

TFZ Programmable FOUNDATION Fieldbus™
Temperature Transmitter



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TFZ

Programmable FOUNDATION Fieldbus™
Temperature Transmitter

Introduction

This is the user's manual for Moore Industries' TFZ Programmable FOUNDATION Fieldbus™ Temperature Transmitter. It contains all of the information needed to configure, install, operate and maintain the TFZ.

About this Manual

Pay particular attention wherever you see a "**Note**", "**Caution**" or "**WARNING**".

Note— Information that is helpful for a procedure, condition or operation of the unit.

Caution— Hazardous procedure or condition that could damage or destroy the unit.

WARNING— Hazardous procedure or condition that could injure the operator.

The TFZ

The TFZ is a 2-wire (loop-powered), user-configurable, FOUNDATION Fieldbus™-based temperature transmitter. It is an H1 Basic Device conforming to the H1-Standard (IEC 61158-2, 31.25kb/s) and is implemented as a *Group 3, Class 31 device. It allows you to network multiple transmitters onto one link that utilizes the FOUNDATION Fieldbus protocol.

The TFZ is comprised of an Analog Input Function Block (AI) which is supported by one Resource Block (RB) and one temperature Transducer Block (TB).

The TFZ configures to accept a direct input from sensors and a wide array of transmitters and instruments. It then converts the input to a two-way, all digital communication protocol that is ready for direct interface with an AMS, DCS and other computer-based SCADA systems.

Model and Serial Numbers

Moore Industries uses the model and serial numbers of our instruments to track information regarding each unit that we sell and service. If a problem occurs with your instrument, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

*Group 3 indicates that the device is network configurable.
Class 31 indicates that the device might publish and/or subscribe data and/or is a client.

Specifications

<p>Performance Input Accuracy: Refer to Table 4 Overall Accuracy: The overall accuracy of the unit is the input accuracy. It includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution. It does not include ambient temperature effect. For T/C input, add the RJC error. Reference Junction Compensation: ±0.45°C (±0.81°F) Stability: Refer to Table 1 Isolation: 500Vrms between input, output and case continuous, and will withstand a 500Vac dielectric strength test for one minute (with no breakdown) Step Response Time: 500msec, maximum, 256msec typical from the time an input is applied until the time the corresponding floating point processed variable is available to be read by other FOUNDATION Fieldbus devices Over-voltage Protection: Input, ±5Vdc peak, maximum Digital Input Filter: 50/60 Hz (user-selectable) Power Supply Requirement: 9-32Vdc, 12.07mA maximum under normal operation; 18mA maximum under fault conditions</p>	<p>Performance (Continued) Supply Range: 9-32V, Foundation Fieldbus Approved Load Effect: N/A T/C Input Impedance: 40Mohms, nominal Excitation Current: RTD and Ohms, 250 microamps, ±10% RTD Lead Wire Resistance Maximum: RTD resistance + 2X lead wire resistance <4000 ohms; Recommended lead wire resistance for three wire connections: <35 ohms/wire; 10 ohm copper sensor <5 ohms Sensor Lead Resistance Effect: 1.0 ohm in reading/ohm of lead resistance for 2-wire sensors; 1.0 ohm in reading/ohm of lead of unbalanced resistance for 3-wire sensors; no effect on 4-wire sensors Resolution: Input, 20-bit</p> <p>Display Type: Top Row, 10mm (0.4 in) high black digits on a reflective background; Bottom Row, 6mm (0.225 in) high digits on a reflective background; Two-digit FOUNDATION Fieldbus address indicator Format: Two rows of five alphanumeric characters</p>	<p>Display (Continued) Decimal Points: Automatically adjusted decimal point with a user selectable maximum up to four places Range: -99999 to 99999 Minimum Display Span: 1.00</p> <p>Ambient Temperature Operating and Storage Range: -40°C to +85°C (-40°F to +185°F) Relative Humidity: 0-95%, non-condensing Ambient Temperature Effect: Refer to Table 2 Effect on Reference Junction Compensation: ±0.005°C of input span/°C change of ambient temperature RFI/EMI Immunity: 20V/m@80-1000MHz, 1kHz AM when tested according to IEC 1000-4-3-1995 with 0.5% of span or less Startup Time: Performance falls within specification 8 seconds after power is applied Noise Rejection: Common mode, 100dB@50/60Hz; Normal Mode: Refer to Table 3</p> <p>Weight 210g (7.4 oz)</p>
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Specifications and information subject to change without notice.

