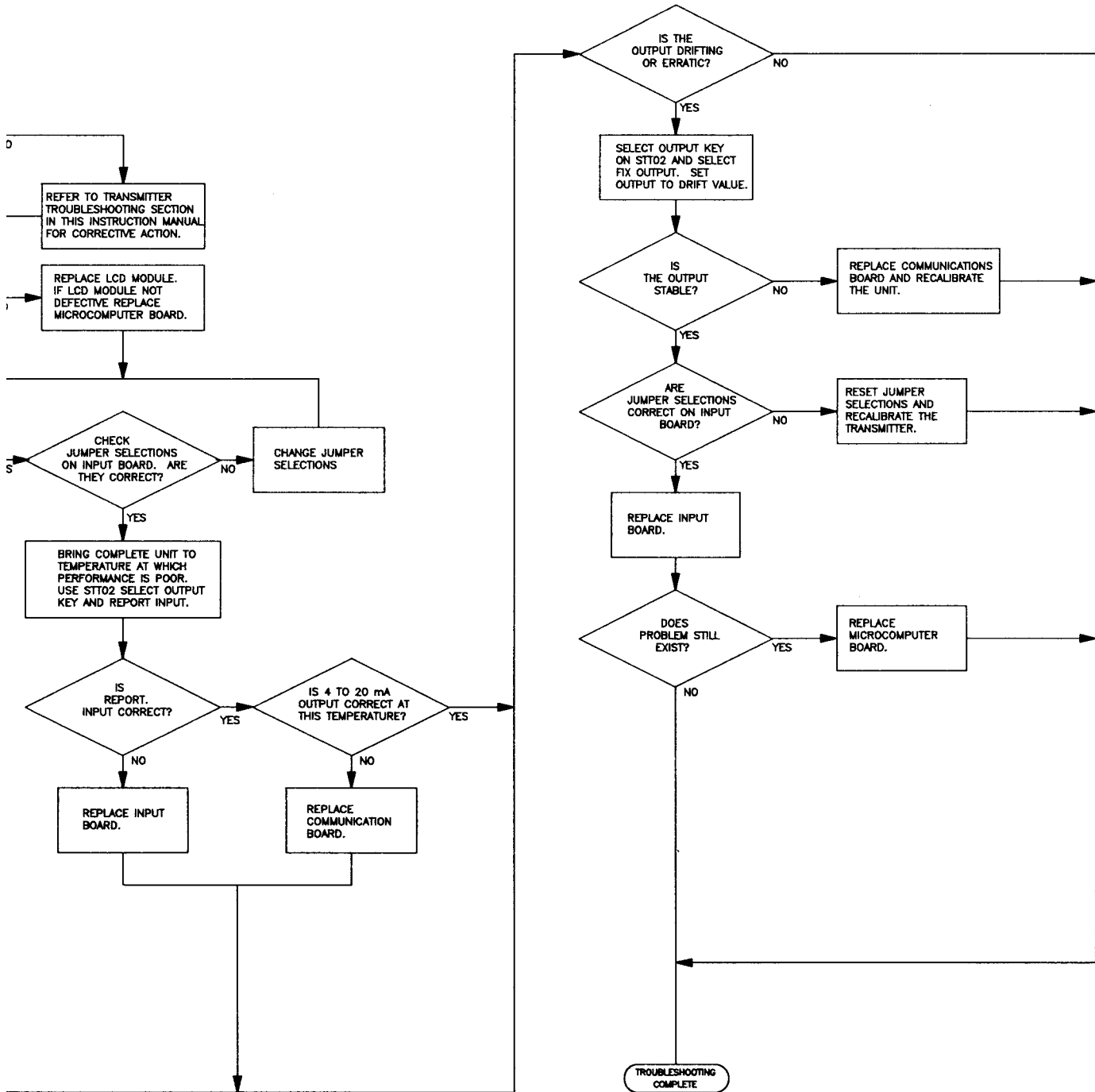
Error Message	Probable Cause	Corrective Action
Checksum Error	The data the transmitter received did not pass a checksum test. (Data corrupted.)	Extreme line noise could cause this code to randomly appear. Since the transmitter and STT02 do check data for integrity, this is not a problem. If error code appears frequently, replace communications board. Refer to Removing the Amplifier Assembly for board replacement.
Cannot Execute Due to Hardware Problems	Detected error in hardware.	Press STATUS key to determine error and use this table for the appropriate corrective action.
Lockout Engaged Command Not Allowed	The hardware lockout jumper on the microcomputer board is set in the lockout mode. (The user cannot change any parameters when this jumper is set in the lockout mode.)	Refer to Configuration Lockout procedure and Figure 9 for procedure to change jumper position on the microcomputer board. Refer to Figure 14 for location of board.
On-line With FBM Command Not Allowed	STT02 normally not used when Transmitter is in the field bus mode. STT02 cannot change parameters while the field bus is active.	Normal communications are through the Slave. The Slave can change parameters. Transmitter must be taken off line. There is a 2-minute time out period until the STT02 will be allowed to change parameters. After the 2-minute time period, the Transmitter will allow the STT02 access.
EPROM Checksum Error	Program chip on microcomputer board is bad.	Replace microcomputer board. Refer to Figure 14 for board location and to Removing the Amplifier Assembly for replacement procedures.
Failed RAM Check	Microcomputer chip defective.	Replace microcomputer board. Refer to Figure 14 for board location and to Removing the Amplifier Assembly for replacement procedures.
Failed EPROM Check	The microcomputer has detected a memory problem.	Reconfigure and recalibrate the transmitter. The microcomputer will attempt to fix the problem. If it cannot, it will send out a MICROCOMPUTER BAD error code. Refer to that error message.
Microcomputer Bad	The microcomputer cannot retain configuration and calibration data. Microcomputer board is defective.	Replace microcomputer. Refer to Removing the Amplifier Assembly for replacement procedures and to Figure 14 for board location.
A-D Failure	a. Input board defective most probable cause. b. Microcomputer board defective least probable cause.	a. Replace input board. Refer to Removing the Amplifier Assembly for replacement procedures and to Figure 14 for board location. b. Replace microcomputer board. Refer to Removing the Amplifier Assembly for replacement procedures and to Figure 14 for board location..

