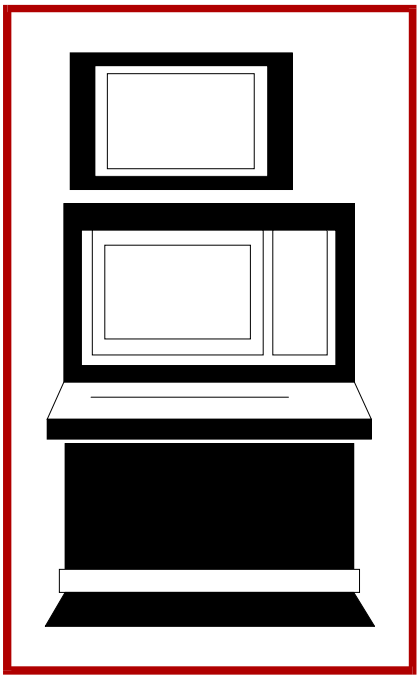
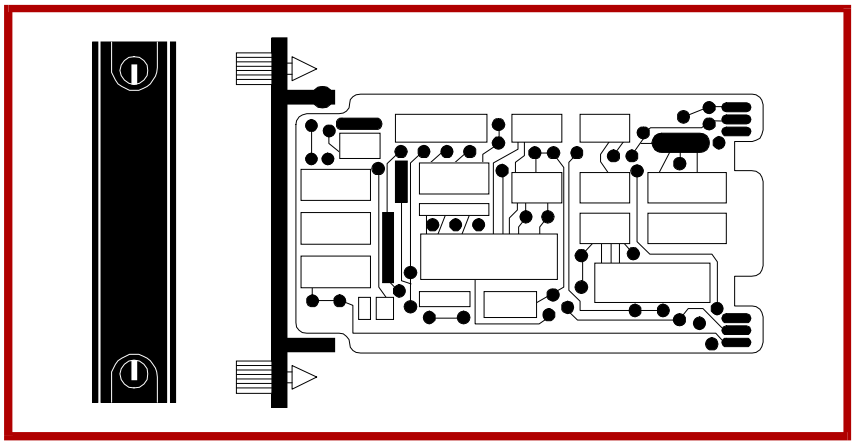
Bailey® infi 90®

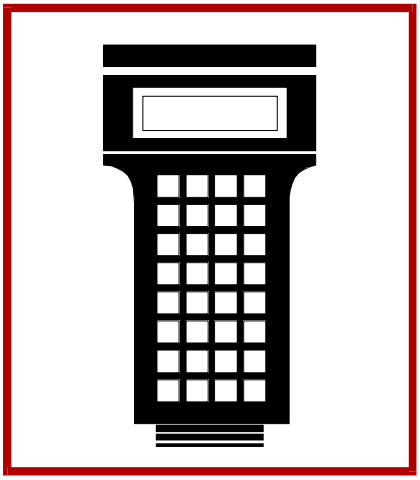
E96-302

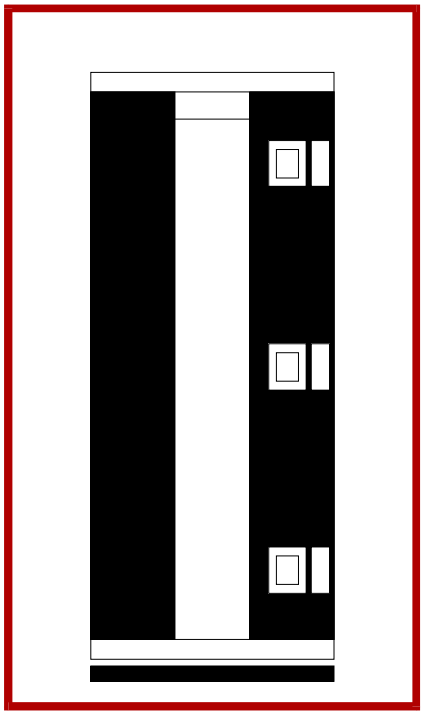
Instruction

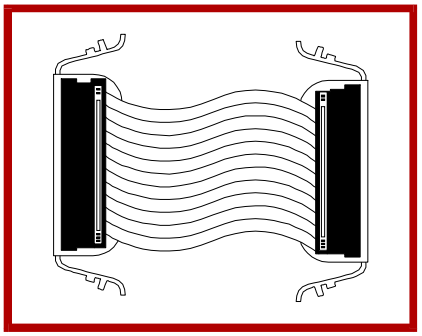
Field Bus Slave Module
(IMFBS01)

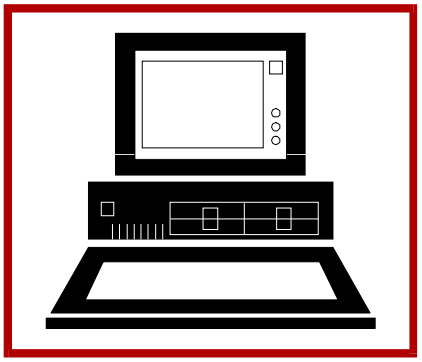












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WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

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

NOTES highlight procedures and contain information that assists the operator in understanding the information contained in this instruction.

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Preface

The IMFBS01 Field Bus Slave (FBS) Module supplies 15 field inputs to the INFI 90® strategic process management system. It links process data and communication from Bailey-Fischer & Porter smart transmitters to all multi-function processors (MFP), or the IMMFC03, IMMFC04 and IMMFC05 multi-function controller (MFC) modules. The field bus I/O module operates in one of three modes: FSK field bus mode (FSK digital data and communication), FSK analog point-to-point mode (analog inputs with or without FSK digital communication available) and baseband analog point-to-point mode (analog inputs with or without baseband communication available).

This instruction explains the FBS features, specifications and operation. It explains how to set up and install an FBS module, and covers troubleshooting procedures.

The system engineer or technician using the FBS module should read and understand this instruction before installing and operating the module. In addition, a complete understanding of the INFI 90 system is beneficial.

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List of Effective Pages

Total number of pages in this instruction is 54, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through vi	Original
1-1 through 1-7	Original
2-1 through 2-12	Original
3-1 through 3-5	Original
4-1 through 4-2	Original
5-1 through 5-3	Original
6-1 through 6-4	Original
7-1 through 7-4	Original
8-1	Original
9-1	Original
A-1 through A-3	Original
B-1 through B-2	Original
C-1 through C-2	Original
Index-1 through Index-2	Original

When an update is received, insert the latest changed pages and dispose of the 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 beside the page number.

Safety Summary

GENERAL WARNINGS	**Equipment Environment** All components, whether in transportation, operation or storage, must be in a noncorrosive environment. **Electrical Shock Hazard During Maintenance** Disconnect power or take precautions to insure that contact with energized parts is avoided when servicing.
SPECIFIC WARNINGS	Disconnect power before installing dipshunts on the module mounting unit backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock. (p. 3-5) Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board. (p. 7-1)

Sommaire de Sécurité

AVERTISSEMENTS D'ORDRE GÉNÉRAL	**Environnement de l'équipement** Ne pas soumettre les composants à une atmosphère corrosive lors du transport, de l'entreposage ou l'utilisation. **Possibilité de chocs électriques durant l'entretien** Débrancher l'alimentation ou prendre les précautions pour éviter tout contact avec des composants sous tension durant l'entretien.
AVERTISSEMENTS D'ORDRE SPÉCIFIQUE	Interrompez l'alimentation avant d'installer des dipshunts sur le fond de panier du châssis de montage des modules. Sinon, tout contact avec cette zone entraîne des risques d'électrocution sérieuse ou fatale. (p. 3-5) Des lunettes de protection devraient être portées lors de travail avec des solvants nettoyants. Lorsqu'on enlève les solvants des circuits imprimés à l'aide d'air comprimé, les éclaboussures de solvant pourraient causer des blessures aux yeux. (p. 7-1)

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SECTION 1 - INTRODUCTION

OVERVIEW

The IMFBS01 Field Bus Slave (FBS) Module inputs 15 channels of analog or frequency shift keyed (FSK) digital signals to the multi-function processor (MFP) or multi-function controller (MFC) module. It is a dedicated module that connects field equipment and Bailey-Fischer & Porter smart transmitters to controlling modules (MFP/MFC) within the INFI 90/ Network 90® system.

The module also provides a signal path from an INFI 90 operator interface, such as an operator interface station (OIS) or configuration and tuning terminal (CTT), through an MFC or MFP module and I/O interface to Bailey-Fischer & Porter smart transmitters. Figure 1-1 shows how the FBS module fits within the INFI 90 system.

The FBS module communicates with the Bailey-Fischer & Porter line of FSK digital transmitters in a field bus or point-to-point configuration. Communication is also available with Bailey-Fischer & Porter baseband smart transmitters (point-to-point).

INTENDED USER

Installation and application personnel should have a solid background in electronic instrumentation and process control. They should be familiar with proper grounding and safety procedures for electronic instrumentation. Operators should have a knowledge of the process and should read and understand this instruction before placing the module in operation.

HARDWARE DESCRIPTION

The FBS module is an intelligent module, with on-board microprocessor, memory, analog-to-digital converter and communication circuitry. The module is a single printed circuit board that occupies one slot in a module mounting unit (MMU). Two captive latches on the module faceplate secure it to the module mounting unit.

The module has three card edge connectors for external signals (transmitter inputs and communication), system communication (I/O expander bus) and power. The module receives input through a cable connection to a termination unit (TU) or termination module (TM). Wiring from the field devices connect to terminal blocks on the termination unit or termination module.

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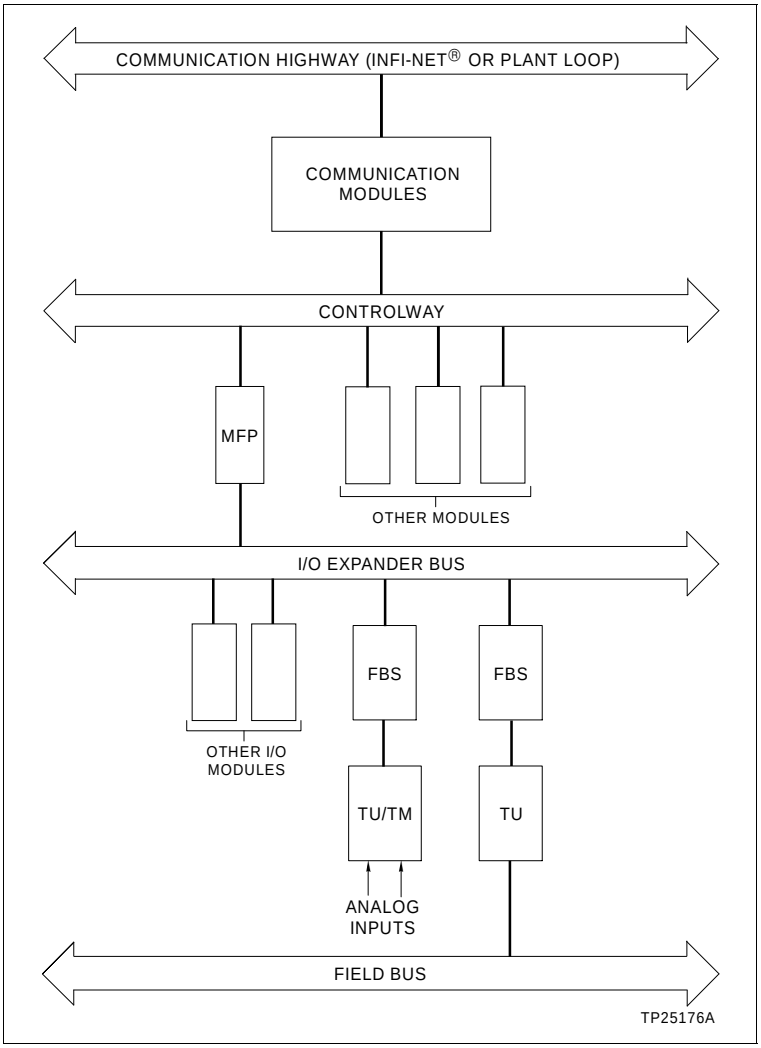

Figure 1-1. INFI 90 Communication Levels

The circuit board contains four jumpers that allow selecting the mode of operation and communication. A dipswitch setting holds the I/O expander bus address of the module.

HARDWARE APPLICATION

The FBS module interfaces analog and digital signals from field devices to the MFP or MFC module. The FBS module can interface Bailey-Fischer & Porter FSK smart transmitters and baseband smart transmitters, conventional transmitters and standard analog inputs (four to 20 milliamps, zero to one VDC, one to five VDC, zero to five VDC, zero to ten VDC and ±10 VDC).

The FBS module can operate in one of three modes: FSK field bus mode, FSK analog point-to-point mode, or baseband analog point-to-point mode. In the FSK field bus mode, a single

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two-wire input (bus) links a maximum of 15 FSK smart transmitters. All inputs (process data and module to transmitter communication) are in the frequency shift keyed format and share the field bus. Refer to the ***NTFB01 Field Bus Slave Termination Unit*** instruction for specific limitations on field bus communications. All field devices must be Bailey-Fischer & Porter FSK smart transmitters when using this mode.