Table 1. Long-Term Stability

Stability (% of maximum span)	Input to FOUNDATION Fieldbus H1		
	1 yr	3 yrs	5 yrs
T/C, mV	0.008	0.014	0.019
RTD, Ohm, Potentiometer	0.047	0.081	0.104

Table 2. Ambient Temperature Effects

Sensor Type	Digital Accuracy per 1°C (1.8°F) change in Ambient
RTD	0.003°C
T/C	0.003°C + 0.005% of reading
Millivolt	0.005mV + 0.005% of reading
Ohm	0.002 ohms + 0.005% of reading

Table 3. Normal Mode Rejection Ratio

Sensor Type	Max. p-p Voltage Injection for 70dB at 50/60Hz	
T/C: J, K, N, C, E	150mV	
T/C: T, R, S, B	80mV	
Pt RTD: 100, 200, 300 ohms	250mV	
Pt RTD: 400, 500, 1000 ohms	1V	
Ni: 120 ohms	500mV	
Cu: 9.03 ohms	100mV	
Resistance	mV	
1-4kohms	250-1000	1V
0.25-1kohms	62.5-250	250mV
0.125-0.25kohms	31.25-62.5	100mV

Table 4. Input and Accuracy Table

Input	Type	α	Ohms	Conformance Range	Minimum Span	Input Accuracy	Maximum Range	Sensor-to-Transmitter Matching
RTD	Platinum	0.003850	100	-200 to 850°C -328 to 1562°F	10°C (18°F)	±0.1°C (±0.18°F)	-240 to 960°C -400 to 1760°F	Up to ±0.014°C (±0.025°F) system accuracy*.
			200					
			300					
			400					
			500					
			1000					
		0.003902	100	-100 to 650°C -148 to 1202°F				
			200					
			400					
			500					
0.003916	100	-200 to 510°C -328 to 950°F	-240 to 580°C -400 to 1076°F					
Nickel	0.00672	120	-80 to 320°C -112 to 608°F	-100 to 360°C -148 to 680°F				
Copper	0.00427	9.035	-50 to 250°C -58 to 482°F	100°C	±0.85°C (±1.53°F)	-65 to 280°C -85 to 536°F		
Ohms	Direct Resistance	n/a	0-4000 ohms	0-4000 ohms	10 ohms	±0.4 ohms	0-4095 ohms	
	Potentiometer		125, 250, 500, 1k, 2k, 4k ohms	0-100%	10%	±0.1%	0-100%	
T/C	J	n/a	n/a	-180 to 760°C -292 to 1400°F	35°C 63°F	±0.25°C (±0.45°F)	-210 to 770°C -346 to 1418°F	
	K	n/a	n/a	-150 to 1370°C -238 to 2498°F	40°C 72°F	±0.3°C (±0.54°F)	-270 to 1390°C -454 to 2534°F	
	E	n/a	n/a	-170 to 1000°C -274 to 1832°F	35°C 63°F	±0.2°C (±0.36°F)	-270 to 1013°C -454 to 1855.4°F	
	T	n/a	n/a	-170 to 400°C -274 to 752°F	35°C 63°F	±0.25°C (±0.45°F)	-270 to 407°C -454 to 764.6°F	
	R	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F	
	S	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F	
	B	n/a	n/a	400 to 1820°C 752 to 3308°F	75°C 135°F	±0.75°C (±1.35°F)	200 to 1836°C 392 to 3336.8°F	
	N	n/a	n/a	-130 to 1300°C -202 to 2372°F	45°C 81°F	±0.4°C (±0.72°F)	-270 to 1316°C -454 to 2400.8°F	
	C	n/a	n/a	0 to 2300°C 32 to 4172°F	100°C 180°F	±0.8°C (±1.44°F)	0 to 2338°C 32 to 4240.4°F	
Millivolts	DC	n/a	n/a	-50 to 1000mV	4mV	15 microvolts	-50 to 1000mV	

*High-accuracy measurements are achieved by using a 4-wire, 1000 ohm platinum RTD with a span of 100°F (50°F minimum) calibrated in our sensor-matching calibration bath.