TABLE 3 – Error Messages (continued)

Error Message	Probable Cause	Corrective Action
Input Failure	<p>a. Sensor failure most probable cause.</p> <p>b. Input board failure least probable cause.</p>	<p>a. Check input board connections. Refer to Removing the Amplifier Assembly for disassembly procedures to allow a check of the connections and to Figure 14 for board location. Check jumper selections on the input board.</p> <p>b. Replace input board. Refer to Removing the Amplifier Assembly for replacement procedures and to Figure 14 for board location.</p>
Over Range or Under Range	Temperature out of range.	<p>a. Make certain proper input is applied to the transmitter. Recalibrate. If error still present, go to step b.</p> <p>b. Check jumper connections on the board. Refer to CALIBRATION section. Checking Input Board Jumpers. Refer to Figure 10 for jumper locations for various operating modes.</p> <p>c. Input board not connected properly. Check connections</p> <p>d. Replace input board. Refer to Removing the Amplifier Assembly for replacement procedures.</p>
Input Signal Applied Incorrectly	Input signal is not correct.	Correct input signal and recalibrate. Refer to CALIBRATION section.
Output in Fix Output or Adjust Mode	STT02 turned off when output was fixed to a value or while the 4 to 20 mA output was being adjusted.	Power down the transmitter then power up the transmitter.
Temp Over 85°C or Under -25°C	Transmitter not calibrated properly or transmitter is at a temperature limit at which the temperature performance is not specified. Error code will not effect operation but could mean that temperature performance is out of spec.	<p>a. If the normal operating temperature of the transmitter is over 85°C or under -25°C, ignore the message.</p> <p>b. Recalibrate the transmitter. Refer to the CALIBRATION section. NOTE: Transmitters that are not calibrated may have this error until the unit is calibrated.</p>

TYPE EQN
TROUBLESHOOTING
FLOWCHART





TP80162.PIC
E51-79 (EQ)
25JAN89

TP80162/C0708

FIGURE 13 - Troubleshooting Flow Chart

Maintenance/Repair

WARNING

System maintenance must be performed only by qualified personnel and only after securing equipment controlled by the circuit. Altering or removing components from an active circuit may upset the process being controlled.