In the FSK analog point-to-point mode, the FBS module can interface up to 15 discrete analog process inputs from FSK smart transmitters and communicate (digitally) with those transmitters. Additionally, the FBS module can interface a mixture of baseband smart transmitters, conventional transmitters and other external analog inputs while operating in this mode. These devices can input only process data to the FBS module; they cannot communicate to the module. In point-to-point operation, each device is individually wired to the analog input termination unit or module.

Baseband analog point-to-point mode allows the FBS module to emulate the IMASI02 Analog Input Slave Module. In this mode, the module can interface Bailey-Fischer & Porter FSK smart transmitters, baseband smart transmitters, conventional transmitters and other external analog inputs. Only the Bailey-Fischer & Porter baseband smart transmitters can communicate to the FBS module while it is operating in this mode. The FBS module can interface any mixture of these devices.

FEATURES

The design of the FBS module, as with all INFI 90 modules, allows for flexibility in creating a process management system. The module supports Bailey-Fischer & Porter FSK digital smart transmitters, baseband smart transmitters, conventional transmitters and standard voltage or current inputs. The option of selecting one of three FBS module operating modes is available.

The FSK digital capability eliminates conversion errors and increases process control accuracy. Access is always available to the real time process status. In the field bus mode, all information (including the process variable) is transmitted digitally between the FBS module and the field devices.

The FBS module stores process data, control commands and transmitter configuration data in memory. It works to restore communication with a transmitter if a communication failure occurs. Upon restoring communication with a failed transmitter, the FBS module checks the transmitter configuration before the controlling module (MFP/MFC) resumes updating the process control.

INSTRUCTION CONTENT

This instruction consists of nine sections and three appendices.

Introduction — Overviews the FBS module. It contains features, a description, reference documents and specifications.

Description and Operation — Explains the theory of module operation.

Installation — Covers handling precautions, switch and jumper settings, installing and checking the FBS inputs.

Calibration — Explains how to calibrate the FBS inputs.

Operating Procedures — Explains how to start up and operate the FBS module.

Troubleshooting — Describes how to monitor transmitter errors from the status reports. It explains how to check for FBS errors and the corrective action to take.

Maintenance — Contains a maintenance schedule for the FBS module.

Repair and Replacement Procedures — Explains how to replace a module needing repair.

Support Services — Provides information about ordering parts from your local Bailey Controls Company sales office. It also explains other areas of support that Bailey Controls Company provides.

Appendix A — Shows the dipshunt settings, terminal wiring for the analog input termination unit and the cabling needed for the FBS module.

Appendix B — Shows the dipswitch settings, terminal wiring for the analog input termination module and the cabling needed for the FBS module.

Appendix C — Shows the jumper settings, terminal wiring for the field bus termination unit and the cabling needed for the FBS module.

HOW TO USE THIS INSTRUCTION

Read this instruction before placing the FBS module in operation. Refer to the sections in this list as needed for more information.

1. Read Section 5 before placing the FBS module in operation.
2. Do the steps in Section 3.
3. Do the steps in Section 4 if required.

4. Refer to Section 6 for what to do if a problem occurs.

5. Refer to Section 7 for the scheduled steps needed to maintain the FBS module.

6. Refer to Section 8 for how to replace a module.

7. Use Section 9 for parts ordering information. This section also tells of additional services that Bailey Controls Company offers.

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-1 contains those terms and abbreviations that are unique to Elsag Bailey or have a definition that is different from standard industry usage.

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
Control Module	Directs field processes through an I/O module; the multi-function processor is an example.
Field Bus	A signal line or set of signal lines used by an interface system to which many devices are connected and over which messages are carried.
Function Code	An algorithm which manipulates specific functions. These functions are linked together to form the control strategy.
I/O Expander Bus	Parallel communication bus between the control and I/O modules.
MFC	Multi-function controller module. A multiple loop controller with data acquisition and information processing capabilities.
MFP	Multi-function processor module. A multiple loop controller with data acquisition and information processing capabilities.
MMU	Module mounting unit. A card cage that provides electrical and communication support for INFI 90/Network 90 modules.
OIS	Operator interface station. Integrated operator console with data acquisition and reporting capabilities. It provides a digital access into the process for flexible control and monitoring.
Smart Transmitter	A field measuring device that utilizes digital communication to transmit information.
TM	Termination module; provides input/output connection between plant equipment and the INFI 90/Network 90 modules.
TU	Termination unit; provides input/output connection between plant equipment and the INFI 90/Network 90 modules.

REFERENCE DOCUMENTS

Table 1-2 lists Elsag Bailey instructions referenced in this instruction.

Table 1-2. Reference Documents

Number	Title
C-E96-110	Operator Interface Station
C-E96-800	Engineering Workstation
I-E21-28	Smart Transmitter Terminal, Type STT02
I-E21-28-1	Smart Transmitter Terminal, Type STT02E
I-E92-501-2	Configuration and Tuning Terminal, Type CTT02
I-E93-714	Personal Computer Software Smartport (SEEK)
I-E96-200	Function Code Application Manual
I-E96-201	IMMFP01 Multi-Function Processor
I-E96-202	IMMFP02 Multi-Function Processor
I-E96-211	IMMFC03 Multi-Function Controller
I-E96-212	IMMFC04 Multi-Function Controller
I-E96-213	IMMFC05 Multi-Function Controller
I-E96-416	NTAI05 Analog Input Termination Unit
I-E96-432	NTFB01 Field Bus Slave Termination Unit
I-E96-436	NIAI04 Analog Input Termination Module
P-E21-001	Installing a 4 to 20 mA Transmitter in a Hazardous Location

NOMENCLATURE

Table 1-3 contains the nomenclature used in this instruction. The modules, equipment and software packages listed can be used with an FBS module.

Table 1-3. Nomenclature

Nomenclature	Hardware
BC, BCN	Smart pressure transmitters
EQ, EQN	Smart temperature transmitters
MFC	Multi-function controller module
MFP	Multi-function processor module
NIAI04	Analog inputs termination module
NTAI05	Analog inputs termination unit
NKTM01, NKTU02	Analog inputs termination module cable
NKTU01	Analog inputs/field bus termination unit cable
NTFB01	Field bus termination unit
PTS	Smart pressure transmitters
SEEK0□	Smartport software
STT02E	Smart transmitter terminal
TBN	Smart pH transmitters

SPECIFICATIONS

Table 1-4 contains the specifications for the IMFBS01 module.

Table 1-4. Specifications

Property	Characteristic/Value
Power requirements	
Operating power	5 VDC, ±5% at 85 mA typical +15 VDC, ±5% at 25 mA typical -15 VDC, ±5% at 20 mA typical
Power dissipation	1.1 W typical
Installation category	III for power per ANSI/ISA S:2.01-1994
Operating	
Analog inputs	15 independently configured channels
Analog input ranges	4 to 20 mA, 1 to 5 VDC, 0 to 1 VDC, 0 to 5 VDC, 0 to 10 VDC, -10 to +10 VDC
Analog updates	A/D conversions 5 times/sec
FSK digital updates	3 to 10 times/sec (in field bus configuration)
A/D resolution	14 bits with polarity
Analog accuracy	4 to 20 mA 0.1% 1 to 5 VDC 0.1% 0 to 5 VDC 0.1% 0 to 10 VDC 0.1% ±10 VDC 0.1% 0 to 1 VDC 0.25%
Common mode voltage	-12 VDC minimum, +15 VDC maximum ±12 VDC (±1 VDC) input span ±10 VDC (±5 VDC) input span ±5 VDC (±10 VDC) input span
Common mode rejection	90 dB minimum at 60 Hz
Normal mode rejection	70 dB minimum at 60 Hz
Input impedance	Greater than 1 MΩ (every channel)
Installation category	III for inputs per ANSI/ISA S:2.01-1994
Environmental	
Electromagnetic/radio frequency interference	No values available at this time. Keep cabinet doors closed. Do not use communication equipment closer than 2 m (6 ft) from the cabinet.
Ambient temperature	0° to 70°C (0° to 158°F) (noncondensing)
Relative humidity	5% to 95% up to 55°C (131°F) 5% to 45% at 70°C (158°F) (noncondensing)
Atmospheric pressure	Sea level to 3 km (1.86 mi)
Air quality	Noncorrosive
Mounting	Occupies a single slot in a standard INFI 90 module mounting unit (MMU)
Certification	
Canadian Standards Association (CSA)	Certified for use as process control equipment in an ordinary (nonhazardous) location

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section explains the operation of the FBS module. The module does two major tasks. It provides an interface by which the controlling module (multi-function processor or multi-function controller module (MFP/MFC)) can input analog process data from external devices or smart transmitters. It also serves as a communication link between the INFI 90 control system and field devices.

The FBS module has three modes of operation: FSK field bus mode, FSK analog point-to-point mode and baseband analog point-to-point mode.

SYSTEM OPERATION

The digital interface, made up of the FBS module and the controlling module, provides a communication path between an INFI 90 operator interface and Bailey-Fischer & Porter smart transmitters as shown in Figure 2-1. Commands can be sent from an operator interface to change transmitter parameters or to rerange a transmitter output. In return, the transmitters send process and status data to the operator interface through the FBS module and controlling module (MFP/MFC). The controlling module communicates with the FBS module over the I/O expander bus.

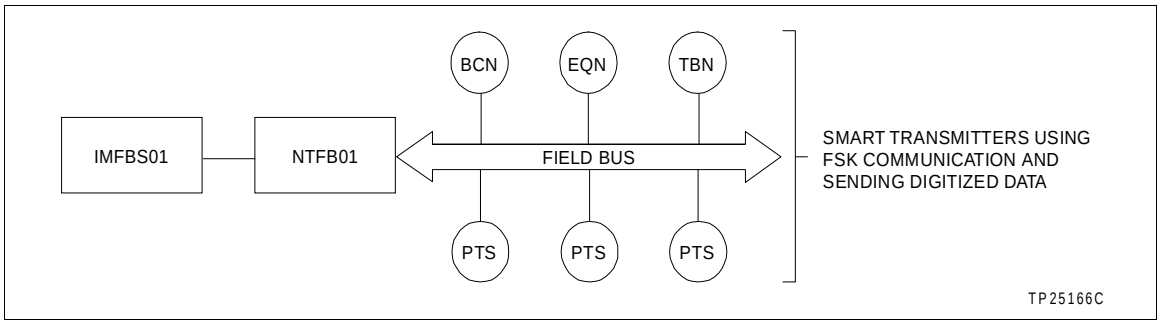

Figure 2-1. Field Bus Mode

MFP/MFC Module

The controlling module (MFP/MFC) directs the operation of the smart transmitters and holds their operating strategy. The configuration of function code 133 (smart transmitter definition) in the controlling module determines the operating strategy of each smart transmitter. Function code 132 (analog input/slave) reads the inputs of the FBS module. Operation

begins when the controlling module is placed in the execute mode with function code 132, and optionally with function code 133, in its configuration. When the controlling module enters the execute mode, it downloads the operating strategy to the FBS module.

IMFBS01 Module

Upon receiving initialization from the controlling module (MFP/MFC), the FBS module stores that information in memory and checks the configuration of each input channel. If all input channels check good, operation begins. If the FBS module detects a configuration error, that error appears in the module status report.

Under normal operation, the controlling module sends transmitter commands and requests process input data and status information from the FBS module. The FBS module continuously reads each input channel, does the necessary conversions and stores the data in memory. When the controlling module makes a request for data, the FBS module sends it the most current information that it has in memory.

If a communication failure with one of the smart transmitters occurs, the FBS module works to restore communication while continuing normal operation. It checks the transmitter configuration upon restoring transmitter communication and normal process control continues.

Smart Transmitter

FSK smart transmitters communicate with the FBS module at a rate of 9600 baud. Baseband smart transmitters communicate at a rate of 600 baud. To prevent changes to the transmitter configuration during normal operation, the module sends a security byte to the transmitter at the beginning of each transmitter communication.

The security byte triggers the smart transmitters to take configuration commands only from the module, unless the FBS module turns the transmitter off-line. The security byte locks out configuration commands from other operator interface devices such as a smart transmitter terminal (Types STT02 and STT02E). All devices can monitor the transmitter. When the transmitter receives the security byte, it sets a two-minute timer. The timer counts down until another command is received to reset the timer. Normally the timer does not expire because the module resets it before the two-minute timer expires.

NOTE: Both the Types STT02 and STT02E terminals are referred to in this instruction. Differences are noted as they occur.

In the event a module failure occurs, the transmitter timer expires after two minutes. The transmitter resets itself and receives configuration commands from other devices such as the smart transmitter terminal.

IMFBS01 MODES OF OPERATION

The FBS module has three operating modes: FSK field bus mode, FSK analog point-to-point mode and baseband analog point-to-point mode (analog I/O input emulation mode). Mode selection is through FBS circuit board jumpers. Function code 132 must be configured in the MFP or MFC device for every five analog inputs.