Figure 1. TFZ Hockey-Puck Housing (HP) Dimensions with Flanges

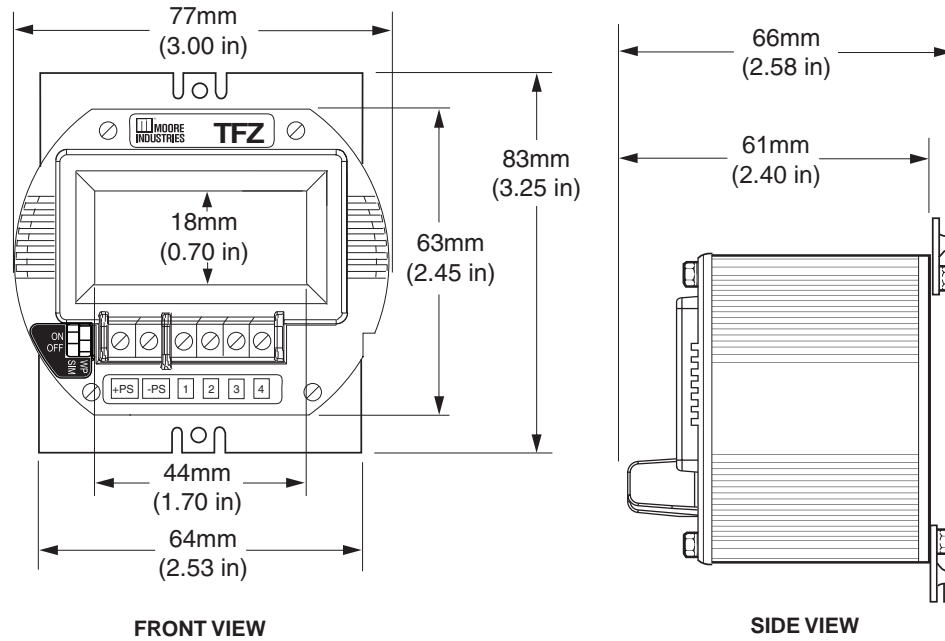