AVERTISSEMENT

L'entretien du système doit être effectué par des personnes compétentes et uniquement à partir du moment où les éléments contrôlés par le circuit ont été isolés. Le fait d'enlever ou d'altérer les composants d'un circuit sous tension peut perturber le processus contrôlé.

Bailey does not recommend printed circuit board repair in the field. Equipment requiring repair should be returned to the factory or your nearest Bailey service center.

Checkout Of Amplifier Assembly Boards

The amplifier assembly can easily be checked for a malfunction by substituting spare circuit boards into the circuit. Refer to **Removing the Amplifier Assembly** section for removal procedures.

Amplifier Boards Check

Refer to the Troubleshooting Flow Chart, Figure 13, for assistance in diagnosing the problem. The chart will assist you in determining which board is not functioning properly.

Checkout of Optional LCD Board

The optional LCD board should be checked (if used) only after the amplifier assembly has been verified operational.

1. Attach the LCD board to the amplifier assembly (see **Assembling the Amplifier Assembly** in this section of the manual).
2. Apply power to the transmitter and observe the LCD display. If the LCD does not display properly, replace the LCD board. If the problem still exists, the microcomputer board is defective.

Removing The Amplifier Assembly

1. Turn off power to transmitter.
2. Unscrew and remove the cover from the electronics side of transmitter housing. Examine the large cover

O-ring and replace if necessary. Lubricate with Dow Corning No. 4 Silicone Compound (or equivalent).

3. Remove three amplifier mounting screws (Figure 14). Carefully lift the amplifier assembly partially out of the housing. Do not try to remove the amplifier assembly until some of the components listed in Step 4 have been disconnected.

CAUTION

Do not remove or force amplifier assembly completely out of housing. This will cause damage to the pins and connectors at P₁, P₂ and the sensor lead connector.

ATTENTION

Ne pas retirer complètement l'assemblage des composants de l'amplificateur de son boîtier. Ceci endommagerait les broches et les connexions P₁ et P₂ ainsi que le connecteur des fils de la sonde.

4. Disconnect sensor lead connector from the 6-pin connector header on the input board. Disconnect the filter leads from pin connectors P1 and P2 on the communications board.