FSK Field Bus Mode

The FSK field bus mode allows pure digital communication with Bailey-Fischer & Porter FSK smart transmitters on a bus (Fig. 2-1). Examples of the FSK line of smart transmitters are the PTS and BCN smart pressure transmitters, EQN smart temperature transmitter and Type TBN580 smart pH/ORP smart transmitter. In the FSK field bus mode, all transmitters reside on the field bus. The process variable signal from each transmitter is sent to the FBS module in an FSK digital format. Since all 15 input channels are FSK digital, no channel can accept an analog input signal when the module is in this mode. The NTFB01 terminals provide a bus to connect the FSK smart transmitters to the FBS module. Function codes 132 and 133 must be configured in the MFP or MFC device for every five analog inputs from each transmitter.

FSK Analog Point-to-Point Mode

The FSK analog point-to-point mode enables the FBS module to input standard analog inputs, such as four to 20 milliamp signals, and use digital communication with Bailey-Fischer & Porter FSK style smart transmitters (Fig. 2-2). In this mode,

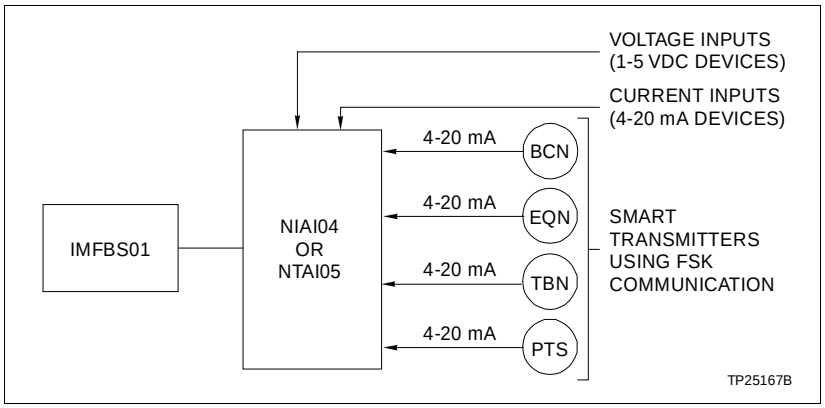

Figure 2-2. FSK Analog Point-to-Point Mode

the analog signal from each smart transmitter goes to an individual input channel (point-to-point). Because the inputs are analog point-to-point, the FBS module can interface any combination of devices while it is in this operating mode. For example, in addition to FSK smart transmitters, baseband smart and conventional transmitters can input process data but cannot communicate with the FBS module. The NTAI05 termination unit or NIAI04 termination module provides point-to-point termination. Dipshunts select the type of input signal for each channel. Function code 133 must be configured in the MFP or MFC device for every five analog inputs from each FSK device.

Baseband Analog Point-to-Point Mode

The baseband analog point-to-point mode emulates the operation of the IMASI02 Analog Input Slave Module, which was the predecessor to the FBS module. When operating in this mode, the FBS module can interface any combination of Bailey-Fischer & Porter FSK smart transmitters, baseband smart transmitters, conventional transmitters and other analog inputs. The FBS module inputs analog process data point-to-point and communicates to the baseband smart transmitters (Fig. 2-3). Examples of these transmitters are the BC smart pressure transmitter, EQ2 smart temperature transmitter and smart pH/ORP/pION transmitter. The NTAI05 termination unit or NIAI04 termination module provides point-to-point termination. Dipshunts or dipswitches select the type of input signal for each channel. Function codes 132 and 133 must be configured in the MFP or MFC device for every five analog inputs from each baseband transmitter.

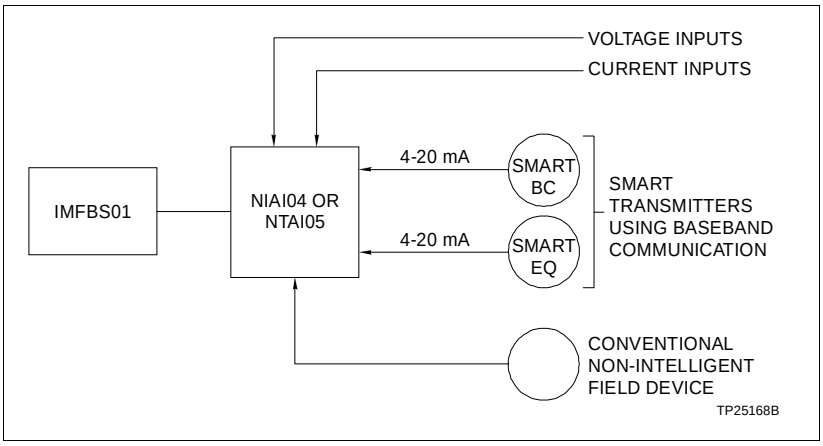

Figure 2-3. Baseband Analog Point-to-Point Mode

IMFBS01 OPERATION

The FBS module can be divided into five functional blocks. Figure 2-4 shows a block diagram of the IMFBS01 module. The five functional blocks of the FBS module are:

- Module inputs/outputs (I/O).
- Communication circuitry.
- Microprocessor and control logic.
- Analog-to-digital converter.
- I/O expander bus interface.

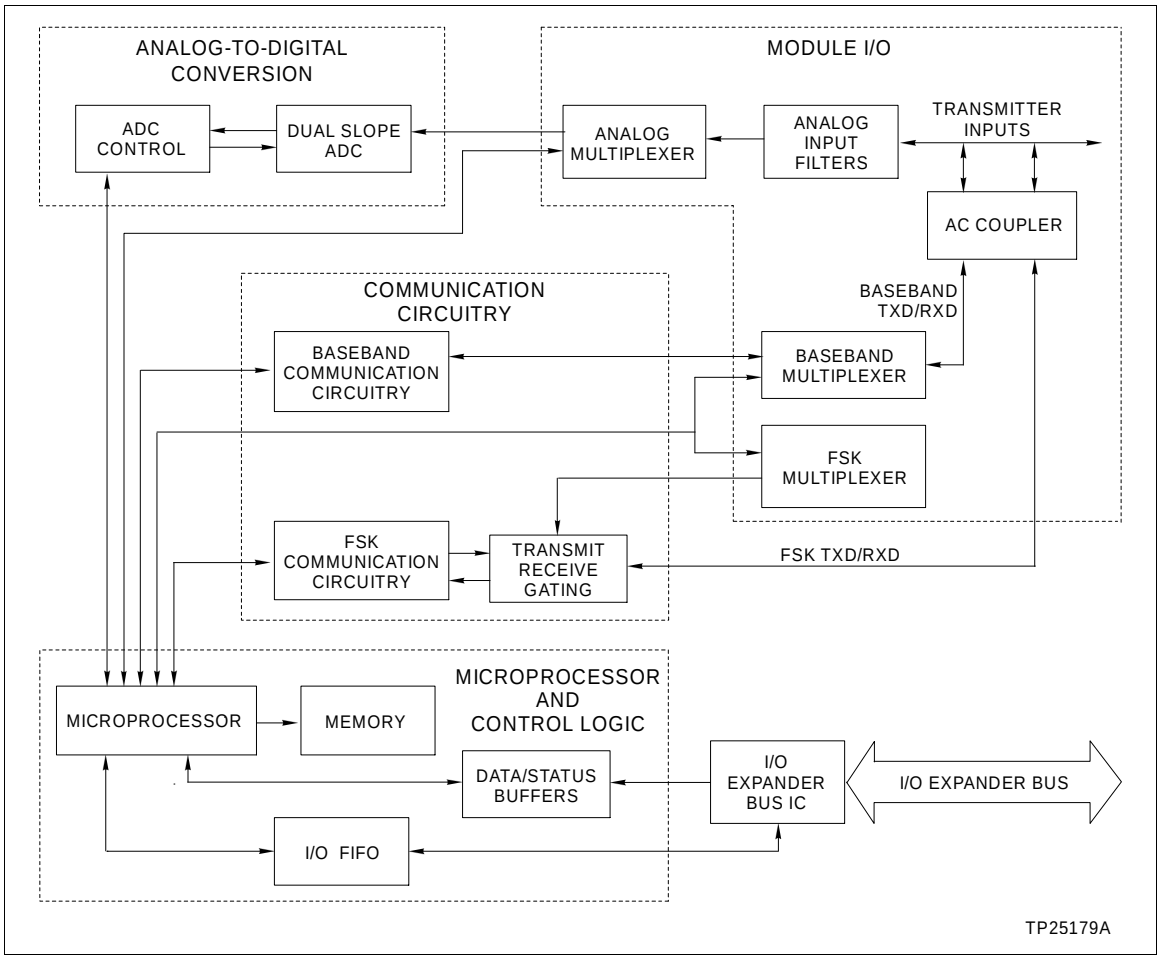

Figure 2-4. IMFBS01 Functional Block Diagram

The FBS module interfaces Bailey-Fischer & Porter smart transmitters to the controlling module (MFP/MFC). It does this by encoding and decoding communication and data that is going to and coming from the transmitters. Under normal operation, the FBS module continuously inputs, converts and stores data so that it is available to the controlling module. The controlling module requests process data, transmitter status, does calibrations and sends operating commands through the I/O expander bus interface.

The microprocessor directs and coordinates the operation of the functional blocks that make up the FBS module. The module stores (in memory) the transmitter configurations it receives from the controlling module during start-up. The microprocessor uses this information to monitor transmitter status. The FBS module can initiate action to correct nonfatal errors it detects during normal operation such as a communication error from a transmitter.

The microprocessor selects an individual input channel through a multiplexing scheme. There are several sets of multiplexers that handle the various inputs for each mode of operation. On-board jumpers set the module operating mode (define the type of input). Thus, when an input type is selected, the microprocessor directs all inputs to the proper conversion or decoding circuitry. Inputs pass through analog-to-digital conversion if they are analog inputs or through FSK decoding if they are digital. On-board jumpers also set the communication mode (FSK or baseband). The microprocessor directs communication by multiplexing the signals to the proper communication circuitry for decoding (or encoding).

A dual slope analog-to-digital converter (ADC) handles conversion of analog inputs. It has 14-bit resolution and polarity detection. An analog-to-digital control chip contains logic that the microprocessor uses to control the ADC circuitry. The FBS module stores the data it receives from the ADC circuitry in memory. When the controlling module requests process data from a particular input channel, the FBS module sends it the most current data that it has in memory.

MODULE CIRCUITRY

The following sections explain the operation of the five functional blocks that make up the FBS circuitry.

Microprocessor and Control Logic

The on-board microprocessor and control logic coordinates module functions. The microprocessor has four main functions:

- Storing the digital data in random access memory (RAM).
- Coordinating analog-to-digital conversion through the analog-to-digital control chip.
- Preparing digital commands to send to the smart transmitters.

- Reading and sending data to the controlling module (MFP/MFC).

The microprocessor directly links to eight kilobytes of random access memory. This memory serves as a storage area for process data and transmitter configuration information.

The microprocessor coordinates analog-to-digital conversions through ADC circuitry. The microprocessor takes the converted process data it receives from the ADC circuitry and places it into a memory buffer. It remains in memory until the controlling module makes a request for process data or the microprocessor updates it with a new value. When the microprocessor receives a request for process data, it transfers that data from the memory buffer to a first in first out (FIFO) shift register where the controlling module can access it through the I/O expander bus interface.

The MFP module communicates with the FBS module over the I/O expander bus. An Elsag Bailey designed integrated circuit interfaces the microprocessor to the I/O expander bus. All MFP commands and process data pass through the I/O expander bus interface and first in first out inputs or outputs.

The microprocessor sends command signals to the smart transmitters through the FBS module communication circuitry and the FSK or baseband multiplexers (depending on jumper settings). One of two sets of communication circuitry converts commands from the microprocessor into FSK or baseband signals. The microprocessor directs the command transmission to the proper channel through the FSK and baseband multiplexers.

Module Input/Output Circuitry

Process inputs to the FBS module can be frequency shift keyed digital signals (on a bus) or analog signals (point-to-point). The module input circuit provides two paths for process data inputs. One path handles analog inputs when the FBS module is in the point-to-point mode. The other path handles FSK digital signals when the FBS module is in the field bus mode. On-board jumpers set the operating mode.

> **NOTE:** In field bus mode, the FBS module can handle up to 15 transmitters. The Type STT02E terminal can program a maximum of eight transmitters on a single field bus. Refer to the ***Smart Transmitter Terminal, Type STT02*** instruction for more information (Table 1-2).

FSK DIGITAL INPUTS (FIELD BUS MODE)

In the field bus mode, all data and communication are FSK encoded digital signals on a shared bus and require decoding. The microprocessor can read any input by specifying the bus address of the device. The signal enters the FSK communication circuitry through a transmit/receive gate that works with the multiplexer and communication circuitry.

Figure 2-5 shows the digital input circuit with the FSK multiplexer and FSK transmit/receive gate. After decoding the digital input, the FBS module can store that data in memory or send it directly to the controlling module (MFP/MFC) through the I/O expander bus interface.