Figure 2. BH Housing Dimensions

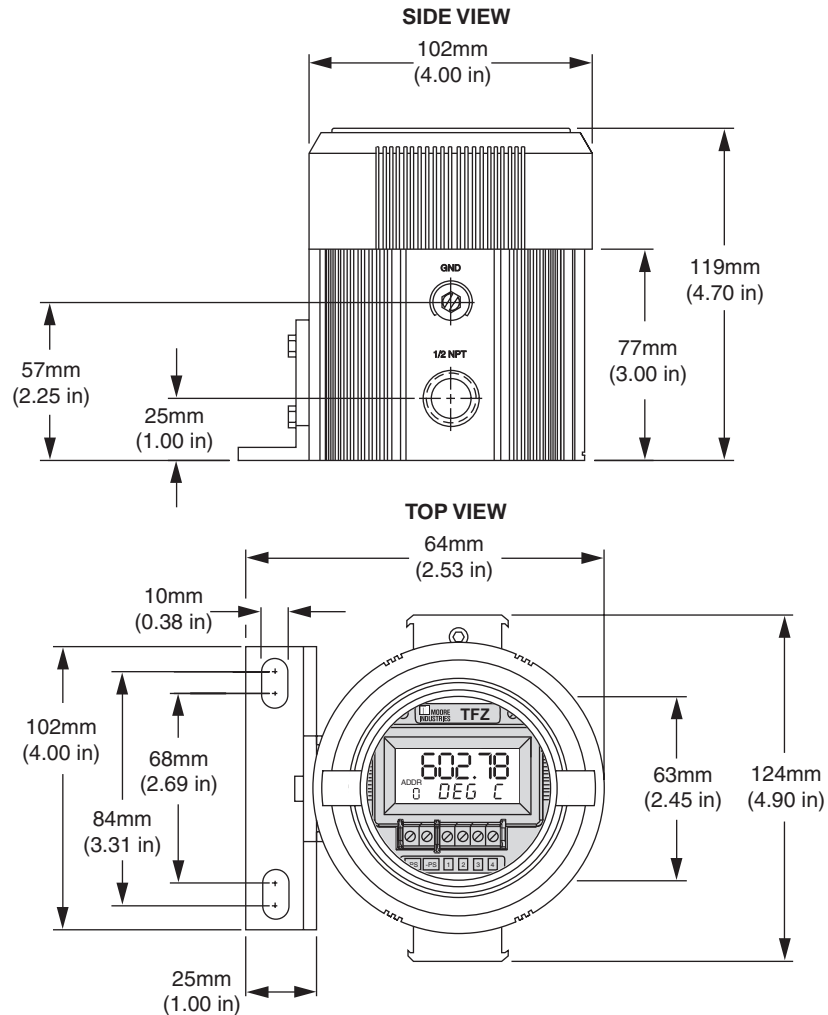


Figure 3. D-Box