5. Remove amplifier assembly from housing.

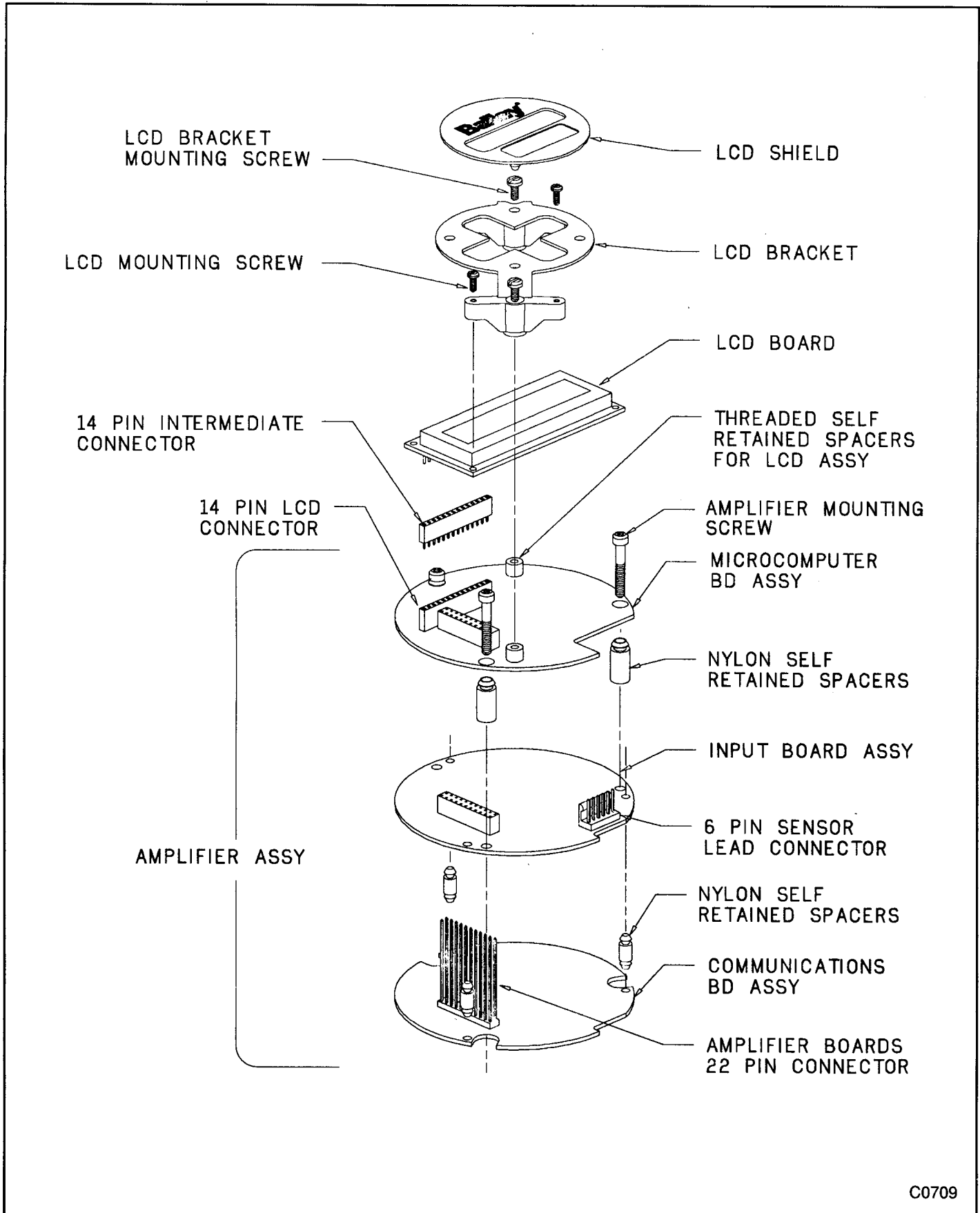
6. If an LCD is provided and it is necessary to remove it from the amplifier assembly, follow Steps 7, 8 and 9. If the LCD assembly is not used, proceed to Step 10.

7. Remove the two LCD mounting bracket screws. GENTLY pull the LCD bracket and LCD board until they disconnect from the 14-pin LCD connector on the microcomputer board.

8. To remove the LCD board from the LCD bracket, remove the two LCD mounting screws.

9. Disconnect the intermediate LCD connector from the LCD board.

10. The communications board, input board and microcomputer board are held together with nylon self-retained spacers that just snap apart to disassemble the boards. When disassembling the boards, be careful not to damage the pins of the 22-pin connector that goes through both the input board and the microcomputer board.



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FIGURE 14 - Removing the Amplifier Assembly

Assembling The Amplifier Assembly

NOTE: If the amplifier assembly is replaced, be sure that jumpers J1, J2 and J3 on the input board are positioned as shown in Figure 10 and the configuration lockout feature on the microcomputer board (jumper J1) is set for your application.

1. Snap the three 1/4-inch nylon spacers onto the communications board.

2. Line up the connector of the input board with the pins of the 22-pin connector on the communications board and slide the input board over the pins and snap the nylon self-retained spacers to secure the boards (Figure 14). The heads of the spacers will extend through the input board.

3. Snap the three 1/2-inch nylon spacers into the microcomputer board.

4. Line up the connector of the microcomputer board with the 22 pins extending through the input board and slide the microcomputer board into place.

5. Plug the intermediate 14-pin connector into the LCD board.

6. Line up the pins on the LCD board with the 14-pin connector on the microcomputer board and slide the LCD board into position. There are four positions to choose from. The LCD board is upright when its 14-pin connector is in the upper left hand corner.

7. Position the LCD bracket so that the LCD bracket mounting screws will line up with the threaded self-retained spacers for the LCD assembly on the microcomputer board. Install the two LCD mounting screws and then install the two LCD bracket mounting screws and tighten.

8. Before inserting the amplifier assembly into the housing, attach the sensor lead connector to the 6-pin connector on the input board assembly. Attach RED (P1) and BLACK (P2) filter leads to the communications board and slide the amplifier assembly into the housing.