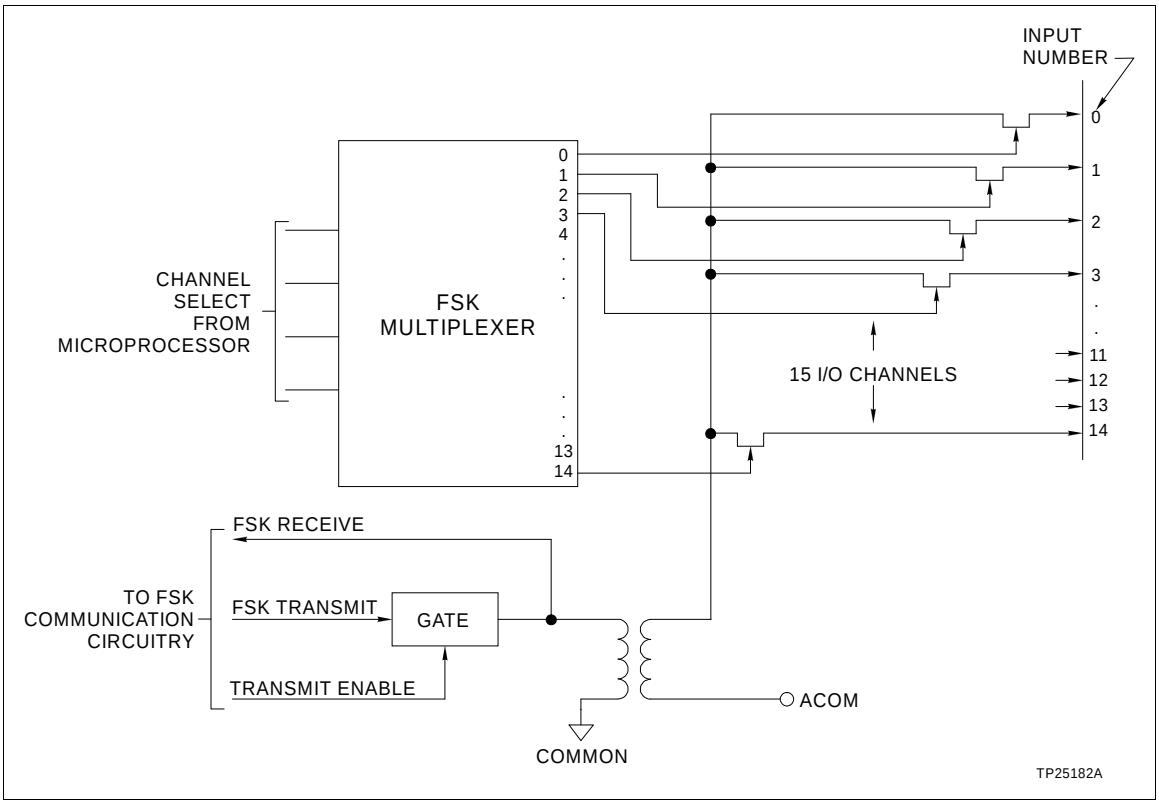

Figure 2-5. Digital Input Circuit

ANALOG INPUTS (POINT-TO-POINT MODE)

All analog inputs are point-to-point. When operating in the FSK or baseband mode, the FSK baseband digital communication signal rides on a small portion of the analog input signal. Each channel has an analog input filter that separates the communication signal from the process data (analog input) before the data goes to the analog-to-digital converter (ADC). In the FSK communication mode, that input also passes through the FSK communication circuitry for decoding. In the

baseband communication mode, the input passes through the baseband communication circuitry for decoding. The microprocessor coordinates operation of point-to-point input and output through three sets of multiplexers (analog input, FSK and baseband).

Figure 2-6 shows a typical analog input filter circuit. The circuit shown in Figure 2-6 connects to the FBS termination (point-to-point) through the P3 connector. Each analog input has overvoltage protection to protect the FBS circuitry. The analog signal passes through two low pass filters that separate communication from data. The microprocessor multiplexes the filtered input signal (process data) to the ADC circuitry for conversion.

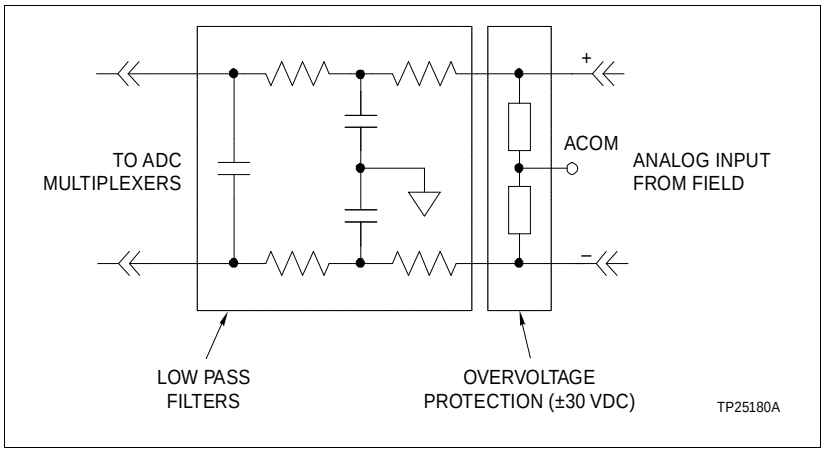

Figure 2-6. Analog Input Filter and Overvoltage Protection

The FBS module does analog-to-digital conversions on each input channel continuously at five times per second. After converting the analog signal to a digital equivalent, the FBS module stores that value in memory. When in the point-to-point-mode, the FBS module can input any of these signal types: four to 20 milliamps, zero to one DC, zero to five VDC, zero to ten VDC, one to five VDC, or -10 to +10 VDC. Function code 132 allows selecting the signal type for each channel.

Communication Circuitry

There are two sets of communication circuitry: one for FSK digital communication and one for baseband communication. The mode of communication is selected through an on-board jumper.

FSK COMMUNICATION

The FBS module can use FSK digital communication in the field bus mode or point-to-point mode. When the microprocessor enables the FSK receive gate, digital signals from an FSK style smart transmitter enter the FSK communication circuitry. Table 2-1 lists the firmware requirements for FSK communications. Figure 2-7 shows that these signals pass through a set of high and low pass filters to a voltage comparator. The voltage comparator outputs a DC voltage that follows the frequency of the input signal and shapes the signal for the decoding logic. Figure 2-8 shows the decoding logic presents a nine-bit digital word to the microprocessor. The microprocessor reads the incoming communication at a rate of 9600 baud.

Table 2-1. Firmware Revision Level Requirements

Device	Revision[1]
BCN/EQN	A16
IMFBS01	A14
IMMFC03	L.1
IMMFC04	F.1
IMMFC05	E.1
IMMFP01/02	D.1
PTS	All
Smartport[2,3]	2.0
STT02□[4]	D10
STT02	C11
TBN580/581	B11

NOTES:
1. Firmware revision levels that are higher than those listed also support FSK communications.
2. Smartport requires firmware revision E.1 in IMMFP01/02/03.
3. Smartport is not supported by IMMFC03/04/05.
4. STT02□ models include the E, F and S models. These are English, French and Spanish versions.

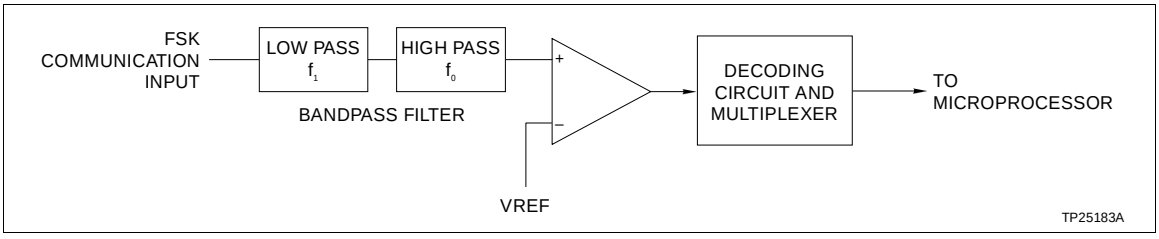

Figure 2-7. FSK Communication Circuitry

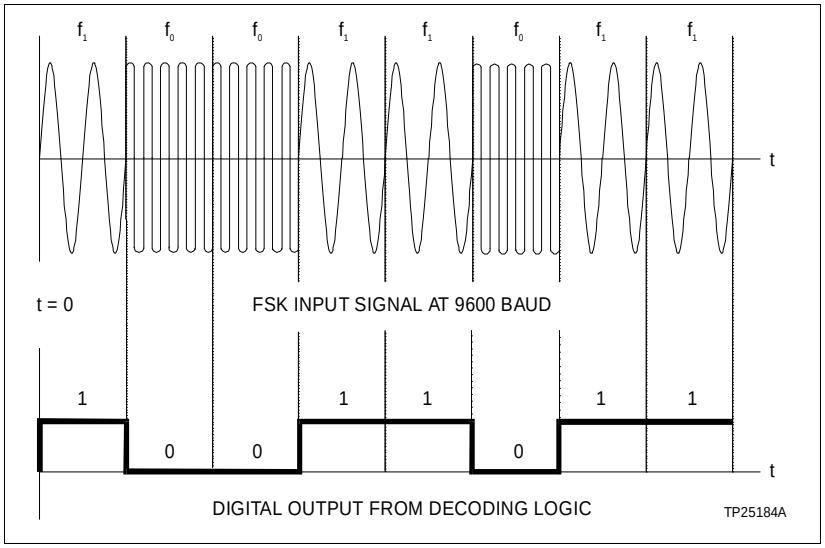

Figure 2-8. FSK Signal and Decoded Digital Equivalent

To transmit, the microprocessor enables the FSK transmit gate. The microprocessor transmits a digital signal that passes through encoding logic to an oscillator circuit. A digital value on the input of the oscillator causes it to transmit a keyed frequency. As the digital input to the oscillator changes its state, the oscillator shifts its output frequency to represent that new state. For example, the oscillator outputs a frequency of 19 kilohertz when its input is a logic one. It outputs a frequency of 30.5 kilohertz when its input is a logic zero.

BASEBAND COMMUNICATION

The microprocessor can directly encode and decode baseband communication. The ASI communication circuitry shapes the baseband signal before it reaches the AC coupler circuit. The AC coupler combines the baseband and analog signals for point-to-point transmission.

Analog-to-Digital Converter

The FBS module can digitize analog values within the range of -10 to +10 volts. Figure 2-9 shows the analog-to-digital conversion circuitry. The analog-to-digital control chip provides the logic needed to control the dual slope integrator. The analog-to-digital conversion takes place in three stages: input integration, de-integration with a +10 or -10 volts reference and zeroing the integrator/de-integrator.

The microprocessor signals the ADC circuitry to begin converting inputs. The ADC circuitry selects the input, reference voltage and conversion operation through the select multiplexer. The input signal from the select multiplexer passes through buffers and a differential amplifier that converts the input

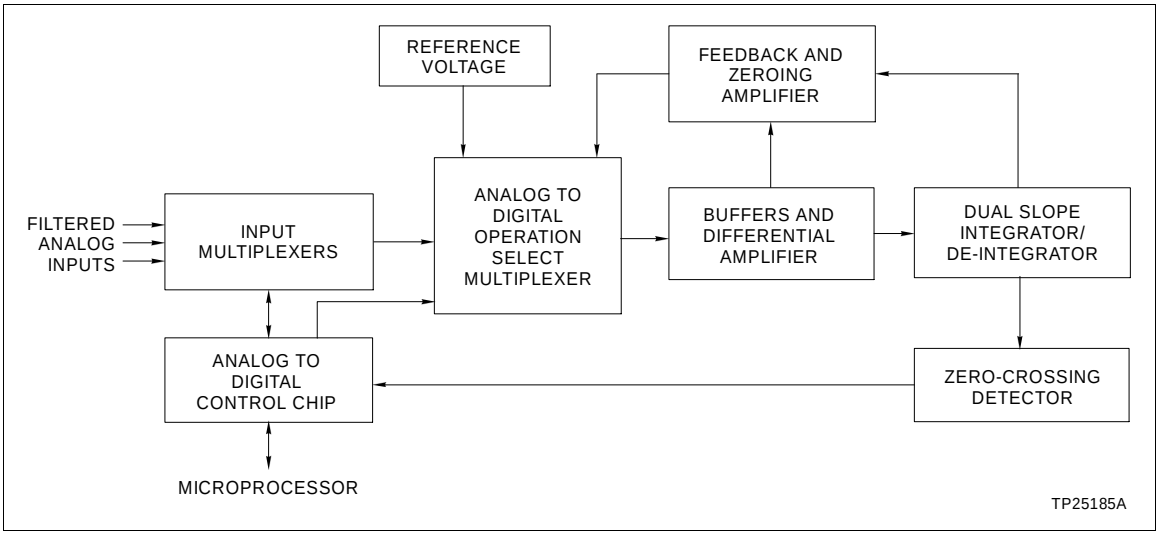

Figure 2-9. Analog to Digital Conversion Circuitry

signal to a single ended voltage. Then the signal goes to the input of the integrator/de-integrator stage.

