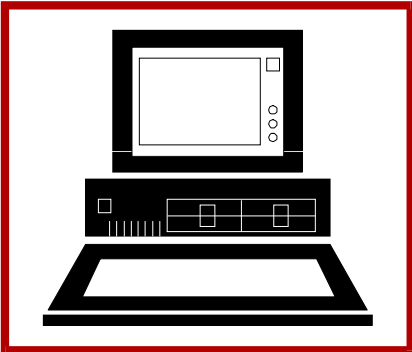
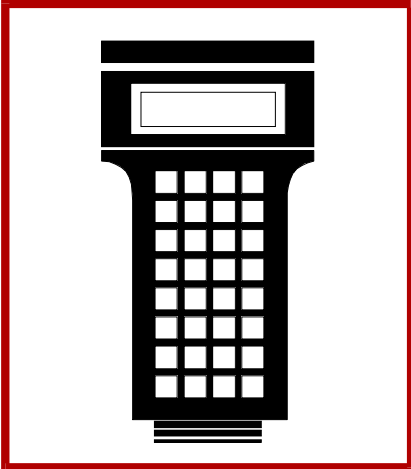
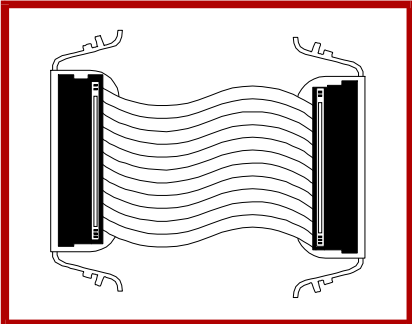
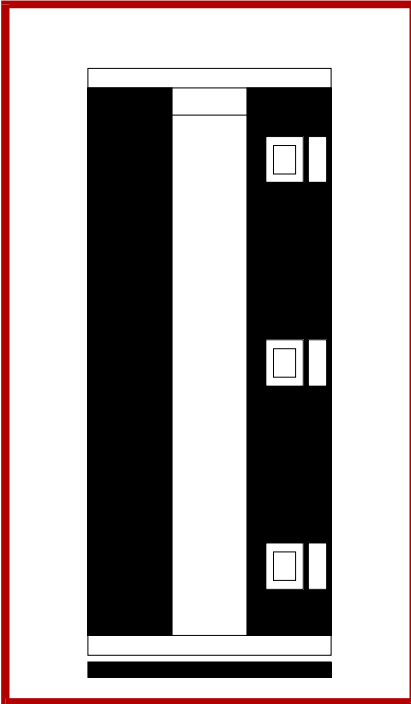
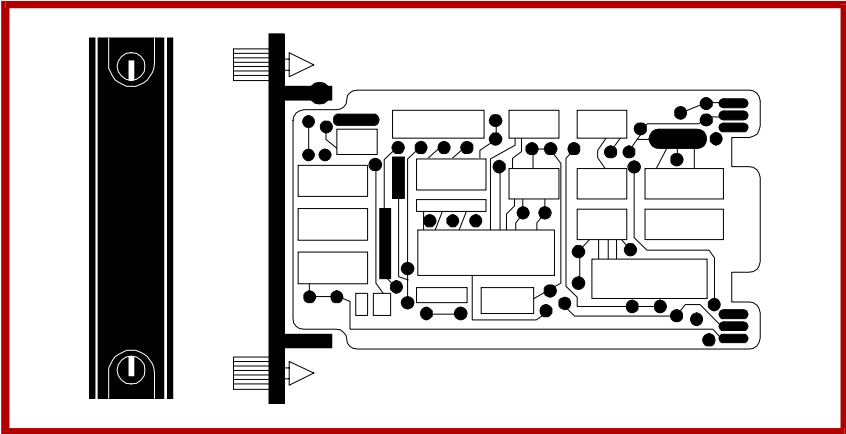
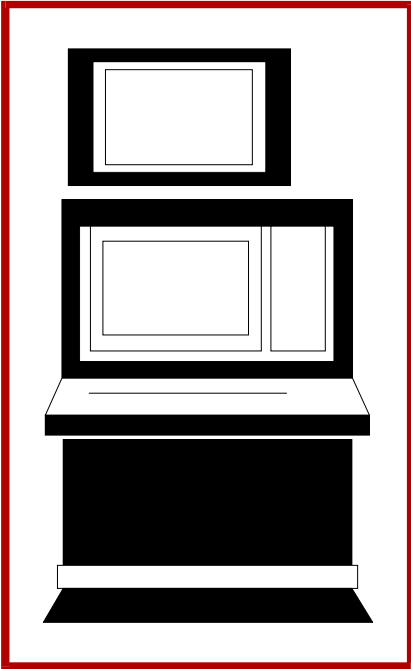




IMFEC11/12

Instruction

Analog Input Module



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.

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN, OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING, AND FOLLOWING THE PROPER **Elsag Bailey** 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.

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Preface

The IMFEC1□ Analog Input Module module supplies 15 field inputs to the INFI 90® OPEN strategic process management system. There are two variations available.

The IMFEC12 module interfaces to conventional transmitters and standard analog inputs. It links process data and communication from field devices to all multifunction processors (MFP), or the IMMFC03, IMMFC04 and IMMFC05 multifunction controller (MFC) modules. The IMFEC12 module can be used as a direct replacement for the IMASIO2 module; however, baseband communications are not supported.

The IMFEC11 module performs all the functions of the IMFEC12 module plus it is an interface for Bailey-Fischer & Porter smart transmitters and other smart devices. It links process data and communication from Bailey-Fischer & Porter smart devices to all multifunction processors (MFP), or the IMMFC03, IMMFC04 and IMMFC05 multifunction controller (MFC) modules. The analog input module operates in one of two modes: FSK field bus mode (FSK digital data and communication) and FSK analog point-to-point mode (analog inputs with or without FSK digital communication available). The IMFEC11 module can be used as a direct replacement for the IMFBS01 Field Bus Module; however, baseband communications are not supported.

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

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

List of Effective Pages

Total number of pages in this instruction is 53 consisting of the following:

Page No.	Change Date
Preface	Original
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iii through vii	Original
1-1 through 1-8	Original
2-1 through 2-10	Original
3-1 through 3-6	Original
4-1 through 4-3	Original
5-1 through 5-4	Original
6-1 through 6-4	Original
7-1	Original
8-1	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.

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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. 3-6)

There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death. (p. 6-2)

If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist. (p. 6-2)

Never clean electrical parts of components with live power present. Doing so exposes you to an electrical shock hazard. (p. 6-3)

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. 6-3)

Trademarks and Registrations

Registrations and trademarks used in this document include:

® INFI 90	Registered trademark of Elsig Bailey Process Automation
® Platinum Standard	Trademark of Elsig Bailey Process Automation
® IBM	Registered trademark of International Business Machines Corporation

SECTION 1 - INTRODUCTION

OVERVIEW

The IMFEC12 High Level Analog Input (FEC) module inputs 15 channels of analog signals only to the multifunction processor (MFP) or multifunction controller (MFC) module.

The IMFEC11 High Level Analog Input (FEC) module inputs 15 channels of analog or frequency shift keyed (FSK) digital signals to the MFP or MFC module. The IMFEC11 module performs all the functions of the IMFEC12 module and also provides communication with the Bailey-Fischer & Porter line of FSK digital smart transmitters and other smart devices in a field bus or point-to-point configuration.

Figure 1-1 shows how the FEC module fits within the INFI 90 OPEN system.

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 FEC 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. The IMFEC11 circuit board has 18 jumpers; three jumpers that allow selecting the mode of operation and communication (J2, J3 and J4) and 15 jumpers that select voltage/current input (J6 through J20). A dipswitch setting (S1) holds the I/O expander bus address of the module.