9. Install the three amplifier mounting screws and tighten. Snap the LCD shield into position on the LCD bracket.

10. Thread the cover onto the housing.

11. Calibrate the transmitter.

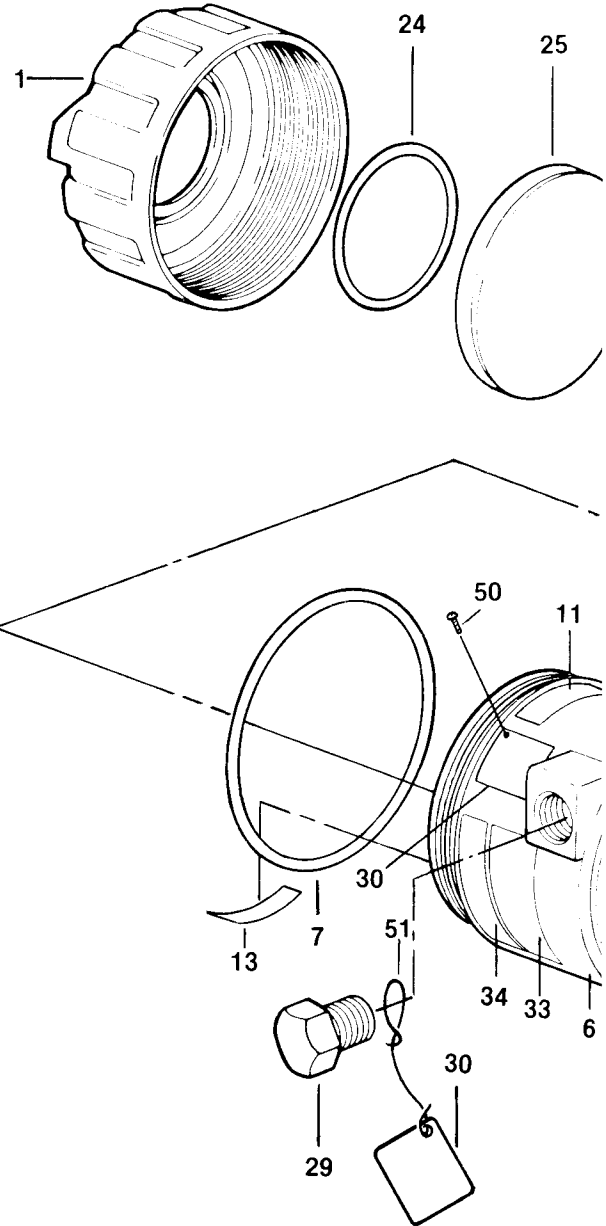
Replacement Parts

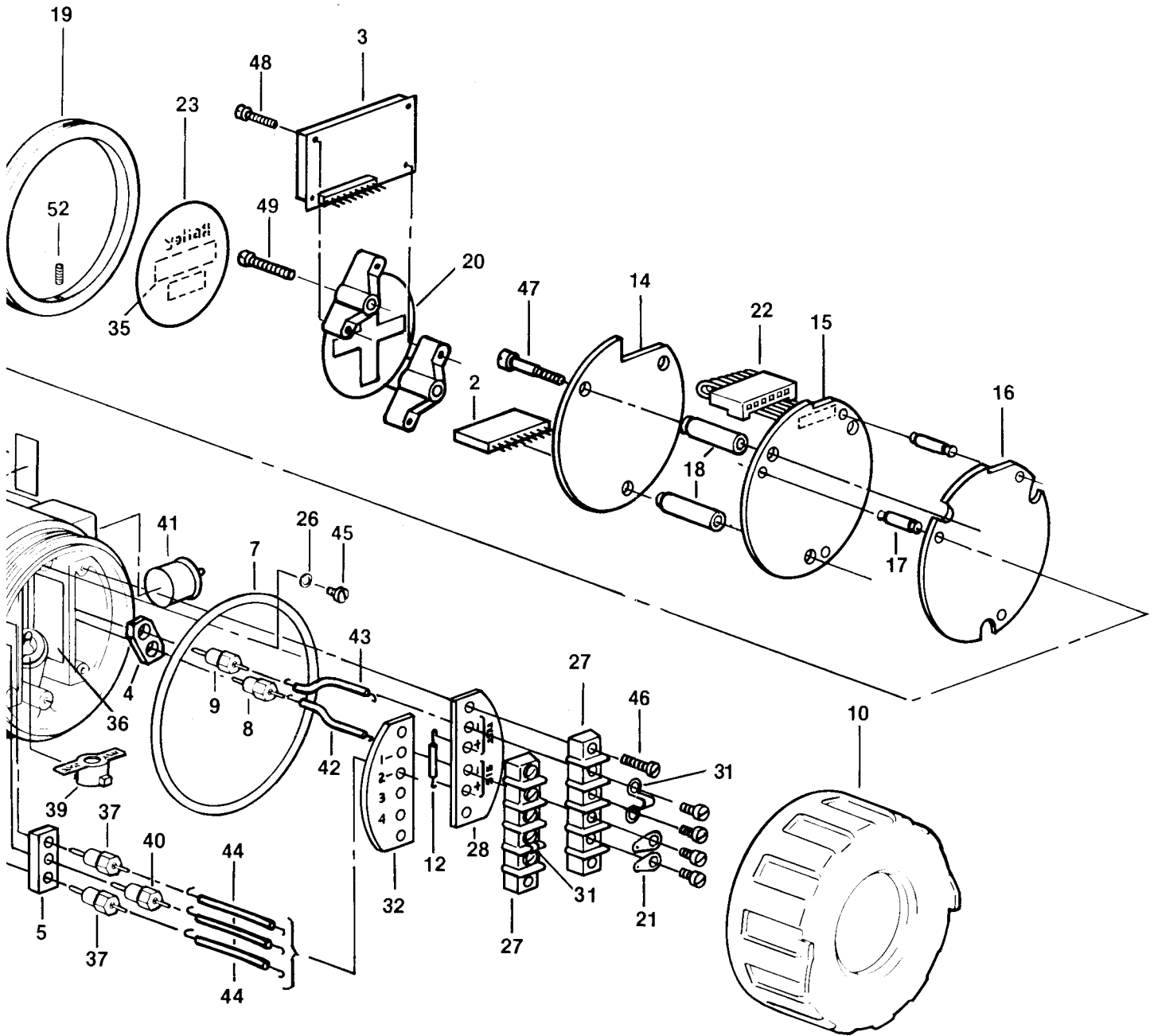
Figure 15 is a parts drawing for Type EQN Transmitter.

When ordering replacement parts or kits, specify Nomenclature Type, the part number and part name required, or the kit part number.

Bailey Controls Company is ready to assist in the use and repair of its products at any time. Requests for sales and/or application service should be made to the nearest sales or service office.