The ADC circuitry selects a positive or negative reference voltage for this stage. Once the integrator is set to zero, the ADC circuitry allows the integrator to run until its output reaches the reference voltage. At this point, the ADC circuitry selects the de-integration operation and begins a count until the zero crossing circuit detects the signal at zero. A feedback and zeroing amplifier sets the integrator to zero and the process repeats with the opposite polarity of the input and reference voltage.

The count that the ADC circuitry takes during the de-integration operation is the digital equivalent of the input. It sends that information and the polarity to the microprocessor. The microprocessor places it into memory and signals the ADC circuitry to begin the next conversion.

I/O Expander Bus Interface

The FBS module uses a semicustom gate array for the I/O expander bus interface. An integrated circuit (IC) holds all the control logic and communication protocol. This IC circuit provides the following functions:

- Address comparison and detection.
- Function code latching and decoding.
- Read strobe generation.
- Data line filtering of bus signals.
- On-board bus drivers.

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains how to install the FBS module. ***Do not proceed*** with operation until reading, understanding and doing the steps in the order in which they appear.

SPECIAL HANDLING

Use the static grounding wrist strap when installing and removing modules. Static discharge may damage static sensitive devices on modules in the cabinet. Use grounded equipment and static safe practices when working with static sensitive devices. Observe these steps when handling electronic circuitry:

> **NOTE:** Always use Elsag Bailey's field static kit (part number 1948385_1 - consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipating work surface) when working with static sensitive devices. The kit is designed to connect the technician and the static dissipating work surface to the same ground point to prevent damage to the static sensitive devices by electrostatic discharge.

1. ***Use Static Shielding Bag.*** Keep the module in the static shielding bag until you are ready to install it in the system. Save the bag for future use.

2. ***Ground Bags Before Opening.*** Before opening a bag containing an assembly with static sensitive devices, touch it to the equipment housing or ground to equalize charges.

3. ***Avoid Touching Circuitry.*** Handle assemblies by the edges; avoid touching the circuitry.

4. ***Avoid Partial Connection of Static Sensitive Devices.*** Verify that all devices connected to the modules are properly grounded before using them.

5. Ground Test Equipment.

6. ***Use an Antistatic Field Service Vacuum.*** Remove dust from the modules if necessary.

7. ***Use a Grounded Wrist Strap.*** Connect the wrist strap to the appropriate grounding plug on the power entry panel. The grounding plug is connected to the cabinet chassis ground.

8. ***Do Not Use Lead Pencils to Set Dipswitches.*** To avoid contamination of switch contacts that can result in circuit board malfunction, do not use a lead pencil to set a dipswitch.

UNPACKING AND INSPECTION

For general handling:

1. Examine the module to make sure that no damage has occurred in transit.

2. Notify the nearest Elsag Bailey sales office of any damage.

3. File a claim for any damage with the shipping company that handled the shipment.

4. Use the original packing material to store the module.

5. Store the module in a place with clean air, free from extremes of temperature and humidity. Refer to Table 1-4 for the module specifications.

INSTALLATION IN HAZARDOUS LOCATIONS

One or more intrinsic safety barriers are required when the FBS module interfaces to transmitters or other external devices located in a Division I hazardous location (flammable atmosphere). Refer to the ***Installing a 4 to 20 mA Transmitter in a Hazardous Location*** application guide (Table 1-2) to determine the intrinsic safety barrier requirements for your application.

CONTROLLER MODULE (MFP/MFC) FIRMWARE REQUIREMENTS

Full FBS functionality requires the use of enhanced versions of function codes 132 and 133. The module firmware revision levels listed in Table 3-1 support the enhanced function codes.

Table 3-1. Firmware Revision Level Requirements

Controlling Module	Revision
IMMFC03	L.1
IMMFC04	F.1
IMMFC05	E.1
IMMFP01/02	

NOTE: Firmware revision levels higher than those listed also support the enhanced function codes.

IMFBS01 DIPSWITCH AND JUMPER SETTINGS

There is one dipswitch (S1) and four jumpers (J1-J4) that must be set before installing the FBS module. The single dipswitch sets the I/O expander bus address. The jumpers set the operating and communication mode.

Module Address Selection Switch (S1)

The FBS module must have a unique address on the I/O expander bus. The FBS module can have one of 64 addresses (zero to 63). This address identifies the FBS module to the control module and must be the same as the address set in the control module setup data (function code 132, specification S1). Set the address with the eight-position address dipswitch (S1) shown in Figure 3-1. Switch positions three through eight of S1 set the six-bit address. Positions one and two must remain in the closed position. Refer to Table 3-2 for examples of address settings. Record the I/O expander bus address of the FBS module in the space provided.

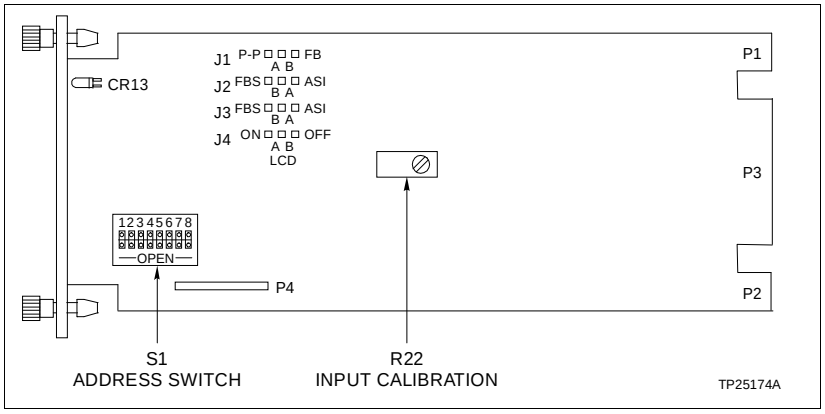

Figure 3-1. IMFBS01 Switch and Jumper Locations

Table 3-2. Sample Address Switch Settings (S1)

Address Example	Switch Position[1,2] (Binary Value)					
	3 (32)	4 (16)	5 (8)	6 (4)	7 (2)	8 (1)
08	0	0	1	0	0	0
32	1	0	0	0	0	0
63	1	1	1	1	1	1
User setting						

NOTES:
1. Switch positions 1 and 2 must be closed.
2. 0 = CLOSED or ON, 1 = OPEN or OFF.

Operating Mode Jumper (J1)

The operating mode jumper sets the FBS operation to point-to-point mode or field bus mode. Set jumper J1 for the desired operating mode. Table 3-3 lists the jumper settings for J1. Figure 3-1 shows the location of J1 on the FBS circuit board.

NOTE: Point-to-point mode must be selected if using baseband communication.

Table 3-3. IMFBS01 Jumper Settings

Jumper	Position	Function	User Setting
J1	P-P	Analog point-to-point mode. Module accepts analog inputs and communication is possible with FSK or baseband style smart transmitters.	
	FB	Field bus mode. No analog inputs are possible and module communicates with FSK style smart transmitters on a field bus.	
J2, J3	FBS	FBS module mode. Module will communicate only with FSK style smart transmitters on field bus or point-to-point.	
	ASI	Analog input module mode. IMFBS01 emulates IMASI02 and communicates only with baseband style smart transmitters point-to-point.	
J4	Off	Normal operating mode.	
	On	Factory test mode.	

NOTE: To select an option, use a jumper to short pins.

Communication Mode Jumper (J2 and J3)

The communication mode jumpers set the FBS communication mode to FSK digital or baseband. Set jumpers J2 and J3 for the desired communication mode. Table 3-3 lists the jumper settings for J2 and J3. Refer to Figure 3-1 for the location of J2 and J3 on the FBS circuit board. ***Both jumpers*** must be set to the same communication mode.

Factory Test Jumper (J4)

Jumper J4 is used for factory test purposes only. When in the on position, this jumper enables an LCD display that connects to P4 for diagnostic purposes. This is a factory test feature and should always be disabled during normal operation. If this jumper is in the on position during normal operation, it degrades the operation of the module because of the extra time required to run diagnostics. Table 3-3 shows the setting for J4.

Termination Unit or Module Installation

Wiring from field devices connect to the INFI 90 system through terminal blocks on a termination unit or module. If installing the FBS module in the point-to-point mode, use the NTAI05 Analog Input Termination Unit (refer to Appendix A) or the NIAI04 Analog Input Termination Module (refer to Appendix B).

If installing the FBS module in the field bus mode, the NTFB01 Field Bus Termination Unit must be used. Refer to Appendix C for information on NTFB01 configuration for field bus termination. For more information about the termination units or modules, refer to the instructions listed in Table 1-2.

Installing the IMFBS01 Module

The FBS module inserts into a standard INFI 90 module mounting unit (MMU) and occupies one slot. To install:

1. Verify the MMU slot assignment for the module.

WARNING	**Disconnect power before installing dipshunts on the module mounting unit backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**
AVERTISSEMENT	**Interrompez l'alimentation avant d'installer des dipshunts sur le fond de panier du châssis de montage des modules. Sinon, tout contact avec cette zone entraîne des risques d'électrocution sérieuse ou fatale.**

2. Install a 24-pin dipshunt in all I/O expander bus sockets (on the MMU backplane) that are between the slot assigned to the FBS module and the slot assigned to its control module (MFP/MFC).

3. Connect the hooded end of the cable from the termination unit or module to the cable opening (on the MMU backplane) belonging to the FBS slot. Do not force the cable connection to the MMU backplane. This cable is keyed and should latch into place when properly installed.

4. Align the module with the guide rails in the module mounting unit. Slide the module into the module mounting unit until the front panel is flush with the top and bottom of the MMU frame.

5. Turn the two captive latches ½-turn on the module faceplate to lock the module in place. To remove the module, turn the captive latches ½-turn to release the module. Pull on the module faceplate to remove it from the module mounting unit.

SECTION 4 - CALIBRATION

INTRODUCTION

The FBS analog inputs are calibrated in the factory, eliminating the need for calibration during installation. However, from time to time (during plant maintenance and routine calibration checks), the module analog inputs may need adjustment. Use the calibration procedure in this section to check the FBS calibration.

This calibration procedure is only necessary for analog inputs using either the NIAI04 termination module or NTAI05 termination unit. This calibration is not necessary when only the field bus operating mode is used with the NTFB01 termination unit.

EQUIPMENT NEEDED

The following items are required to calibrate the FBS module:

- Power supply with digital display and fine voltage adjustment to one millivolt.
- ***Function Code Application Manual*** (Table 1-2).

Adjusting R22

Adjusting potentiometer R22 calibrates the analog input circuitry on the FBS module. This procedure is valid for any FBS input span. To adjust R22 to calibrate the FBS inputs:

1. Select an input channel to calibrate. The example procedure uses FBS input channel one. Calibrating any one of the 15 analog inputs calibrates all inputs.

2. Place the controlling module (MFP/MFC) in its configure mode. Go to the block address of function code 132 containing the specifications for the selected input channel.

3. Set function code 132 specifications for the channel being calibrated to:

    a. Input signal type = 1 (1 to 5 VDC input signal).

    b. EU zero = 1.0 (EU zero for the selected input).

    c. EU span = 4.0 (EU span for the selected input).

Refer to the ***Function Code Application Manual*** to determine the function code specifications which apply to the selected input.

4. Connect the power supply to the termination unit/module terminals (refer to Appendix A or Appendix B for terminal assignments) of the input being calibrated.

5. Set the dipshunt or dipswitch for differential voltage mode as shown in Figure A-3 or B-2.

6. Apply 1.000 VDC (±0.001 VDC) to the channel.

7. Place the controlling module (MFP/MFC) in execute mode.

8. Monitor the function code 132 block output for the channel being calibrated using an operator interface such as the Type CTT02 terminal, engineering work station or operator interface station.

9. Adjust R22 (refer to Figure 3-1 for the location of R22) until the block output value is within ±0.1% of the input span (0.996 to 1.004).

10. Apply 3.000 VDC (±0.001) VDC to the input channel under calibration.

11. Verify the block output value is within ±0.1% of the input span (2.996 to 3.004). If the input voltage is not within tolerance, adjust R22 until it is within the desired tolerance.

12. Apply 5.000 VDC (±0.001 VDC) to the input channel under calibration.

13. Verify the block output value is within ±0.1% of the input span (4.996 to 5.004 VDC). If the input voltage is not within tolerance, adjust R22 until it is within the desired tolerance.

14. Apply 1.000 VDC to the input channel under calibration.

15. Verify that the block output value remains within tolerance. If it is not within tolerance, repeat Steps 4 through 10.

16. Repeat Steps 1 through 11 with any other input channel to verify the calibration.

17. If any input channel is not within tolerance, replace the module or contact your nearest Elsag Bailey service representative.

Completing this calibration procedure also calibrates all other input ranges listed in Table 1-4.

SECTION 5 - OPERATING PROCEDURES

INTRODUCTION

This section explains the start-up and operating procedures for the FBS module.