Housing Dimensions

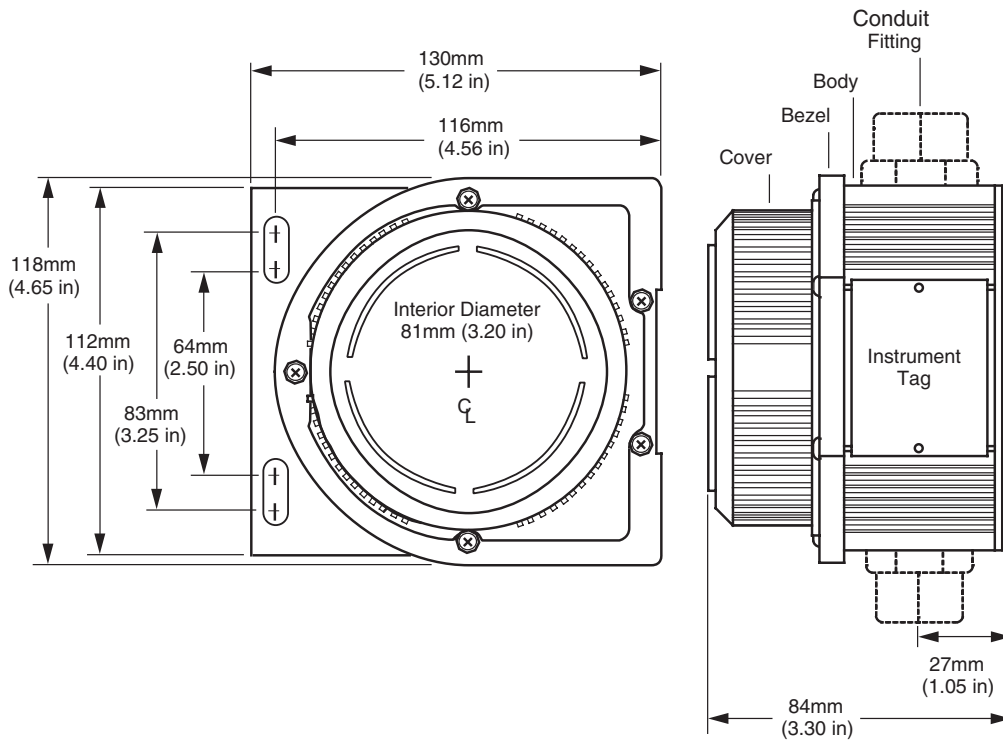
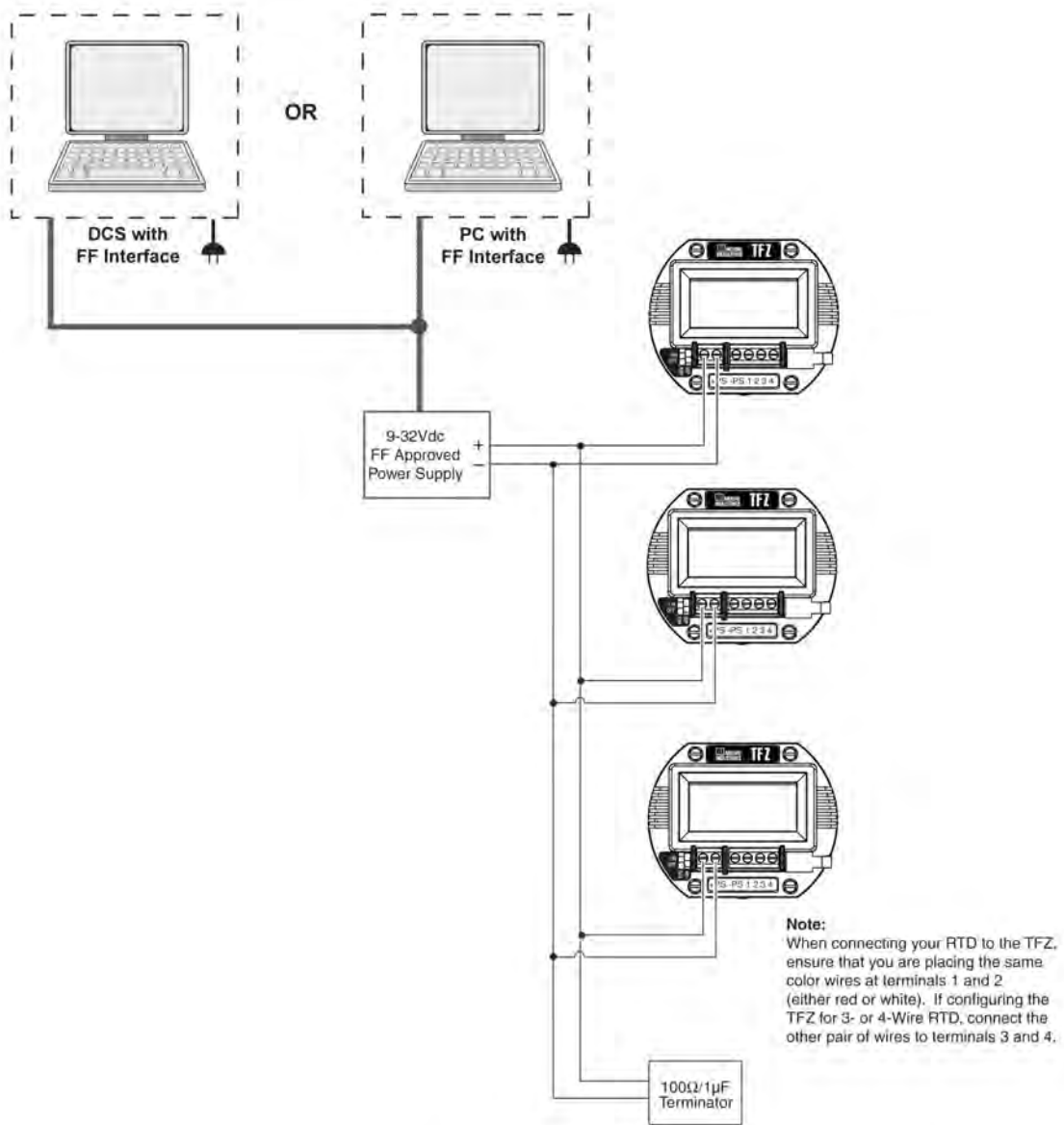