ITEM	PART NO.	NAME
1	6634627-2	COVER (SEE TABLE A)
2	1948528-114	CONNECTOR (SEE TABLE A)
3	6636084-1	LCD ASSY (SEE TABLE A)
4	6637477-1	SPACER
5	6637477-2	SPACER
6	6634628-5	HOUSING, BASE
7	1951420-154	O-RING, SEAL, 2 REQD
8	6634668-7	FILTER ASSY (BLK)
9	6634668-8	FILTER ASSY (RED)
10	6634627-1	COVER (SEE TABLE A)
11		FM (FACTORY MUTUAL) LABEL
12	1946447-1	DIODE, SIG, SI, IN914B
13	1948370-1	TEMP LABEL
—	6638009-1	AMPLIFIER ASSY (INCLUDES ITEMS 14-18)
14	6637783-1	MICROCOMPUTER BD ASSY
15	6637781-1	INPUT BD ASSY
16	6637779-1	COMMUNICATIONS BD ASSY
17	197729-4	STANDOFF, 3 REQD
18	197833-1	STANDOFF, 3 REQD
19	6633667-1	LOCKNUT (SEE TABLE A)
20	6638057-1	LCD SUPPORT (SEE TABLE A)
21	1948533-1	LUG
22	1947411-6	CONNECTOR HEADER
23	6638062-1	SHIELD, LCD (SEE TABLE A)
24	1951420-036	O-RING, SEAL (SEE TABLE A)
25	199927-1	WINDOW (SEE TABLE A)
26	197675-2	WASHER
27	1947784-4	TERMINAL BLOCK (2 REQD)
28	6634662-1	SHIELD, TERM. BLOCK
29	195148-3	PLUG, PIPE
30	487436-2	TAG, STN. STL.
31	1944495-2	JUMPER (2 REQD)
32	6636811-1	SHIELD, TERM BLK
33		CSA, FM PLATE
34		NAMEPLATE, 2 REQD
35	1963508-1	LABEL (SEE TABLE A)
36	1963327-1	CALIBRATION LABEL
37	6634668-5	FILTER ASSY (BRN), 2 REQD
38	1964021-1	LABEL, BLANK
39	669531-1	SPRING RETAINER
40	6634668-6	FILTER ASSY (BRN)
41	16349	1/2 IN. PULL PLUG
42	R2041-1650	22 AWG BLK LDWIRE (3.00 IN.)
43	R2041-1652	22 AWG RED LDWIRE (4.50 IN.)
44	R2041-1651	22 AWG BRN LDWIRE (7.50 IN.)
45	NDNAC12006	0.138-32x.375 FIL HD SCREW (ROLOK)
46	NDOAC13012	0.138-32x.750 FIL HD SCREW, (ROLOK), 4 REQD
47	NDOAC13014	0.138-32x.875 FIL HD SCREW, (ROLOK), 3 REQD
48	NHSHA05004	0.086-56x.250 STN STL SLTD PAN HD SCREW, (SEE TABLE A)
49	NHSHA09004	0.112-40x.250 STN STL SLTDPAN HD SCREW, (SEE TABLE A)
50	NRSHA04003	0.086-64x.188 STN STL RD HD SCREW
51	R6440-0005	0.031 DIA. 347 STN STL WIRE (6.00 IN.)
52	NKJHA13004	0.138-32x.250 STN STL SET SCREW (SEE TABLE A)
53	6637013-1	BRACKET
54	6634409-1	KIT, MOUNTING





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FIGURE 15 - Parts Drawing, Type EQN Temperature Transmitter

TABLE A

NOMENCLATURE	METER	ITEM 1-3,19 23,24,35,52	ITEM 10	ITEM 20	ITEM 48,49
EQN 25	NONE	OMIT	2 REQD	OMIT	OMIT
EQN 26	LCD	1 REQD	1 REQD	1 REQD	2 REQD

TYPE EQN TRANSMITTER SPARE PARTS KITS

KIT NO. 258456-1 AMPLIFIER ASSY

ITEM NO.	PART NO.	NAME
14-18	6638009-1	AMPLIFIER ASSEMBLY
21	1948533-1	LUG, 2 REQD
47	NDOAC13014	SCREW, 3 REQD

KIT NO. 258453-2 LCD REPLACEMENT ASSY

ITEM	PART NO.	NAME
2	1948528-114	CONNECTOR
3	6636084-1	LCD ASSEMBLY
20	6638057-1	LCD SUPPORT
23	6638062-1	LCD SHIELD
35	1963508-1	LABEL
48	NHSHA05004	SCREW, 2 REQD
49	NHSHA09004	SCREW, 2 REQD

KIT NO. 258453-1 LCD ADD-ON KIT ASSY

ITEM	PART NO.	NAME
1	6634627-2	COVER
2	1948528-114	CONNECTOR
3	6636084-1	LCD ASSEMBLY
19	6633667-1	LOCKNUT
20	6638057-1	LCD SUPPORT
23	6638062-1	LCD SHIELD
24	1951420-036	O-RING
25	199927-1	WINDOW
35	1963508-1	LABEL
48	NHSHA05004	SCREW, 2REQD
49	NHSHA09004	SCREW, 2 REQD
52	NKJHA13004	SET SCREW

Kit NO. 258461- Amplifier PC Boards

ITEM	PART NO.	NAME
14	6637783-1	MICROCOMPUTER PC BOARD (SEE TABLE B)
15	6637781-1	INPUT PC BOARD (SEE TABLE B)
16	6637779-1	COMMUNICATION PC BOARD (SEE TABLE B)
17	197729-4	STANDOFF, 3 REQD
18	197833-1	STANDOFF, 3 REQD
47	NDOAC13014	SCREW, 3 REQD

TABLE B

KIT PART NO.	MICRO-COMPUTER PC BD	INPUT PC BD	COMMUNICATIONS PC BD
258461-1	1 REQD	OMIT	OMIT
258461-2	OMIT	1 REQD	OMIT
258461-3	OMIT	OMIT	1 REQD

Appendix A – Applications In Flammable Atmospheres

WARNING

Substitution of components may impair suitability for use in a hazardous location.