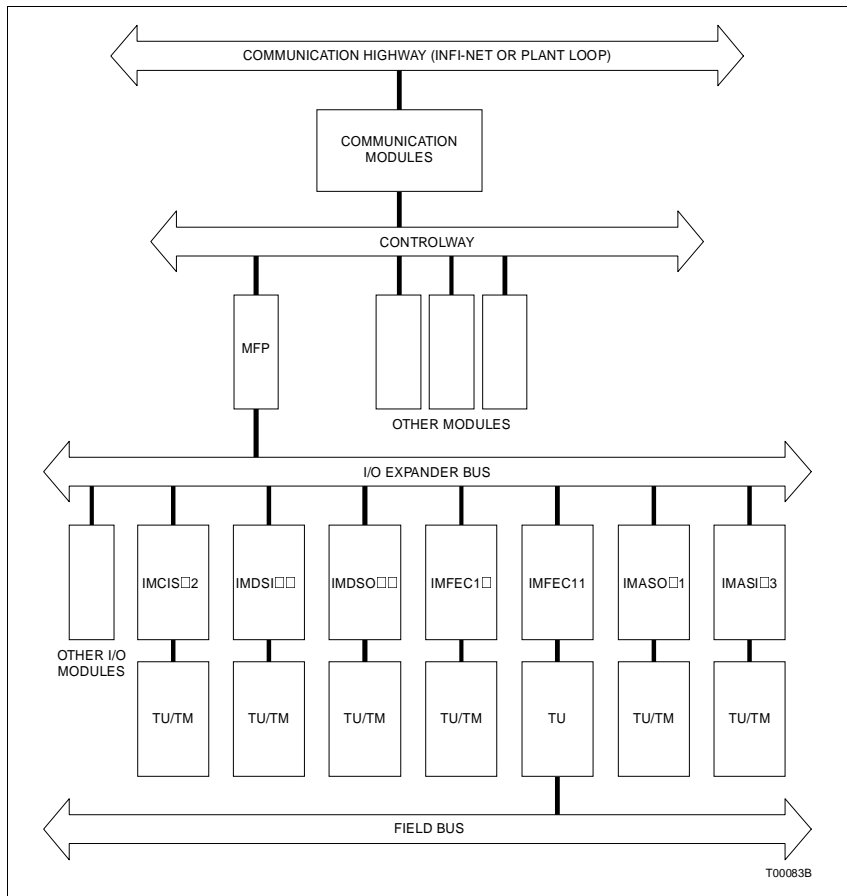


Figure 1-1. INFI 90 OPEN Communication Levels

The IMFEC12 circuit board only uses one working setting, dipswitch S1 that holds the I/O expander bus address of the module. Jumpers J2 through J4 and J6 through J20 are not used.

HARDWARE APPLICATION

The FEC module interfaces analog and digital signals from field devices to the MFP or MFC module. The IMFEC11 module can interface Bailey-Fischer & Porter FSK smart transmitters and other smart devices. The IMFEC12 is for use with conventional transmitters (BC, EQ and PT) and standard analog inputs.

The IMFEC11 module can operate in one of two modes: FSK field bus mode or FSK analog point-to-point mode. In the FSK field bus mode, a single 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 Termination Unit** instruction for specific limitations on field bus communications. All field devices must be Bailey-Fischer & Porter when using this mode.

In the FSK analog point-to-point mode, the IMFEC11 module can interface up to 15 discrete analog process inputs from FSK smart devices and communicate (digitally) with those devices. Additionally, the IMFEC11 module can interface a mixture of conventional transmitters and other external analog inputs while operating in this mode. These devices can input only process data to the FEC 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.

FEATURES

The design of the FEC module, as with all INFI 90 OPEN modules, allows for flexibility in creating a process management system. The module supports Bailey-Fischer & Porter FSK digital smart transmitters and other smart devices, conventional transmitters and standard voltage or current inputs.

The FSK digital capability (IMFEC11) 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 FEC module and the field devices.

The FEC 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 FEC module checks the transmitter configuration before the control module (MFP/MFC) resumes updating the process control.

INSTRUCTION CONTENT

This instruction consists of eight sections and three appendices.

Introduction	Overviews the FEC 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 FEC inputs.
Operating Procedures	Explains how to start up and operate the FEC module.
Troubleshooting	Describes how to monitor transmitter errors from the status reports. It explains how to check for FEC errors and the corrective action to take.
Maintenance	Contains a maintenance schedule for the FEC module.

- Repair and Replacement Procedures** Explains how to replace a module needing repair.
- Support Services** Provides information about ordering parts from your local Elsag Bailey sales office. It also explains other areas of support that Elsag Bailey provides.
- Appendix A** Shows the dipshunt settings, terminal wiring for the NTAI05 analog input termination unit and the required cabling.
- Appendix B** Shows the dipswitch settings, terminal wiring for the NIAI04 analog input termination module and the required cabling.
- Appendix C** Shows the jumper settings, terminal wiring for the NTFB01 field bus termination unit and the required cabling.

HOW TO USE THIS INSTRUCTION

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

1. Read **Section 4** before placing the FEC module in operation.
2. Do the steps in **Section 3**.
3. Refer to **Section 5** for what to do if a problem occurs.
4. Refer to **Section 6** for the scheduled steps needed to maintain the FEC module.
5. Refer to **Section 7** for how to replace a module.
6. Use **Section 8** for parts ordering information. This section also tells of additional services that Elsag Bailey 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 multifunction 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.

Table 1-1. Glossary of Terms and Abbreviations (continued)

Term	Definition
MFC	Multifunction controller module. A multiple loop controller with data acquisition and information processing capabilities.
MFP	multifunction 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 OPEN/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 uses digital communication to transmit information.
TM	Termination module; provides input/output connection between plant equipment and the INFI 90 OPEN/Network 90 modules.
TU	Termination unit; provides input/output connection between plant equipment and the INFI 90 OPEN/Network 90 modules.

REFERENCE DOCUMENTS

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

Table 1-2. Reference Documents

Number	Title
I-E21-56	SmartLink Transmitter Management Software
I-E92-501-2	Configuration and Tuning Terminal, Type CTT02
I-E96-192-1	Operation manual, Operator Interface Station (40 Series) IIOIS42
I-E96-200	Function Code Application Manual
I-E96-201	IMMFP01 Multifunction Processor
I-E96-202	IMMFP02 Multifunction Processor
I-E96-203	IMMFP03/03B Multifunction Processor
I-E96-211	IMMFC03 Multifunction Controller
I-E96-212	IMMFC04 Multifunction Controller
I-E96-213	IMMFC05 Multifunction Controller
I-E96-416	NTAI05 Analog Input Termination Unit
I-E96-432	NTFB01 Field Bus Termination Unit
I-E96-436	NIAI04 Analog Input Termination Module
P-E21-001	Installing a 4 to 20 mA Transmitter in a Hazardous Location
WBPEEU1110501A0	Smart Transmitter Terminal, Type STT03
WBPEEU200501A0	Module Mounting Unit (IEMMU11/12/21/22)
WBPEEU220756A0	Operation manual, Operator Interface Station (40 Series) IIOIS43

NOMENCLATURE

Table 1-3 contains the analog input module nomenclature used in this instruction.

Table 1-3. Nomenclature

Nomenclature	Description
IMFEC11	Analog input module with FSK communications for smart transmitter interface and standard analog inputs
IMFEC12	Analog input module for use with conventional transmitters and standard analog inputs

RELATED HARDWARE AND SOFTWARE

Table 1-4 contains the related hardware and software packages that can be used with an IMFEC1 □ module.

Table 1-4. Related Hardware

Nomenclature	Hardware
AVS	Electro-pneumatic smart positioner
BC, BCN	Conventional and smart pressure transmitters
EQ, EQN	Conventional and smart temperature transmitters
EQS	Platinum Standard™ smart temperature transmitters
MFC	Multifunction controller module
MFP	Multifunction processor module
NIAI04	Analog input termination module
NTAI05	Analog inputs termination unit
NKTM01, NKTU02	Analog input termination module cable
NKTU01	Analog inputs/field bus termination unit cable
NTFB01	Field bus termination unit
PT	Platinum Standard conventional pressure transmitter
PTS	Platinum Standard smart pressure transmitters
SLNK011A0	SmartLink transmitter management software
SM, XM, XE	Smart magnetic flowmeter
STT02/03	Smart transmitter terminal
TBN	Smart pH transmitters

SPECIFICATIONS

Table 1-5 contains the specifications for the IMFEC module.

Table 1-5. Specifications

Property	Characteristic/Value
Power requirements	
Operating power	5 VDC, $\pm 5\%$ at 85 mA typical +15 VDC, $\pm 5\%$ at 25 mA typical -15 VDC, $\pm 5\%$ at 20 mA typical
Power dissipation	1.1 W typical
Overvoltage category	I for power per ANSI/ISA S82.01-1994
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 (IMFEC11 only)	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 to +10 VDC	0.1%
0 to 1 VDC	0.25%
FSK digital accuracy (IMFEC11 only)	Same as transmitter accuracy for each input
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 50/60 Hz
Normal mode rejection	70 dB minimum at 50/60 Hz
Input impedance	Greater than 1 M Ω (each channel)
Overvoltage category	III for inputs per ANSI/ISA S82.01-1994

Table 1-5. Specifications (continued)

Property	Characteristic/Value		
Electromagnetic Compatibility Conducted transients	Test	Common Mode	Normal Mode
	Pulse voltage test (1.2/50 μS) (IEC 801-5)	2 kVp	1 kVp
	Line frequency wave (50 Hz)	50 Vp	N/A
	Low voltage wave train (Sweep from 10 KHz to 1 MHz)	50 Vp	N/A
	Damped 1 MHz oscillatory wave (IEC 1000-4-12)	1 kVp	0.5 kVp
	Electrical fast transient/burst (IEC 801-4)	1 kVp	N/A
	Conducted RF interferences (IEC 801-6 level 3)	10 V RMS	N/A
	Keep cabinet doors closed. Do not use communication equipment closer than 2 m (6 ft.) from the cabinet.		
Communication baud rate	9600 baud		
Environmental Ambient temperature Relative humidity Atmospheric pressure Air quality	0° to 55°C (0° to 131°F) (noncondensing) 5% to 95% up to 55°C (131°F) 5% to 45% at 70°C (158°F) (noncondensing) Sea level to 3 km (1.86 mi) Noncorrosive		
Mounting	Occupies a single slot in a standard INFI 90 OPEN module mounting unit (MMU)		
CE mark EMC96 Directive 89/336/EEC Low Voltage Directive 73/23 /EEC	This product, when installed in an INFI 90 OPEN cabinet, complies with the following Directives/Standards for CE marking. EN50082-2 Generic Immunity Standard - Part 2: Industrial Environment EN50081-2 Generic Emission Standard - Part 2: Industrial Environment EN61010-1 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements		
Certification Canadian Standards Association (CSA) Factory Mutual (FM) (pending)	Certified for use as process control equipment in an ordinary (nonhazardous) location Approval for the following categories, nonincendive for: Class I Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G		

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section explains the operation of the IMFEC1 Analog Input Module (FEC). The module does two major tasks. It provides an interface by which the controlling module (multifunction processor or multifunction 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 OPEN control system and field devices.