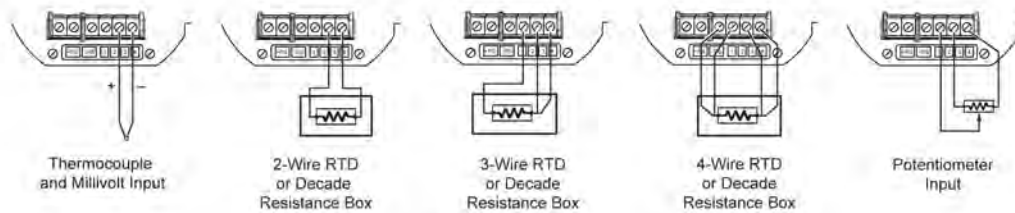
Table 5. Necessary Equipment Table

Device	Specifications
Variable Input Simulator for Thermocouple, RTD, Millivolt, Potentiometer or Decade Resistance Box	Variable; Accurate to $\pm 0.05\%$ of unit span
Power Supply	9-32Vdc, Foundation fieldbus® registered
Personal Computer (Optional)	Microsoft Windows based PC; 16Mb free RAM; 20MB free disk space on hard drive Microsoft Windows XP, Vista or 7 1 (one) serial port or one available USB port (with optional USB cable)
Fieldbus Configuration Tool	Capable of configuring the required FOUNDATION Fieldbus® parameters

Figure 4. Incorporating the TFZ Into Your System



Input Hook-Up Connections



FOUNDATION Fieldbus Interface

The TFZ's fieldbus interface is comprised of an Analog Input Function Block (AI) which is supported by one Resource Block (RB) and one temperature Transducer Block (TB).

The following describes additional interface parameters.

Device Description

The Device Description (DD) files are required in order to use a Fieldbus Configuration Tool. The DD files can be found on the *Moore Industries Interface Solution PC Configuration Software* CD, which accompanied your TFZ.

You may also visit our website at www.miinet.com to obtain the installation files.

Common File Format

The Common File Format (CFF) capability is required for offline configuration of the TFZ.

Manufacturer's ID

The Manufacturer's ID is a constant value and is stored in the Resource Block MANUFAC_ID parameter.

The Manufacturer's ID for Moore Industries devices will always be 0x0007B0.

Device Type

The device type is a constant value that is assigned by the manufacturer. It is held in the Resource Block's DEV_TYPE parameter. For the TFZ, this value will always be 0x0001.

Device ID

Device ID is a constant value that is assigned by Moore Industries at the time of manufacture. It manifests itself as the DEV_ID object which is the device identifier. It is a permanent, unique identifier for the device and is made up of the Manufacturer's ID, Device type and serial number as shown in the following example.

mmmmmmttttssssssssssssssss

where

mmmmmm = Manufacturer ID

tttt = Device type

ssssssssssssss = Serial number packed with leading zeros

The full length of the serial number identifier is not needed. Therefore, the final six characters are replaced with spaces. This leads to the following:

If the serial number is 8492, the Device ID will be:

0007B000010000000000008492

Physical Device Tag

Initially, the Physical Device Tag is assigned by Moore Industries at the time of manufacture. It manifests itself as the PD_TAG object, which is an alphanumeric, unique identifier for the device. The parameter is initially *TFZ_Transmitter_* with the value following the underscore being ten serial number characters and then six spaces. Once installed, you can alter the Physical Device Tag to reflect a desired descriptor.

Block Tags

Block tags for the individual blocks are initially assigned by Moore Industries at the time of manufacture. They are comprised of a sixteen character string, followed by the last ten numerical characters of the serial number, and then six space characters. The sixteen character string identifies each block uniquely within the device. Once the TFZ is installed, each of the block tags may be altered (in isolation) for compatibility with plant practice.

LC-Display

The LC-Display contains two rows of five alphanumeric characters. The larger display is typically used to display the process variable; the smaller display will indicate the units. The two-character display shows the fieldbus node address.

Function Blocks

The following describes general information regarding TFZ functions blocks.

Device Description

Before attempting to configure the TFZ, ensure that the host is operating with the most recent version of the Device Description file. To verify that you are using the most recent version, you may visit our website at www.miinet.com and install the files.

Node Address

When shipped, the TFZ is temporarily set to address 248. This enables FOUNDATION fieldbus host systems to automatically detect the device and move it to a permanent address.

Modes

The Resource, Transducer and Analog Input Function Blocks have modes of operation that dictate the operation of the block. Each block supports both automatic (AUTO) and out of service (OOS) modes. There may also be other modes that are supported.

When an upstream block is set to OOS, the output status of all downstream blocks is affected. Therefore, the Resource Block mode will affect the AI Function Block mode. However, the Transducer Block is not in the mode stream so will neither affect, nor be affected by, the modes of the other blocks.