START-UP

To start up the FBS module:

1. Apply power to the FBS module.

2. Place the controlling module (MFP/MFC) in execute mode.

Communication between the FBS module and the controlling module begins automatically if there are no configuration errors and the controlling module is in the execute mode.

Upon start-up, all channels are marked bad quality. The controller sends the FBS module the transmitter configurations and the FBS module begins checking each channel. If the module detects a channel that is set up for an analog input (function code 132 only) and there are no other errors, the module marks that channel good quality and begins checking the next channel.

When the FBS module detects a channel that is set up for a smart transmitter (a configuration containing function codes 132 and 133), it does a check of that channel. It reads the actual configuration of the smart transmitter and compares it to the configuration within the controlling module. If these configurations are identical and there are no other errors, the FBS module marks that channel good quality. If the module detects a difference in the two configurations, the channel remains bad quality and a ***configuration mismatch*** status error occurs. The FBS module proceeds until it checks all 15 channels.

The FBS module periodically checks each channel having a smart transmitter configuration by trying to communicate with the transmitter on that channel. If a transmitter fails to communicate, the module marks the channel bad quality and a ***transmitter not responding*** status error occurs. If the transmitter resumes communication, the module does a configuration check (like the one made at start-up) of the device on that channel. The module marks the channel as good or bad quality depending on the results of the check.

OPERATION

Normal operation begins after the FBS module completes the communication checks of all input channels. During operation, the function code specifications can be tuned through an INFI 90 operator interface to make changes in transmitter operating parameters and calibrate outputs. Refer to the ***Function Code Application Manual*** for more information on function code 132 (analog input) and function code 133 (smart transmitter definition).

> **NOTE:** On-line configuration changes which affect the mode of operation are not supported for function codes 132 and 133. A mode change (reset) of the MFP or FBS module may be required for changes to take effect.

Smart transmitter parameters can be viewed or modified using the handheld Type STT02 smart transmitter terminal. View only is possible when the FBS module is present and the FBS channel is on-line. View or modify is possible without the FBS module present or when the FBS channel is off-line. Figure 5-1 shows how the Type STT02 terminal connects to the NTFB01 termination unit.

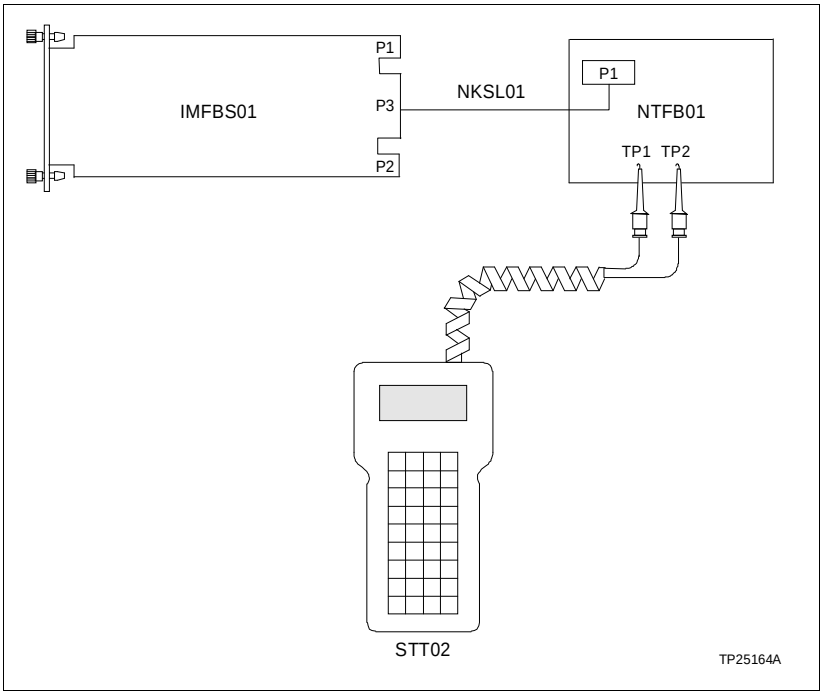

Figure 5-1. Connecting the Type STT02 Terminal to the NTFB01 Termination Unit

IMFBS01 STATUS LED

The FBS module has one red/green LED on its faceplate that indicates module status. Figure 5-2 shows the location of the status LED on the FBS faceplate. Refer to Table 5-1 for a list of LED states and their meaning.

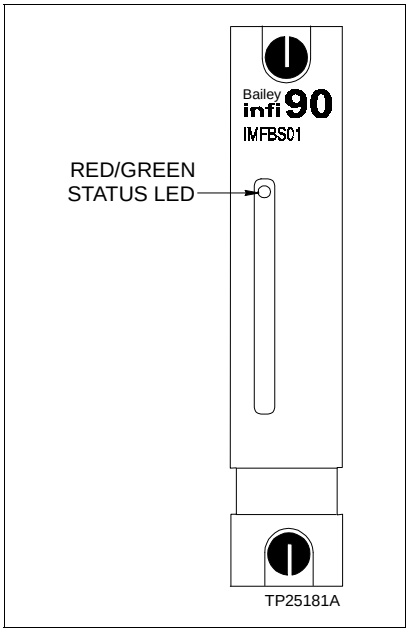

Figure 5-2. IMFBS01 Status LED

Table 5-1. IMFBS01 Status LED States

LED State	Meaning
Off	No power to the IMFBS01 or no communication with the MFP/MFC
Green	Normal operation and communication with the MFP/MFC
Red	I/O expander bus not operating
Blinking green (6 times/min)	IMFBS01 hardware failure

SECTION 6 - TROUBLESHOOTING

INTRODUCTION

This section explains how to detect FBS errors and the corrective action to take for those errors.

ERROR MESSAGES AND CORRECTIVE ACTION

Status reports from the control module are available through any INFI 90 operator interface such as an operator interface station (OIS), configuration and tuning terminal (CTT) or an IBM® AT compatible computer with the Smartport (SEEK) software package.

> **NOTE:** Only MFP controller modules are supported by Smartport (SEEK) software.

Status Reports

The FBS module continuously monitors smart transmitters to provide status reports. The module sends transmitter status data to the controlling module (MFP/MFC). Access this data from the controlling module by viewing the module summary display on the operator interface. The module summary display contains status reports for each module. The instruction for your particular operator interface will explain how to access the module summary display.

From the module summary display, call up the *I/O SLAVE* status report. The status report will display specific FBS module and smart transmitter error codes when an error occurs. The status report lists the following:

> *I/O SLAVE ERROR NUMBER (#), SLAVE ADDRESS (#), BLOCK NUM. (#)*

To determine if the error number belongs to the FBS module, check the function block to find the function code assigned to the block. If the block is function code 132, then the status report refers to the FBS module. Table 6-1 lists the meaning of FBS status report error codes and corrective actions.

When the function block listed (within the *I/O SLAVE* status report) contains a smart transmitter definition function code, that status report applies to a smart transmitter connected to an FBS module. Table 6-2 lists smart transmitter error codes and their meaning. For corrective action, refer to the product instruction for the smart transmitter in error.

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Table 6-1. IMFBS01 Error Codes

Error No.	Description	Corrective Action
1	No FBS module response or wrong module type	Check FBS jumper and switch settings. Replace the IMFBS01 if jumper and switch settings check good. Check function code 132 for correct specification values, such as I/O module address.
2	Calibration error	Check the FBS input calibration.
3	Channel failure or out of range	Check TU or TM and cabling. Replace IMFBS01 if cabling is good. Check function code 132 for correct specification values, such as I/O module address.

NOTE: Out of range refers to values of FBS analog inputs.

Table 6-2. Smart Transmitter Error Codes

Error No.	Description
6	Not responding
7	Configuration mismatch
8	Wrong transmitter type
9	Input failure or memory failure
10	Overpressured
11	Temperature range exceeded
12	Output fixed
13	Calibration required
14	Transmitter being calibrated
15	Transmitter off-line
16	Communication error

A communication failure will occur if a configuration download is attempted to a transmitter whose configuration lockout jumper is set to the lockout position. Each smart transmitter has its own function block. If a smart transmitter communication failure occurs, its function block appears in the *I/O SLAVE* report listing.

> **NOTE:** The configuration lockout jumper (on the transmitter) prevents the transmitter from being configured. Transmitter configuration and operation can be monitored, but the transmitter configuration cannot be changed from any source. Refer to the smart transmitter product instruction for information about using the lockout feature.

Missing I/O Module Error

A missing I/O module error (no FBS response or wrong type) occurs when the FBS address (set by dipswitch S1 on the FBS module) does not match the I/O module address in the control

module configuration (function code 132). This error appears in the status bytes of the control module (bytes three through five). A missing I/O module error sets byte three equal to 03 and bytes four and five equal to the block number of the missing I/O module. A missing I/O module error also occurs if the I/O module and control module do not share the same I/O expander bus. To correct a missing I/O module error:

1. Remove the module and check the setting of S1. It should match the I/O module address set in function code 132 in the control module configuration. If the I/O module addresses match, go to Step 2. If the I/O module addresses do not match, correct the I/O module addressing error.

   a. Change the setting of S1 on the I/O module to match the I/O module address set in its configuration. Table 3-1 explains how to set the FBS address.

   or

   b. Modify the I/O module address in the control module configuration (function code 132) to match the I/O module address set by S1. Refer to the ***Function Code Application Manual*** and ***Operator Interface Station*** instructions for information about changing the control module configuration.

2. Verify that the I/O module and its control module reside on the same I/O expander bus. There must be a 24-pin dipshunt (all pins intact) installed in all dipshunt sockets between the FBS module and its control module.

Blinking Green Status LED

The green status LED on the FBS module blinks every ten seconds if the module has a hardware failure. To correct a hardware failure, replace the FBS module.

EDGE CONNECTOR PIN ASSIGNMENTS

Edge connector pin assignments (P1, P2 and P3) are listed in Tables 6-3 through 6-5. The pin assignments for P4 (connector for the LCD diagnostic display) are in Table 6-6.

Table 6-3. P1 Edge Connector Pin Assignments

Pin	Connection	Pin	Connection	Pin	Connection
1	+5 VDC	5	Common	9	PFI
2		6		10	
3	Not used	7	+15 VDC	11	Not used
4		8	–15 VDC	12	

Table 6-4. P2 Edge Connector Pin Assignments

Pin	Connection	Pin	Connection	Pin	Connection
1	Data 1	5	Data 5	9	BCLOCK
2	Data 0	6	Data 4	10	SYNC
3	Data 3	7	Data 7	11	Not used
4	Data 2	8	Data 6	12	

Table 6-5. P3 Input Signal Pin Connections

Group A		Group B	
Pin	Connection	Pin	Connection
1	INPUT 1–	A	INPUT 1+
2	INPUT 2–	B	INPUT 2+
3	INPUT 3–	C	INPUT 3+
4	INPUT 4–	D	INPUT 4+
5	INPUT 5–	E	INPUT 5+
6	INPUT 6–	F	INPUT 6+
7	INPUT 7–	H	INPUT 7+
8	INPUT 8–	J	INPUT 8+
9	INPUT 9–	K	INPUT 9+
10	INPUT 10–	L	INPUT 10+
11	INPUT 11–	M	INPUT 11+
12	INPUT 12–	N	INPUT 12+
13	INPUT 13–	P	INPUT 13+
14	INPUT 14–	R	INPUT 14+
15	INPUT 15–	S	INPUT 15+

Table 6-6. P4 Pin Assignments

Pin	Connection	Pin	Connection
1	Common	8	D1
2	+5 VDC	9	D2
3	Common	10	D3
4	A0_	11	D4
5	R/W	12	D5
6	LCD_E	13	D6
7	D0	14	D7

SECTION 7 - MAINTENANCE

INTRODUCTION

WARNING	**Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board.**
AVERTISSEMENT	**Des lunettes de protection devraient être portées lors de travail avec des solvants nettoyants. Lorsqu'on enlève les solvants des circuits imprimés à l'aide d'air comprimé, les éclaboussures de solvant pourraient causer des blessures aux yeux.**

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. Elsag Bailey recommends that all equipment users practice a preventive maintenance program that will keep the equipment operating at an optimum level.

This section presents procedures that can be performed on-site. These preventive maintenance procedures should be used as guidelines to assist in establishing good preventive maintenance practices. Select the minimum steps required to meet the needs of your system.

Personnel performing preventive maintenance should meet the following qualifications.

- Should be qualified electrical technicians or engineers that know the proper use of test equipment.
- Should be familiar with the FBS module and INFI 90 system, have experience working with process control systems, and know what precautions to take when working on live AC systems.

PREVENTIVE MAINTENANCE SCHEDULE

Table 7-1 is the preventive maintenance schedule for the FBS module. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Some tasks in Table 7-1 are self explanatory. Instructions for tasks that require further explanation are covered under ***PREVENTIVE MAINTENANCE PROCEDURES***.

NOTE: The preventive maintenance schedule is for general purposes only. Your application may require special attention.