The IMFEC12 module accepts inputs from conventional transmitters (BC, EQ and PT) and standard analog inputs of 4 to 20 milliamps, 1 to 5 VDC, 0 to 1 VDC, 0 to 5 VDC, 0 to 10 VDC and -10 to +10 VDC. The IMFEC11 has all the functionality of the IMFEC12 module but also provides FSK communications for interface to Bailey-Fischer & Porter smart transmitters and other smart devices.

GENERAL OPERATION

Upon receiving initialization from the controlling module (MFP/MFC), the FEC module stores that information in memory and checks the configuration of each input channel. If all input channels check good, operation begins. If the FEC 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 FEC module. The FEC 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 FEC module sends it the most current information that it has in memory.

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

MFP/MFC MODULE OPERATION

The controlling module (MFP/MFC) directs the operation of the transmitters and holds their operating strategy. Function code 132 (analog input/slave) reads the analog inputs of the FEC module. The configuration of function code 133 (smart transmitter definition, for IMFEC11 only) in the controlling module

determines the operating strategy of each smart transmitter. 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 FEC module.

FUNCTIONAL OPERATION

The FEC module can be divided into four functional blocks for the IMFEC12 and five functional blocks for the IMFEC11. Figure 2-1 shows a block diagram of the IMFEC11 Analog Input (FEC) module. The functional blocks are:

- Module inputs/outputs (AC coupler and FSK multiplexer for the IMFEC11 only).
- Communication circuitry (IMFEC11 only).
- Microprocessor and control logic.
- Analog-to-digital converter.
- I/O expander bus interface.

The following sections explain the operation of the functional blocks that make up the IMFEC11 circuitry.

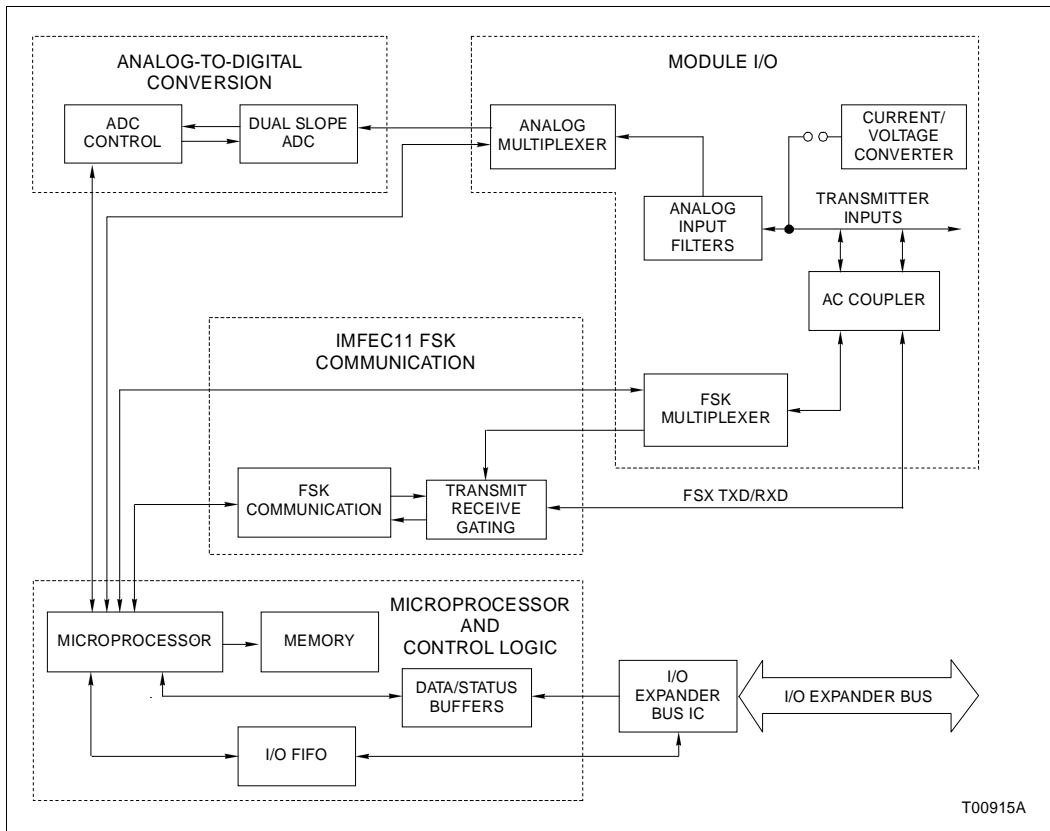


Figure 2-1. Functional Block Diagram

Microprocessor and Control Logic Circuitry

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 (IMFEC11 only).
- 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.

For IMFEC11 modules (FSK communications), the microprocessor sends command signals to the transmitters through the module communication circuitry. The circuitry converts commands from the microprocessor into FSK signals. The microprocessor directs the command transmission to the proper channel.

The MFP module communicates with the FEC module over the I/O expander bus. An Eltag 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.

Module Input/Output Circuitry

Process inputs to the IMFEC11/12 modules can be standard analog signals of four to 20 milliamps and ± 10 VDC; or analog (point-to-point) or frequency shift keyed digital signals (on a field bus) (IMFEC11). The module input circuit provides two paths for process data inputs. One path handles standard analog inputs and analog point-to-point inputs. The other path

handles FSK digital signals when the IMFEC11 module is in the field bus mode. On-board jumpers on the IMFEC11 set the operating mode.

NOTE: In field bus mode, the IMFEC11 module can handle up to 15 transmitters. The Type STT03 terminal can program a maximum of eight transmitters on a single field bus. Refer to the **Smart Transmitter Terminal, Type STT03** instruction for more information (Table 1-2).

ANALOG INPUTS (POINT-TO-POINT MODE)

All analog inputs are point-to-point. 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 (IMFEC11), the FSK digital communication signal rides on a small portion of the analog input signal. That input also passes through the FSK communication circuitry for decoding. The microprocessor coordinates operation of point-to-point input and output through multiplexers.

Figure 2-2 shows a typical analog input filter circuit. The circuit connects to the FEC termination (point-to-point) through the P3 connector. Each analog input has overvoltage protection to protect the 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.

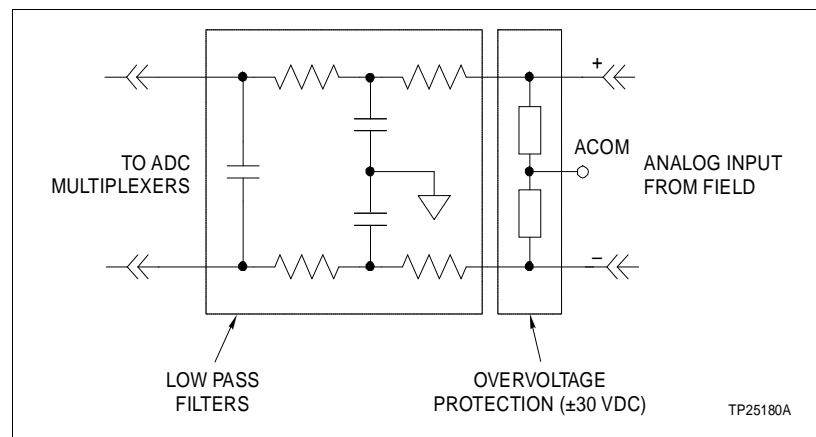


Figure 2-2. Analog Input Filter and Overvoltage Protection

The FEC 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 FEC module stores that value in memory. When in the point-to-point-mode, the FEC module can input four to 20 milliamps or -10 to +10 VDC. Function code 132 allows selecting the signal type for each channel.