AVERTISSEMENT

La substitution de composants peut rendre l'émetteur inadéquat à l'utilisation dans un environnement dangereux.

Division 2 (Zone 2) Applications

A Division 2 hazardous location is a location where a flammable substance is normally adequately contained or is normally adequately diluted by ventilation. A flammable or explosive concentration might occur due to a failure of containment or ventilation, however, such an occurrence would happen infrequently and for a short period of time. Containment failures could be due to leaking fittings, connectors, or seals. Guidelines for classifying areas as either Division 1 or Division 2 are given in standards such as NFPA 497A, "Classification of Class I Hazardous Locations for Electrical Installation in Chemical Plants".

Nonincendive

The nonincendive rating means that the unit has been evaluated to ISA SP12.12 and CSA C22.2 No. 213 and has been found that under normal operation will not create a spark capable of igniting a specified test gas.

WARNING

Disconnecting or reconnecting wiring or removing or inserting printed circuit boards is not considered normal operation. These operations should only be done if power has been removed from all wiring or if the flammable atmosphere is known not to be present.

AVERTISSEMENT

Le débranchement ou le rebranchement des fils et le retrait ou l'insertion des cartes de circuits imprimés n'entrent pas dans les procédures normales. Dans le cas où l'atmosphère est inflammable, on ne doit effectuer les procédures ci-dessus que si l'alimentation a été interrompue.

Disconnecting the wiring connected to the Type EQN Transmitter would be permitted if the circuits were Nonincendive Field Circuits. The National Electrical Code (NEC) would refer to such circuits as simply Nonincendive Circuits. Guidelines are provided for making this determination in ISA Standard S12.12-1984. Essentially, circuits are made nonincendive by limiting the current which would flow if the wires were shorted, opened or grounded. In general, if the supply lead has a minimum of 130 ohms in series, the circuit would be nonincendive for Groups A through D. If the supply lead has a minimum of 50 ohms in series, the circuit would be nonincendive for Groups C and D. Such circuits may use any wiring method and may be installed and tested while powered. Care must be taken to ensure that only one circuit is worked on at a time. Shorting of separate circuits is not part of the evaluation and could result in ignition capable arcs.

The +24 VDC power connected to the Type EQN Transmitter is normally assumed to be at ignition capable levels. Therefore, this wiring must be suitable for use Class I, Division 2, hazardous locations. The National Electrical Code required the use of rigid metal conduit or non-metallic cable (Types MV, PLTC, SNM, TC) or metallic cable (Types MI, MC). The Canadian Electrical Code requires non-metallic cable certified as "HL" or metal conduit.

Explosionproof/Dust-ignition Proof

A proper explosionproof installation must comply with national codes such as NFPA 70 (ANSI C1) and local regulations for electrical installations in hazardous locations. The essential parts of such an installation are:

1. All tapered conduit connections must be made with at least five fully engaged threads.
2. All unused conduit openings must be closed by a 1/2-inch NPT stainless steel pipe plug with at least five fully engaged threads.
3. The enclosure covers must be fully threaded on the enclosure with at least seven fully engaged threads.
4. All conduit connections must be properly sealed no further than 18 inches (45 cm) from the enclosure.
5. Tapered threaded connections (such as pipe plugs and thermowells) must engage at least five full threads.

WARNING

Explosionproof/dust-ignition proof installations and intrinsically safe installations in Class II or III hazardous locations require that the assembly be kept tight while circuits are live unless the location is known to be non-hazardous at the time.

AVERTISSEMENT

En ce qui concerne l'installation anti-explosion et anti-ignition provoquée par la poussière dans des endroits de Classe II ou III, il est indispensable que l'assemblage soit tenu étanche pendant que les circuits sont électrifiés, à moins que cet endroit ne présente aucun danger à ce moment-là.

For prompt, personal attention to your instrumentation and control needs or a full listing of Bailey representatives in principal cities around the world, contact the Bailey location nearest you.

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