Table 7-1. Preventive Maintenance Schedule

Task	Frequency
Check cabinet air filters. Clean or replace them as necessary. Check the air filter more frequently in excessively dirty environments.	3 months
Check cabinet and IMFBS01 for dust. Clean as necessary using an antistatic vacuum.	
Check all FBS signal, power and ground connections within the cabinet. Verify that they are secure. See procedure.	
Check FBS circuit board, giving special attention to power contacts and edge connectors. Clean as necessary. See procedure.	12 months
Complete all tasks in this table.	Shutdown

EQUIPMENT AND TOOLS REQUIRED

Tools and equipment required for maintenance procedures include:

- Antistatic vacuum.
- Clean, lint free cloth.
- Compressed air.
- Eberhard Faber (400A) pink pearl eraser or equivalent.
- Fiberglass or nylon burnishing brush.
- Foam tipped swab.
- Bladed screwdriver suitable for terminal blocks.
- Isopropyl alcohol (99.5 percent electronic grade).
- Natural bristle brush.

PREVENTIVE MAINTENANCE PROCEDURES

This section covers tasks from Table 7-1 that require specific instruction or further explanation:

- Checking signal, power and ground connections.
- Cleaning printed circuit boards.

Checking Connections

Check all signal wiring, power and ground connections within the cabinet to verify their integrity. When checking connections, always turn a screw, nut or other fastening device in the direction to tighten only. If the connection is loose, it will be tightened. If the connection is tight, the tightening action will verify that it is secure. There must not be any motion done to loosen the connection.

NOTE: Power to the cabinet must be off while performing this preventive maintenance task.

Verify that all cable connections are secure.

Printed Circuit Board Cleaning

There are several circuit board cleaning procedures in this section. These procedures cover circuit board cleaning and washing, cleaning edge connectors and circuit board laminate between edge connectors. Use the procedures that meet the needs of each circuit board. Remove all dust, dirt, oil, corrosion or any other contaminant from the circuit board.

Do all cleaning and handling of the printed circuit boards at static safe work stations. Always observe the steps listed under ***SPECIAL HANDLING*** in Section 3 when handling printed circuit boards.

GENERAL CLEANING AND WASHING

If the printed circuit board needs minor cleaning, remove dust and residue from the printed circuit board surface using clean, dry, filtered compressed air or an antistatic field service vacuum cleaner.

Another method of washing the printed circuit board is:

1. Clean the printed circuit board by spraying it with isopropyl alcohol (99.5% electronic grade) or wiping the board with a foam tipped swab wetted in isopropyl alcohol.

2. When the circuit board is clean, remove excess solvent by using compressed air to blow it free of the circuit board.

EDGE CONNECTOR CLEANING

To clean edge connector contacts:

1. Use a solvent mixture of 80% isopropyl alcohol (99.5% electronic grade) and 20% distilled water.

2. Soak a lint free cloth with the solvent mixture.

3. Work the cloth back and forth parallel to the edge connector contacts.

4. Repeat with a clean cloth that is soaked with the solvent mixture.

5. Dry the edge connector contact area by wiping with a clean lint free cloth.

To clean tarnished or deeply stained edge connector contacts:

1. Use an Eberhard Faber (400A) pink pearl eraser or equivalent to remove tarnish or stains. Fiberglass or nylon burnishing brushes may also be used.

2. Minimize electrostatic discharge by using the 80/20 isopropyl alcohol/water solution during burnishing.

3. Do not use excessive force while burnishing. Use only enough force to shine the contact surface. Inspect the edge connector after cleaning to assure no loss of contact surface.

SECTION 8 - REPAIR AND REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement steps for an FBS module. There are no special tools required to replace the module.

MODULE REPAIR AND REPLACEMENT

If the FBS module is faulty, replace it with a new one. ***Do not*** try to repair the module; replacing components may affect the performance of the module. The module may be removed while system power is supplied. To replace a module:

1. Push and turn the two front panel captive latches ½-turn to release the module. It is released when the slots on the screws are vertical and the open end of the slots faces away from the module.

2. Grasp the module faceplate and pull the module out of the module mounting unit (MMU).

3. Configure the replacement module switch and jumper settings. Insure they are set the same as the original module.

4. In the same slot assignment as the original module, align the replacement module with the guide rails in the module mounting unit. Slide it in until the faceplate is flush with the top and bottom of the MMU frame.

5. Push and turn the two captive latches on the module faceplate ½-turn to lock the module in place.

6. Return to normal operation.

SECTION 9 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls Company is always ready to assist in the operation and repair of its products. Send requests for sales or application services to the nearest sales or service office. Bailey Controls Company can also provide installation, repair and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

Order replacement parts through a Bailey Controls Company sales or service office. Provide the following information:

1. Part description, part number and quantity.

2. Model and serial number (if applicable) and ratings of the assembly for which the part has been ordered.

3. Bailey instruction number, page number and reference figure that identifies the part.

When ordering parts, use part numbers and part descriptions from equipment manuals. Parts with no commercial description must be ordered from the nearest sales or service office. Recommended spare parts lists, including prices, on standard assemblies are available through the nearest sales or service office.

TRAINING

Bailey Controls Company has a modern training facility available for training your personnel. On-site training is also available. Contact a Bailey Controls Company sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

Additional copies of this instruction, or other Bailey Controls Company instructions, can be obtained from the nearest Bailey Controls Company sales office at a reasonable charge.

APPENDIX A - NTAI05 TERMINATION UNIT CONFIGURATION

INTRODUCTION

The FBS module uses the NTAI05 termination unit for point-to-point operation. Select the input type of each channel through the dipshunts on the termination unit. The FBS module can accept inputs of four to 20 milliamps, one to five VDC, zero to one VDC, zero to five VDC, zero to ten VDC and -10 to +10 VDC.

CONFIGURING INPUTS

Figure A-1 shows a field bus module input and the input signal path through an NTAI05 dipshunt. Table A-1 shows NTAI05 dipshunt configurations. Figure A-2 shows module to termination unit cabling and Figure A-3 shows the NTAI05 terminal assignments.

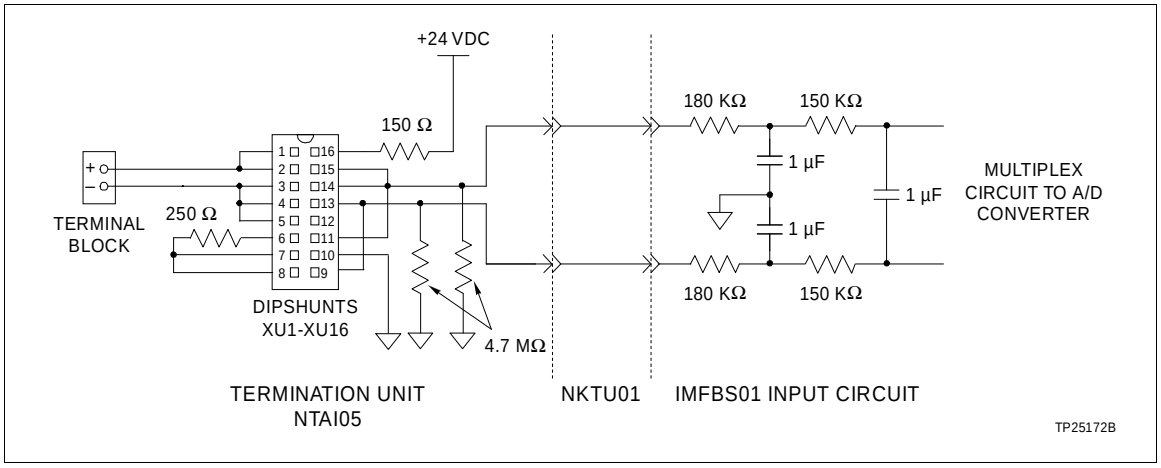
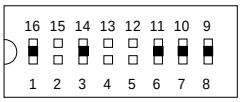
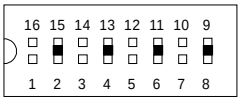
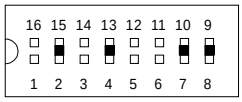
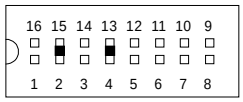
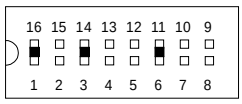


Figure A-1. NTAI05 Input Circuit

Table A-1. NTAI05 Dipshunt Settings

Application/ Signal Type	Dipshunt Configuration	Dipshunt Locations	Connecting Cable
System powered 4 to 20 mA		XU1 to XU15[1]	NKTU01
Externally powered 4 to 20 mA			
Single ended voltage			
Differential voltage[2]			
Above applications: 4 to 20 mA 1 to 5 VDC 0 to 1 VDC 0 to 5 VDC 0 to 10 VDC ±10 VDC		XU17	

NOTES:
1. XU16 is not used.
2. FSK not supported at this time.

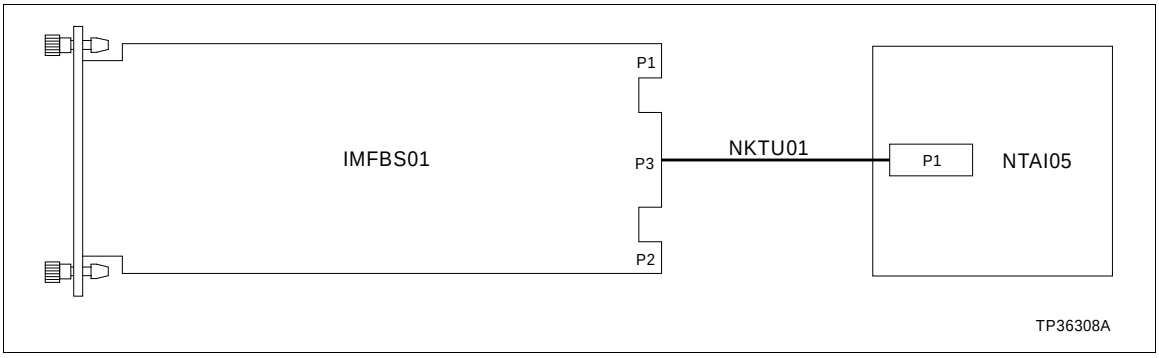


Figure A-2. NTAI05 Cable Connections

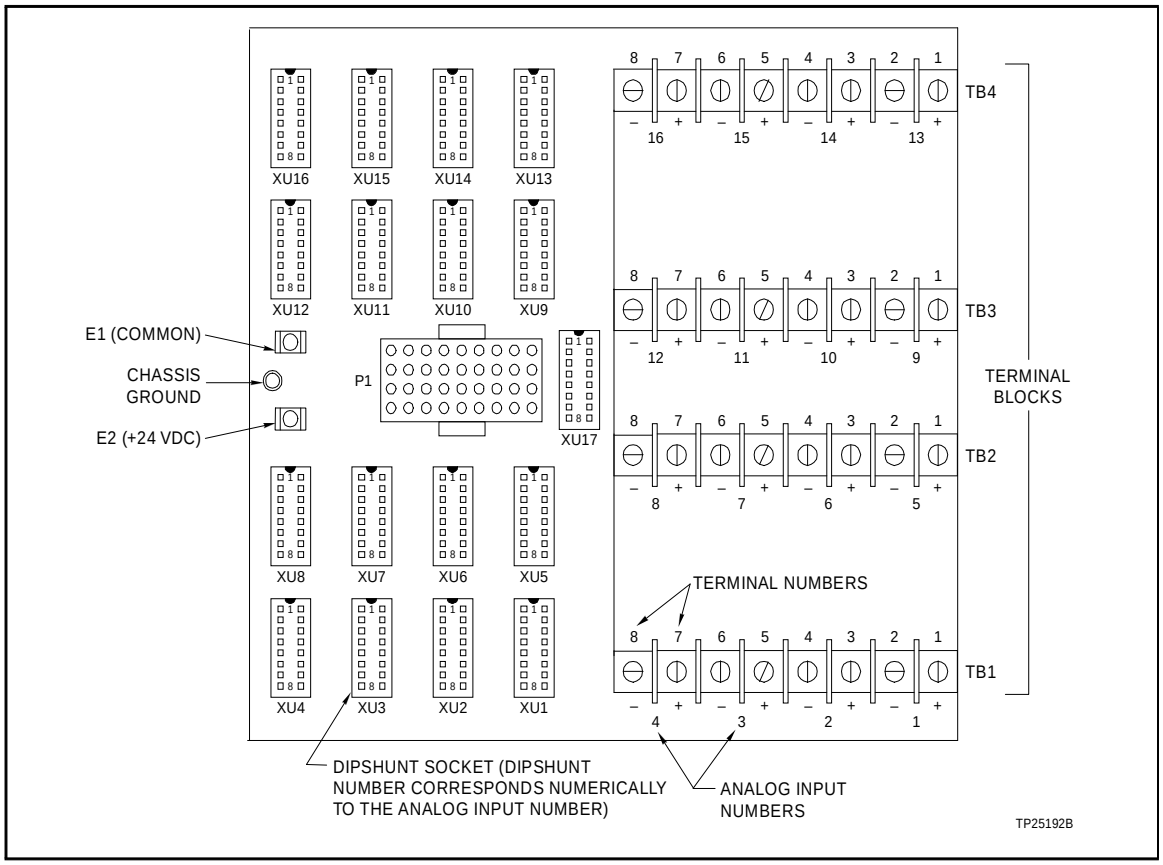


Figure A-3. NTAI05 Terminal Assignments

APPENDIX B - NIAI04 TERMINATION MODULE CONFIGURATION

INTRODUCTION

The FBS module uses an NIAI04 termination module for termination in point-to-point applications. Select the input type of each channel through dipswitches on the NIAI04 termination module. The FBS module can accept inputs of four to 20 milliamps, one to five VDC, zero to one VDC, zero to five VDC, zero to ten VDC and -10 to +10 VDC.