FSK INPUTS (FIELD BUS MODE) IMFEC11 ONLY

For IMFEC11 modules 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 2-3 shows the FSK input circuit with the FSK multiplexer and FSK transmit/receive gate. After decoding the digital input, the FEC module can store that data in memory or send it directly to the controlling module (MFP/MFC) through the I/O expander bus interface.

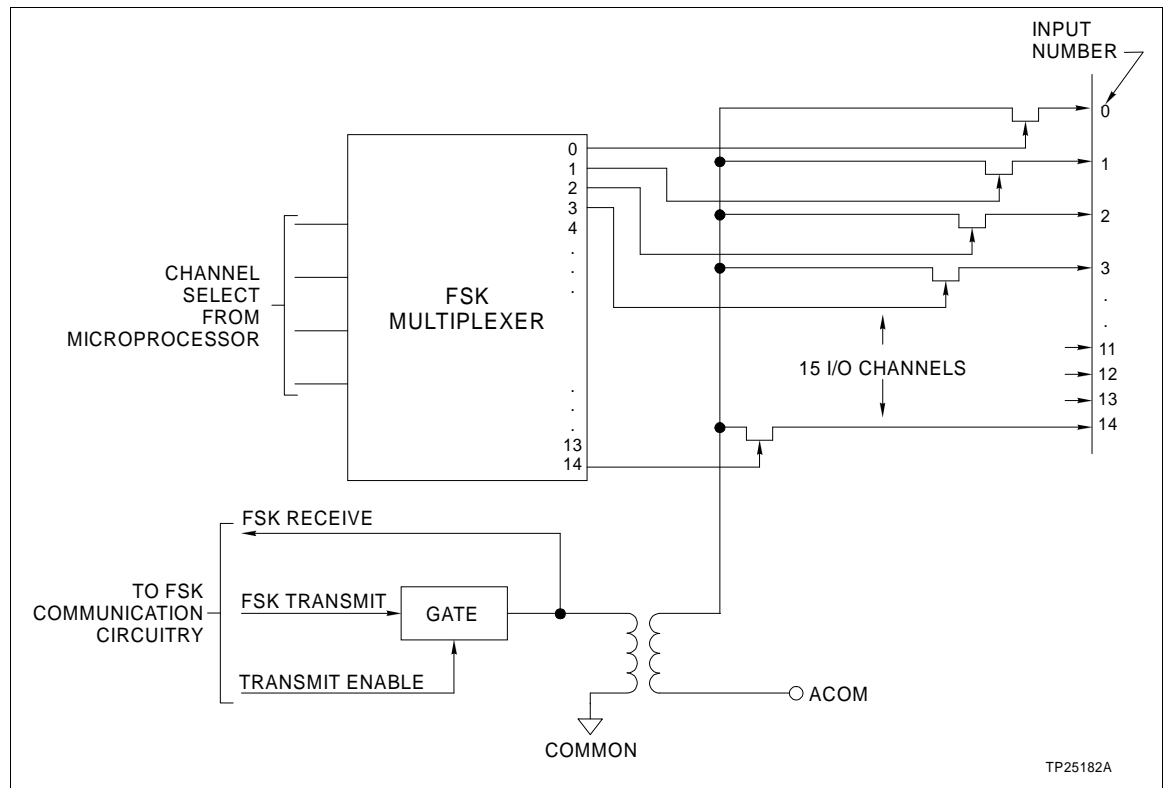


Figure 2-3. FSK Input Circuit

Analog-to-Digital Converter

The FEC module can digitize analog values within the range of -10 to +10 volts. Figure 2-4 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.

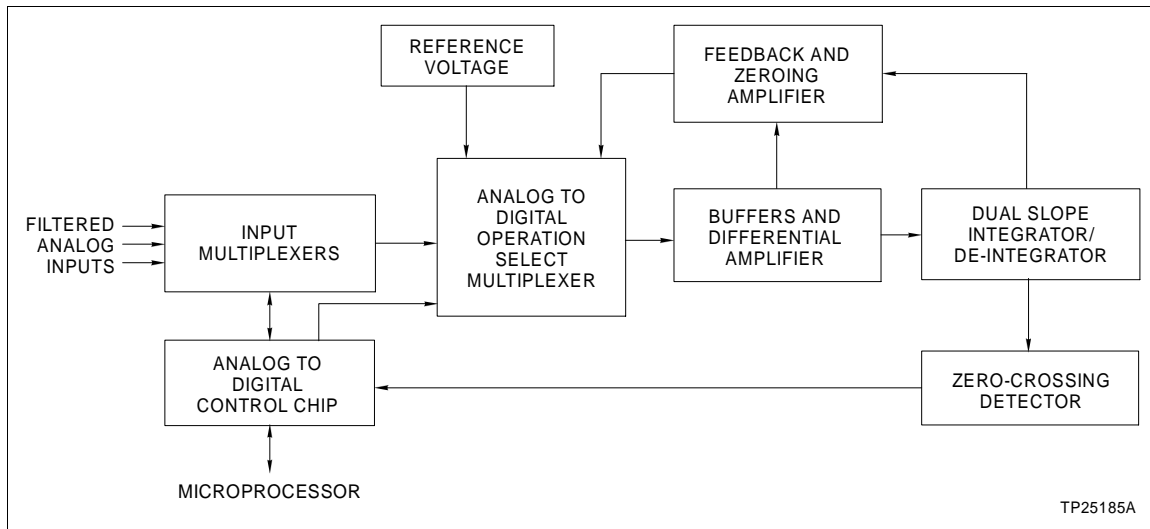


Figure 2-4. Analog to Digital Conversion Circuitry

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 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 Circuitry

The FEC 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.

Communication Circuitry (IMFEC11 only)

The IMFEC11 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 minimum firmware requirements for FSK communications. Figure 2-5 shows the decoding logic which 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
IMFEC11/12	A15
IMMFC03	L.1
IMMFC04	F.1
IMMFC05	E.1
IMMFP01/02	E.1
IMMFP03/03B	E.1
PTS	A11
AVS/EQS	A.0
SM, XM, XE	X.11
SmartLink	1.0
STT02□ ²	D10
STT02	C11
STT03	E10
TBN480	A10
TBN580/581	B11

NOTES:

1. Firmware revision levels that are higher than those listed also support FSK communications.
2. STT02□/□3 models include the E, F and S models. These are English, French and Spanish versions.

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.

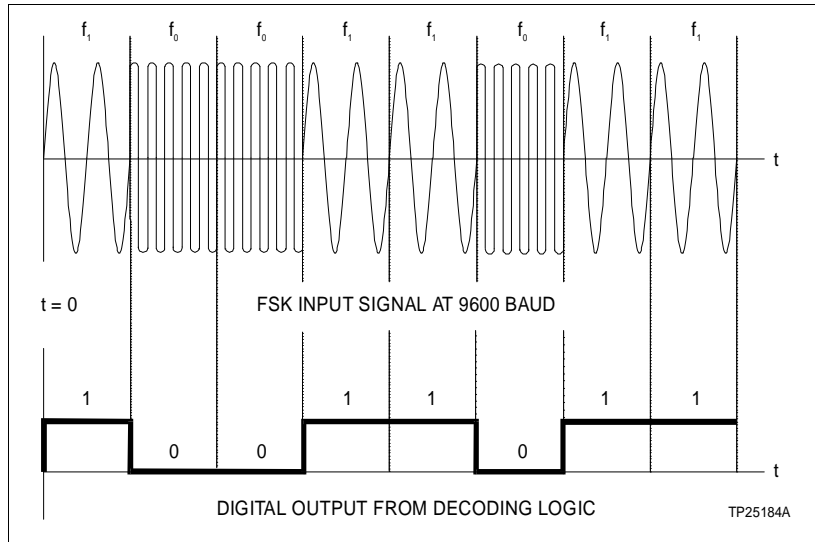


Figure 2-5. FSK Signal and Decoded Digital Equivalent

FSK OPERATION (IMFEC11 ONLY)

The digital interface, made up of the IMFEC11 module and the controlling module, provides a communication path between an INFI 90 OPEN operator interface and Bailey-Fischer & Porter smart transmitters as shown in Figure 2-6. 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 FEC module and controlling module (MFP/MFC). The controlling module communicates with the FEC module over the I/O expander bus.

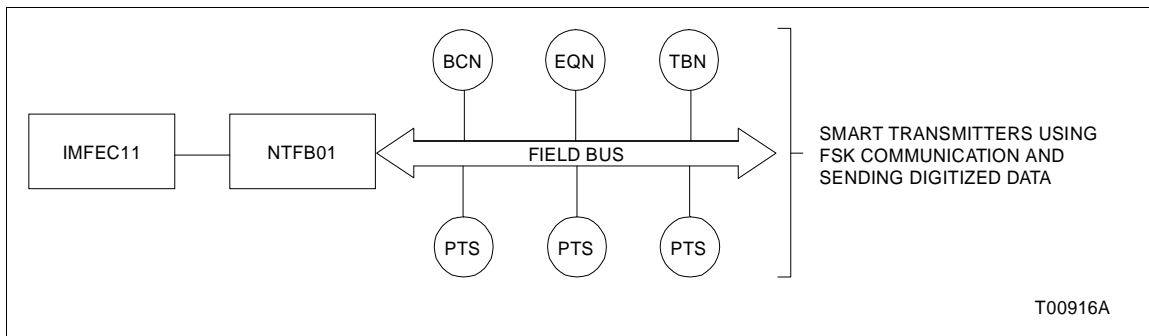


Figure 2-6. Field Bus Mode

SMART TRANSMITTER

FSK smart transmitters communicate with the IMFEC11 module at a rate of 9600 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 FEC module turns the transmitter off-line. The security byte locks out configuration commands from other operator interface devices such as a Type STT03 smart transmitter terminal. 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: Type STT03 is referred to in this instruction. The information also applies to Types STT02 and STT02E terminals. 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.

FSK MODES OF OPERATION (IMFEC11 ONLY)

The IMFEC11 module has two operating modes: FSK field bus mode and FSK analog point-to-point mode. Mode selection is through FEC circuit board jumpers (J2 through J4). 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. 2-6). 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 FEC 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 FEC 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 IMFEC11 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. 2-7). In this 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 FEC module can interface any combination of devices while it is in this operating mode. For example, in addition to FSK smart transmitters, conventional transmitters can input process data but cannot communicate with the FEC 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.

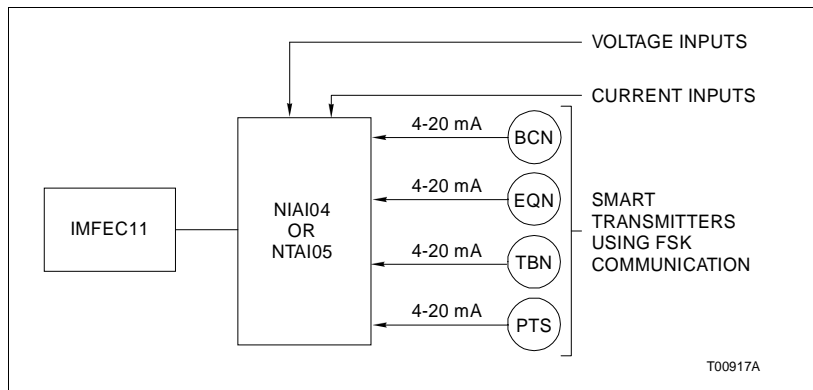


Figure 2-7. FSK Analog Point-to-Point Mode

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains how to install the IMFEC11/12 high level analog input (FEC) 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 Elmag 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 1-5 for the module specifications.

INSTALLATION IN HAZARDOUS LOCATIONS

One or more intrinsic safety barriers are required when the FEC 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 FEC 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	E.1
IMMFP03/03B	E.1

NOTES:
 1. Firmware revision levels higher than those listed also support the enhanced function codes.
 2. Not all transmitters are supported by all firmware revisions.

DIPSWITCH AND JUMPER SETTINGS

For the IMFEC12 module, there is one dipswitch (S1, Fig. 3-1 is the same for both the IMFEC11 and the IMFEC12) that must be set before installing the module. The single dipswitch sets the I/O expander bus address.

For the IMFEC11 module, there is one dipswitch (S1) and 18 jumpers (J2-J4 and J6 -J20) that must be set before installing the module (Fig. 3-1). The single dipswitch sets the I/O expander bus address. Jumpers J2 through J4 set the operating and communication mode, and jumpers J6 through J20 select the input (voltage/current).

NOTE: Input jumpers (J6 through J20) must be set to the voltage position (Fig. 3-1) when using a NTAI05 termination unit, a NIAI04 termination module or the NTFB01 field bus termination unit.

Module Address Selection Switch (S1)

The FEC module must have a unique address on the I/O expander bus. The FEC module can have one of 64 addresses (zero to 63). This address identifies the FEC 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 FEC module in the space provided.

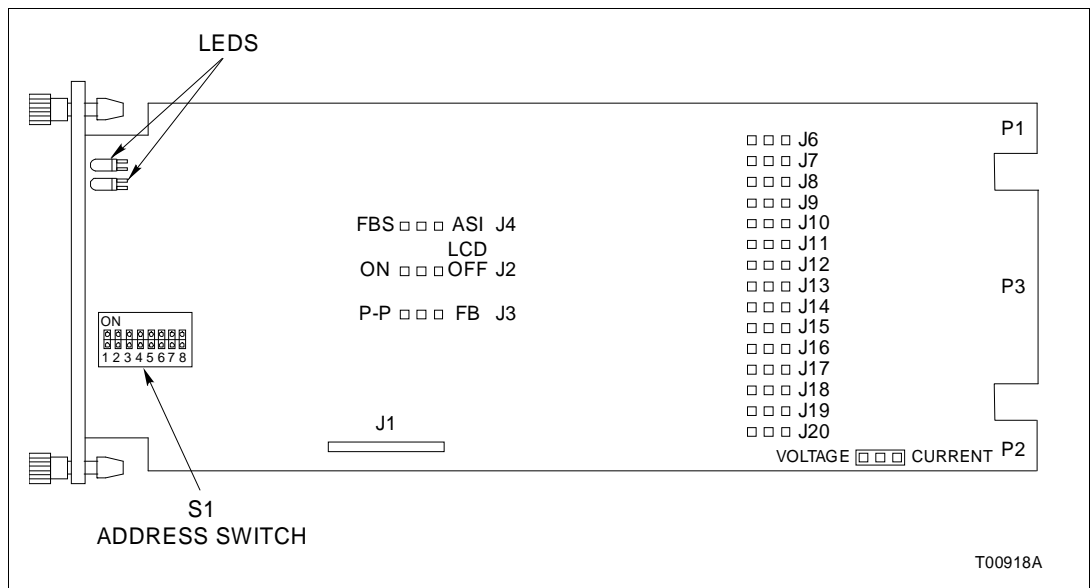


Figure 3-1. IMFEC11/12 Switch and Jumper Locations

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.

Factory Test Jumper (J2)

Jumper J2 is used for factory test purposes only. When in the **ON** position, this jumper enables an LCD display that connects to J1 for diagnostic purposes. This is a factory test feature and should always be disabled (**OFF**) 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 J2.

IMFEC11 Operating Mode Jumper (J3)

The operating mode jumper sets the IMFEC11 operation to point-to-point mode or field bus mode. Set jumper J3 for the desired operating mode. Table 3-3 lists the jumper settings.

Figure 3-1 shows the location of J3 on the FEC circuit board.

Table 3-3. IMFEC11 Jumper Settings¹

Jumper	Position	Function	User Setting
J2	Off	Normal operating mode.	
	On	Factory test mode.	
J3	P-P	Analog point-to-point mode. Module accepts analog inputs and communication is possible with FSK smart transmitters.	
	FB	Field bus mode. No analog inputs are possible and module only communicates with FSK style smart transmitters on a field bus.	
J4	FBS	FEC module mode. Module will communicate only with FSK style smart transmitters on field bus or point-to-point.	
	ASI	Module accepts analog inputs only.	
J6 - J20 ²	Voltage	Voltage input selection.	
	Current	Current input selection (for TBM MMU terminations only).	

- NOTES:**
1. To select a function, use a jumper to short pins.
 2. J6-J20 are always voltage when used with the NTAI05 termination unit, NIAI04 termination module or NTFB01 termination unit.

IMFEC11 Communication Mode Jumper (J4)

The communication mode jumper sets the IMFEC11 communication mode. Table 3-3 lists the jumper setting for J4. Refer to Figure 3-1 for the location of J4 on the FEC circuit board.

IMFEC11 Input Jumpers (J6 through J20)

Fifteen input jumpers allow selection of voltage or current inputs. Refer to Table 3-3 for jumper descriptions.

Figure 3-1 shows the location of the input jumpers and also a diagram silkscreened on the board that shows how to position the jumper. Each jumper has a left pin, center pin and right pin. For voltage, position the jumper on the left and center pins. For current, the jumper would be on the center and right pins.

Termination Unit

Wiring from field devices connect to the INFI 90 OPEN system through terminal blocks on a termination unit or module. Refer to Table 3-4. The termination unit/module must be configured before use.

Table 3-4. Termination Descriptions

Module Description	Termination Used
IMFEC11 (point-to-point analog)	NTAI05 termination unit or NIAI04 termination module
IMFEC11 (FSK - field bus)	NTFB01 field bus termination unit
IMFEC12	NTAI05 termination unit or NIAI04 termination module

NOTE: J6-J20 are always set to voltage when used with the NTAI05, NIAI04, or NTFB01.