CONFIGURING INPUTS

Figure B-1 shows the field bus module input and the input signal path through an NIAI04 dipswitch. Figure B-2 shows the terminal assignments. Table B-1 shows dipswitch settings. Figure B-3 shows FBS module to termination module cabling.

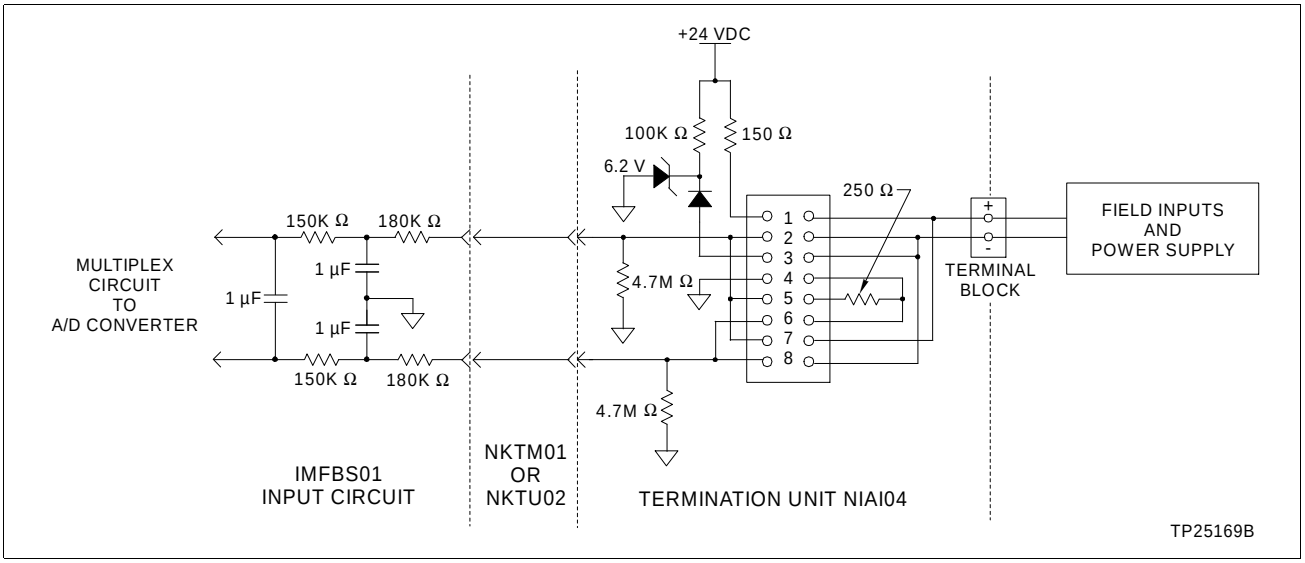


Figure B-1. NIAI04 Input Circuit

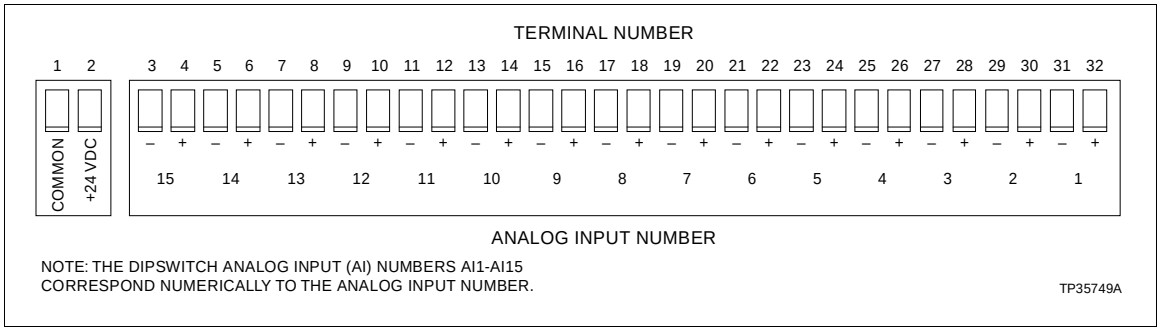
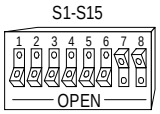
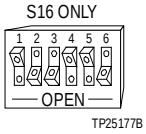


Figure B-2. NIAI04 Terminal Assignments

Table B-1. NIAI04 Dipswitch Settings

Application/Signal Type	Dipshunt Configuration[1, 2]	Connecting Cable
System powered 4 to 20 mA		NKTM01 or NKTU02
Externally powered 4 to 20 mA		
Single ended voltage		
Differential voltage[3]		
All applications		

NOTES:
1. Pole 5 on S1 through S15 should be closed for point-to-point communications.
2. Closed = 1 = ON.
3. FSK not supported at this time.

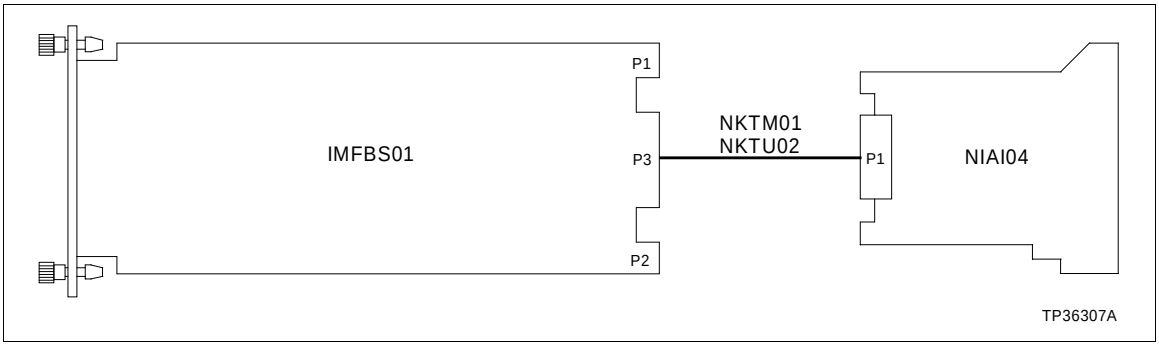


Figure B-3. NIAI04 Cable Connections

APPENDIX C - NTFB01 TERMINATION UNIT CONFIGURATION

INTRODUCTION

The FBS module must use the NTFB01 termination unit to terminate FSK digital smart transmitters on a field bus. All inputs must be in an FSK digital field bus mode when using the NTFB01 termination unit. There are no other input types available when operating in this mode.

CONNECTING INPUTS TO THE NTFB01 TERMINATION UNIT

Figure C-1 shows a simplified circuit diagram of the input signal path through the field bus termination unit. Figure C-2 shows NTFB01 terminal assignments and Figure C-3 shows module to termination unit cabling.

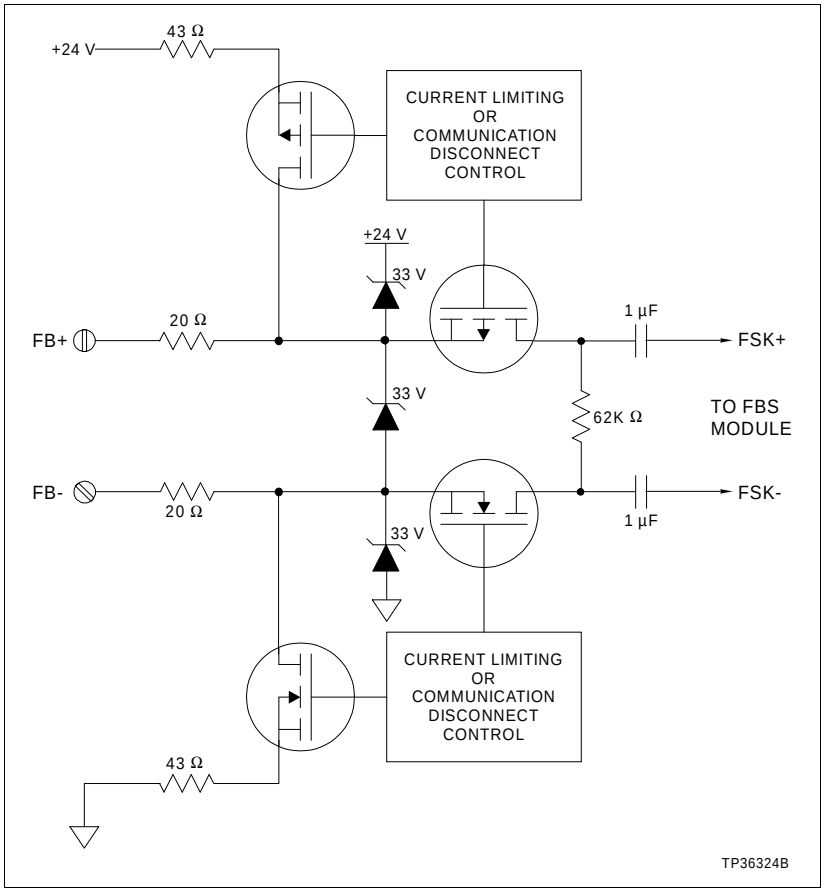


Figure C-1. NTFB01 I/O Module Input Circuit

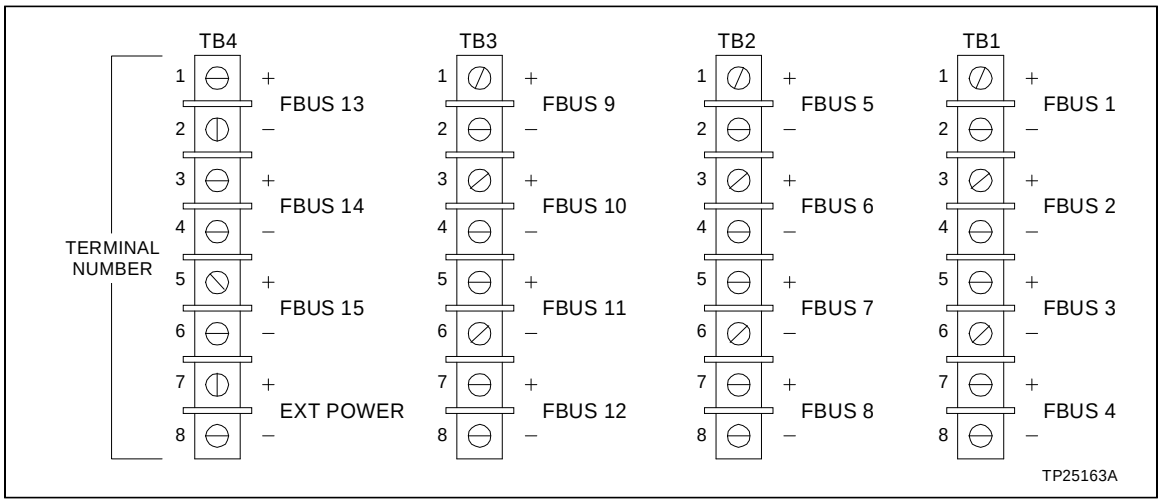


Figure C-2. NTFB01 Terminal Assignments

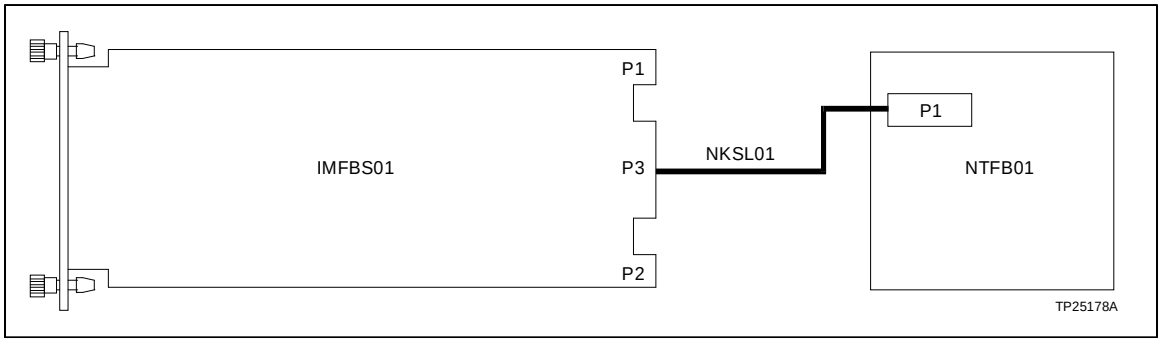


Figure C-3. NTFB01 Cable Connections

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