If installing the FEC module in the analog input (IMFEC12) or point-to-point mode on an IMFEC11 module, use the NTAI05 Analog Input Termination Unit (refer to [Appendix A](#)) or the NIAI04 Analog Input Termination Module (refer to [Appendix B](#)). Input jumpers (J6 through J20) on the IMFEC11 point-to-point mode module must be set to the **voltage** position when using either the NTAI05 termination unit or the NIAI04 termination module.

NOTE: Refer to Figure 3-1 for location of input jumpers J6 through J20 and Table 3-3 for jumper descriptions.

If installing the IMFEC11 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. Input jumpers (J6 through J20) on the FEC module must be set the **voltage** position when using the NTFB01 unit.

For more information about the termination units or modules, refer to the instructions listed in Table 1-2.

Installation

The FEC module inserts into a standard INFI 90 OPEN 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.

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 FEC 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 FEC 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 $\frac{1}{2}$ -turn on the module faceplate to lock the module in place. To remove the module, turn the captive latches $\frac{1}{2}$ -turn to release the module. Pull on the module faceplate to remove it from the module mounting unit.

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section explains the start-up and operating procedures for the IMFEC11 module.

START-UP

To start up the IMFEC11 module:

1. Apply power to the module.
2. Place the controlling module (MFP/MFC) in execute mode.

Communication between the FEC 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 FEC module the transmitter configurations and the FEC 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 IMFEC11 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 FEC 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 FEC module proceeds until it checks all 15 channels.

The IMFEC11 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 FEC module completes the communication checks of all input channels. During operation, the function code specifications can be tuned through an INFI 90 OPEN operator interface. 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 FEC module may be required for changes to take effect.

For IMFEC11 modules, smart transmitter parameters can be viewed or modified using the handheld Type STT02/03 smart transmitter terminal. View only is possible when the FEC module is present and the FEC channel is on-line. View or modify is possible without the FEC module present or when the FEC channel is off-line. Figure 4-1 shows how the Type STT02/03 terminal connects to the NTFB01 termination unit.

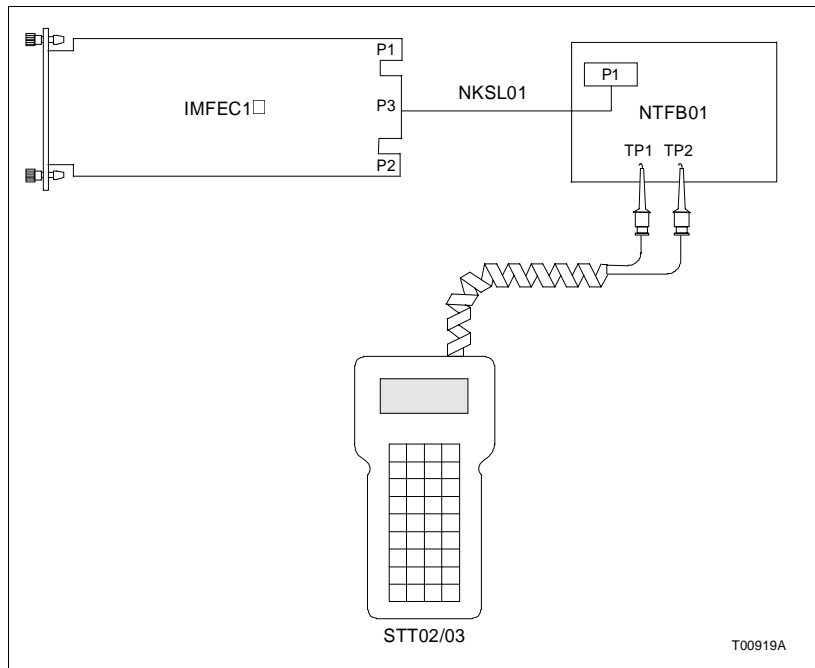


Figure 4-1. Connecting the Type STT02/03 Terminal to the NTFB01 Termination Unit

STATUS LEDS

The IMFEC1□ module has two LEDs (red/green) on its faceplate that indicate module status. Figure 4-2 shows the location of the status LEDs on the FEC faceplate. Refer to Table 4-1 for a list of LED states and their meaning.

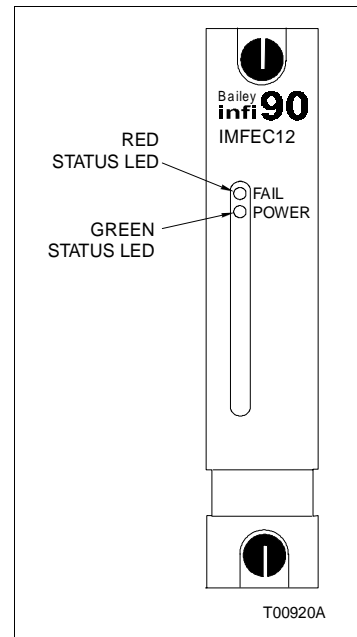


Figure 4-2. IMFEC1□ Status LED

Table 4-1. MFEC1□ Status LED States

Red LED	Green LED	Indication
OFF	OFF	No power or not enabled.
OFF	ON	Enabled and communicating with control module.
ON	OFF	I/O expander bus not operating
OFF	Blinking	(6 times per minute) Module hardware failure

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section explains how to detect IMFEC1□ analog input module errors and the corrective action to take for those errors.

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

From the module summary display on the operator interface, call up the *I/O SLAVE* status report. The status report will display specific FEC 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. (#)*

NOTE: The instruction for your particular operator interface will explain how to access the module summary display.

MODULE STATUS REPORTS

To determine if the error number belongs to the IMFEC1□ 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 FEC module. Table 5-1 lists the meaning of FEC status report error codes and corrective actions.

Table 5-1. IMFEC1□ Error Codes

Error No.	Description	Corrective Action
1	No IMFEC1□ module response or wrong module type	Check IMFEC12 switch setting. Check IMFEC11 jumper and switch settings. Replace the FEC module if switch and/or jumper settings check good. Check function code 132 for correct specification values, such as I/O module address.
2	Calibration error	Replace the module.
3	Channel failure or out of range	Check TU or TM and cabling. Replace IMFEC1□ module if cabling is good. Check function code 132 for correct specification values, such as I/O module address.

Transmitter Status Reports (IMFEC11 ONLY)

The IMFEC11 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.

From the module summary display, call up the *I/O SLAVE* status report. 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 IMFEC11 module. The status report will display specific smart transmitter error codes when an error occurs. The status report lists the following:

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

Table 5-2 lists smart transmitter error codes and their meaning. For corrective action, refer to the product instruction for the smart transmitter in error.

Table 5-2. 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 FEC response or wrong type) occurs when the IMFEC1□ address (set by dipswitch S1 on the 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 address switch 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 FEC 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 of the MMU between the FEC module and its control module.

Blinking Green Status LED

The green status LED on the IMFEC1□ module blinks every ten seconds if the module has a hardware failure. To correct a hardware failure, replace the FEC module.

EDGE CONNECTOR PIN ASSIGNMENTS

Edge connector pin assignments (P1, P2 and P3) are listed in Tables 5-3 through 5-5. The pin assignments for J1 (connector for the LCD diagnostic display) are in Table 5-6.

Table 5-3. 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 5-4. 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 5-5. 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 5-6. J1 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 6 - MAINTENANCE

INTRODUCTION

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. Elsas 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 IMFEC1□ module and the INFI 90 OPEN system, have experience working with process control systems, and know what precautions to take when working on live AC systems.

PREVENTIVE MAINTENANCE SCHEDULE

Table 6-1 is the preventive maintenance schedule for the FEC module. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Some tasks in Table 6-1 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 6-1. 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 module for dust. Clean as necessary using an antistatic vacuum.	
Check all module signal, power and ground connections within the cabinet. Verify that they are secure. See procedure.	
Check module 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 6-1 that require specific instruction or further explanation:

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

Checking Connections

WARNING

There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death.

If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist.

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**WARNING**

Never clean electrical parts of components with live power present. Doing so exposes you to an electrical shock hazard.

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.

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 7 - REPAIR AND REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement steps for an IMFEC1□ analog input module. There are no special tools required to replace the module.

MODULE REPAIR AND REPLACEMENT

If the IMFEC1□ 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 8 - SUPPORT SERVICES

INTRODUCTION

Elsag Bailey 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. Elsad Bailey can also provide installation, repair and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

Order replacement parts through a Elsad Bailey 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. Elsad 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

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

TECHNICAL DOCUMENTATION

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

APPENDIX A - NTAI05 TERMINATION UNIT CONFIGURATION

INTRODUCTION

The IMFEC1□ module can use the NTAI05 termination unit for point-to-point operation. Select the input type of each channel through the dipshunts on the termination unit. The FEC module can accept inputs of 4 to 20 milliamps, 1 to 5 VDC, 0 to 1 VDC, 0 to 5 VDC, 0 to 10 VDC and -10 to +10 VDC.

NOTE: Input jumpers J6 through J20 on the IMFEC11 board must be set to the voltage position. Refer to *IMFEC11 Input Jumpers (J6 through J20)* in Section 3.

CONFIGURING INPUTS

Figure A-1 shows 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.

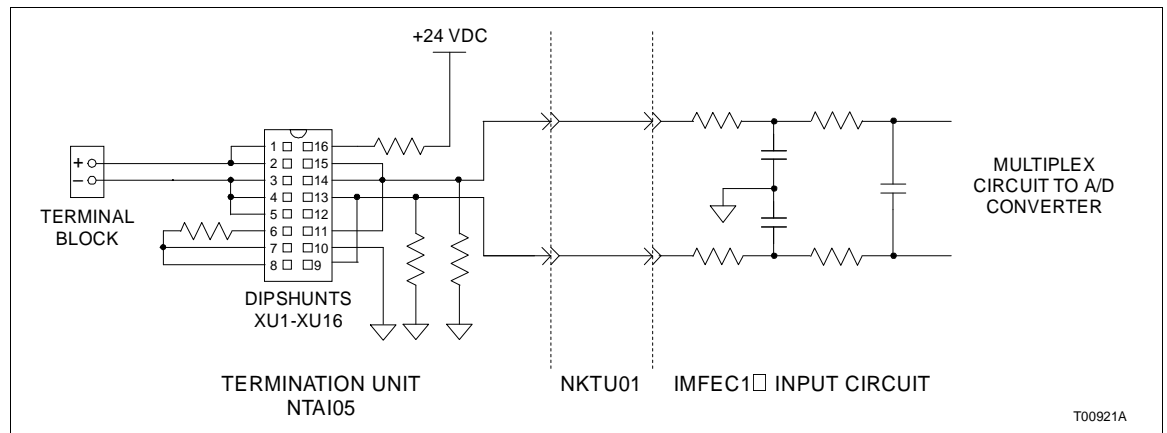


Figure A-1. NTAI05 Input Circuit

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 ²			
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 to +10 VDC	TP25171C	XU17	

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

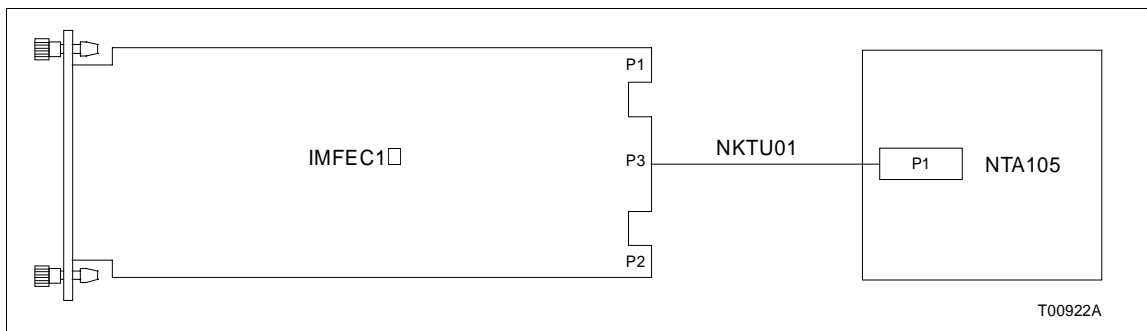


Figure A-2. NTAI05 Cable Connections

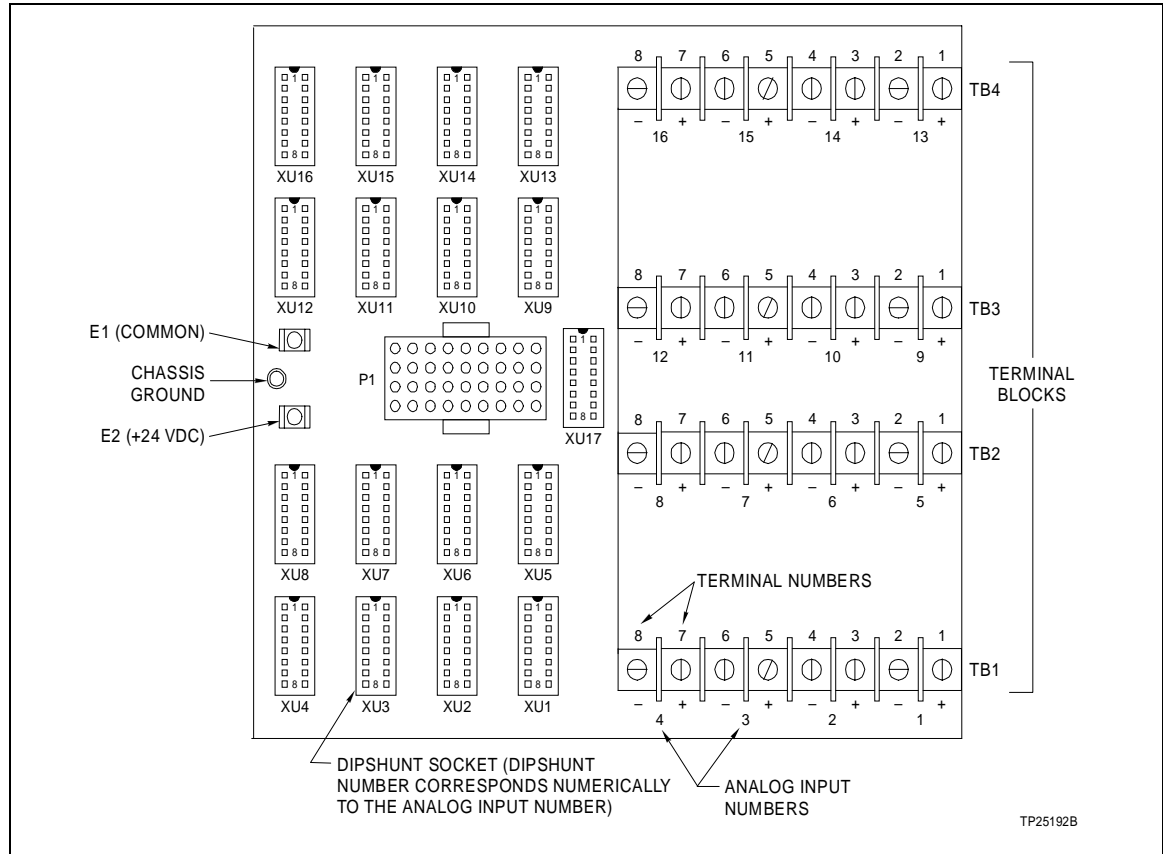


Figure A-3. NTAI05 Terminal Assignments

APPENDIX B - NIAI04 TERMINATION MODULE CONFIGURATION

INTRODUCTION

The IMFEC1□ module can use the 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 FEC module can accept inputs of 4 to 20 milliamps, 1 to 5 VDC, 0 to 1 VDC, 0 to 5 VDC, 0 to 10 VDC and -10 to +10 VDC.

CONFIGURING INPUTS

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

NOTE: Input jumpers J6 through J20 on the IMFEC11 board must be set to the voltage position. Refer to **IMFEC11 Input Jumpers (J6 through J20)** in Section 3.

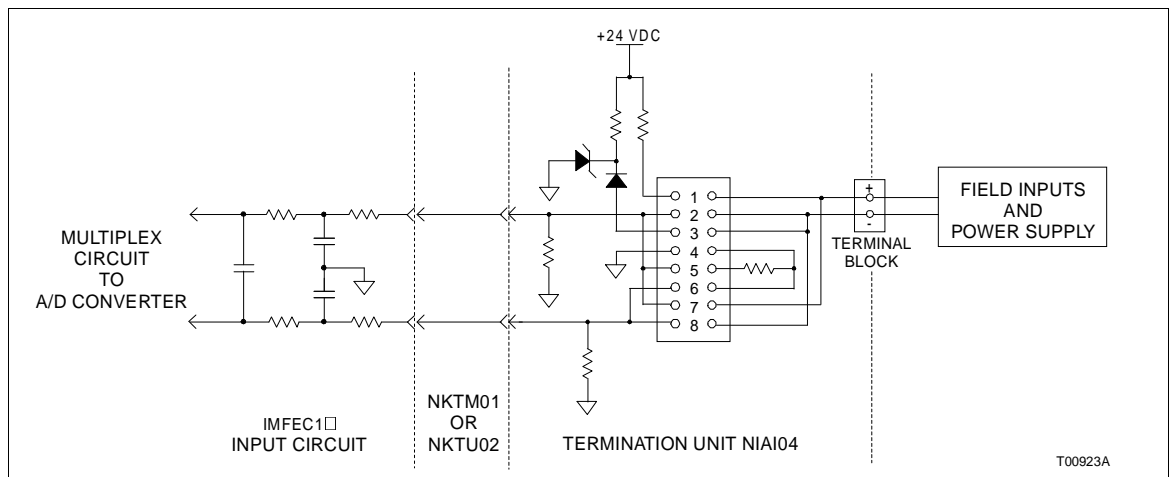


Figure B-1. NIAI04 Input Circuit

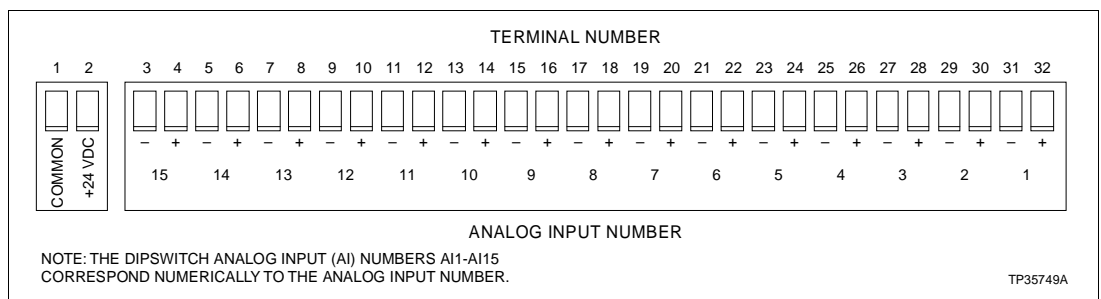


Figure B-2. NIAI04 Terminal Assignments

Table B-1. NIAI04 Dipswitch Settings

Application/Signal Type	Dipswitch Configuration ^{1,2}	Connecting Cable
System powered 4 to 20 mA	<p>S1-S15</p>	NKTM01 or NKTU02
Externally powered 4 to 20 mA	<p>S1-S15</p>	
Single ended voltage ³	<p>S1-S15</p>	
Differential voltage ³	<p>S1-S15</p>	
All applications	<p>S16 ONLY</p> <p>TP25177B</p>	

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.

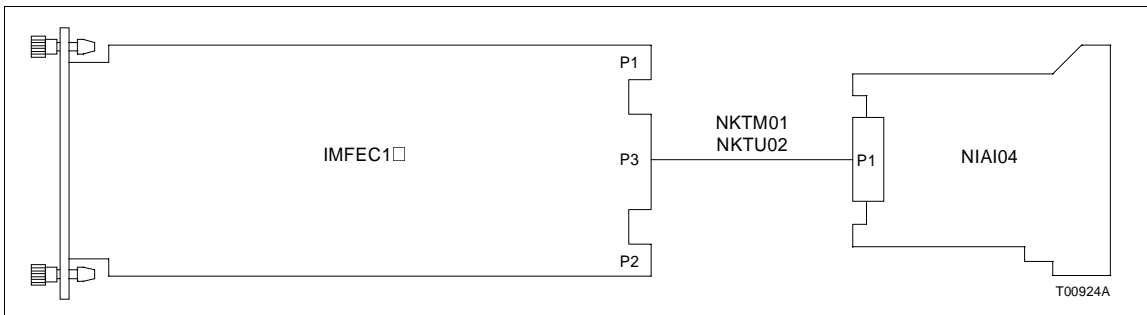


Figure B-3. NIAI04 Cable Connections

APPENDIX C - NTFB01 TERMINATION UNIT CONFIGURATION

INTRODUCTION

The IMFEC11 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.

NOTE: Input jumpers J6 through J20 on the IMFEC11 board must be set to the voltage position. Refer to *IMFEC11 Input Jumpers (J6 through J20)* in Section 3.

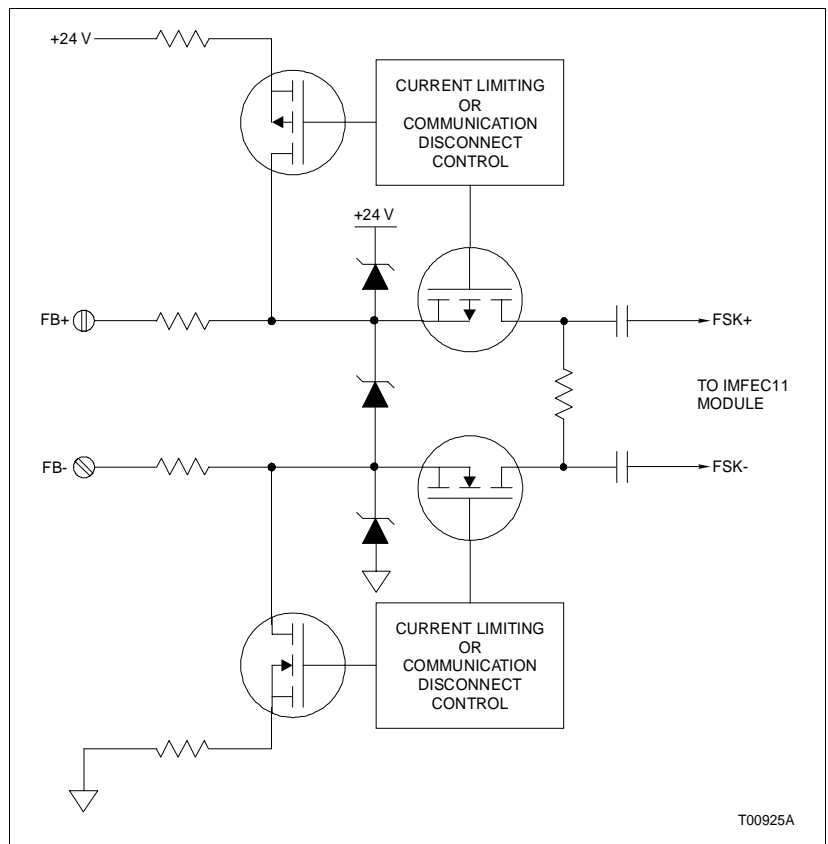


Figure C-1. NTFB01 I/O Module Input Circuit

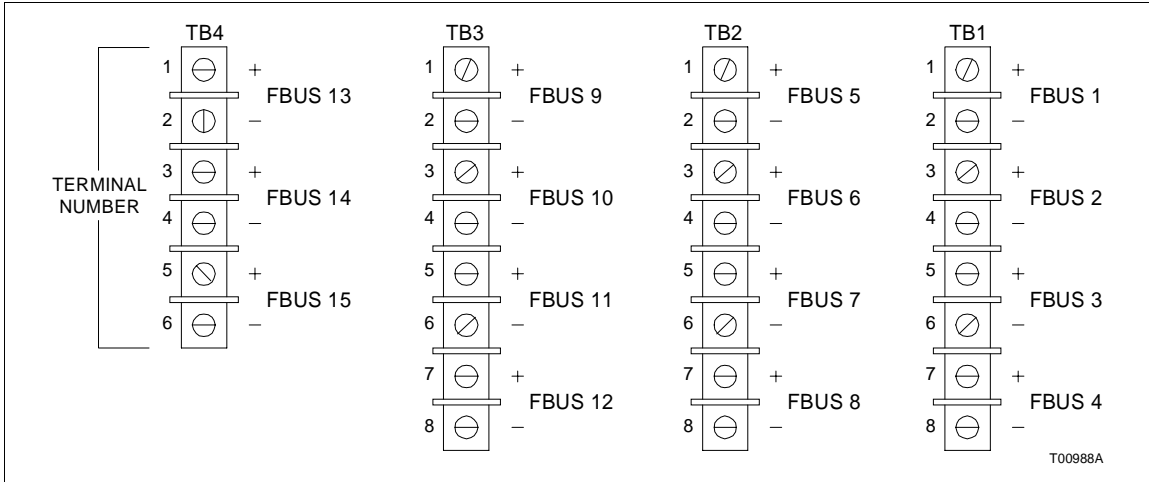


Figure C-2. NTFB01 Terminal Assignments

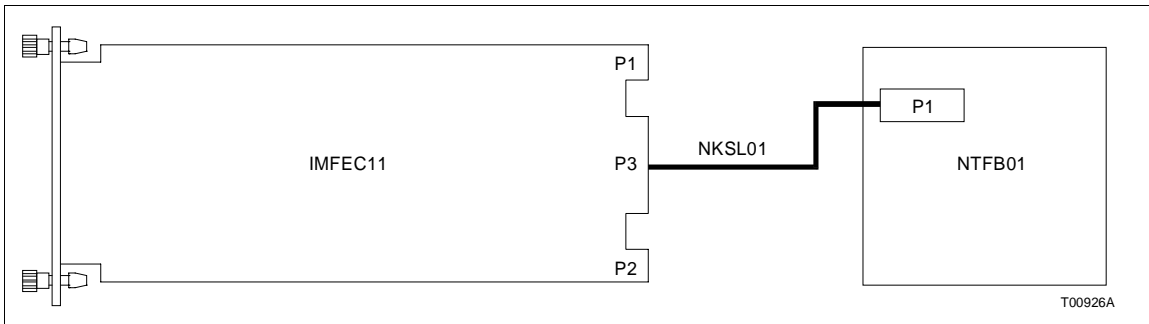


Figure C-3. NTFB01 Cable Connections

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