Changing Modes

To change the operating mode, set the MODE_BLK.TARGET parameter to the desired setting. If the block is functioning properly, after a short delay the MODE_BLOCK.ACTUAL parameter should reflect the change.

Permitted Modes

In order to prevent unauthorized changes to a block's operating mode, configure MODE_BLOCK to PERMITTED. This allows only the desired operating modes to be in use. It is recommended to always select OOS as one of the permitted modes.

Automatic

This is typically set as the normal operating mode. In AUTO mode, any functions performed by the block will execute. If the block has any outputs, they will continue to update.

Out of Service (OOS)

If a block is set to OOS, then some of its functions will not execute. If the block has any outputs, they typically will not update and the status of any values passed to downstream blocks will be returned to the previous setting in order for the block to operate normally.

Some changes to the configuration of the block will require the block mode to be switched to OOS. However, when the changes have been made, the mode should be returned to the previous setting.

Manual

In this mode (labeled MAN), variables that are passed out of the block can be manually set for test or override purposes. In the TFZ, this mode is only available with the AIFB.

Link Active Scheduler (LAS)

Currently, the TFZ has no LAS capabilities.

Block Instantiation

Block instantiation is not supported by the TFZ.

Virtual Communication Relationships (VCRs)

There are a total of 24 VCRs in the TFZ. Of those, four are permanent and 20 are fully configurable by the host system. The TFZ also makes available 22 Link Objects.

Block Execution

The maximum block execution time for an analog input is 30ms.

Host Timer Recommendations

Table 6. Host Timer Recommendations

Host Timer Recommendations	Value
T1	96000
T2	1920000
T3	480000

Simulate Enable Switch

The Simulate Enable switch, labeled SIM, is found on the TFZ's front panel. It is used to enable simulation of measurements and as a lock-out feature for the AIFB. To enable this feature, slide the SIM switch into the ON position.

Write Protect Switch

The Write Protect switch, labeled WP, is found on the TFZ's front panel. It is used in conjunction with the Resource Block to prohibit writing of any configuration changes to the TFZ. If hard write locking is enabled coupled with the Write Protect switch being set to ON, then writing to any block parameters cannot occur.

Description of Foundation Fieldbus Blocks

This section describes the TFZ's available Function Blocks.

Resource Block (Index Number 1000)

The Resource Function Block (RB) contains diagnostics, hardware and electronics information along with display configuration. There are no linkable inputs or outputs to the Resource Block.

Table 7. Resource Block Parameters

Parameter Mnemonic	Rel. Index	Obj Type	Data Type Structure	Store	Size	Valid Range	Initial Value	Unit	Mode	Other	Range Check
STANDARD PARAMETER	0..6										
RS_STATE	7	S	Unsigned8	D	1	[6]:4.4.3.24	0:undefined	E		Read only	
TEST_RW	8	D	Visible String	D	112		null	na			
DD_RESOURCE	9	S	Visible String	S	32		null	na		Read only	
MANUFAC_ID	10	S	Unsigned32	S	4	0x0007B0	0x0007B0	none		Read only	
DEV_TYPE	11	S	Unsigned16	S	2	0x0001	0x0001	E		Read only	
DEV_REV	12	S	Unsigned8	S	1	0x01	0x01	none		Read only	
DD_REV	13	S	Unsigned8	S	1	0x01	0x01	none		Read only	Yes
GRANT_DENY	14	R	DS-70	S	2		0;0	na			
HARD_TYPES	15	S	Bit String	S	2		0x8000	na		Read only	
RESTART	16	D	Unsigned8	D	1	0: undefined 1: Run 2: Restart Resource block 3: Factory defaults 4: Reset device	1: Run	E			Yes
FEATURES	17	S	Bit String	S	2		0x5800; Reports; Soft write lock; Hard write lock	na		Read only	
FEATURE_SEL	18	S	Bit String	S	2		0x4800; Reports; Hard write lock	na			
CYCLE_TYPE	19	S	Bit String	S	2		0xC000	na		Read only	
CYCLE_SEL	20	S	Bit String	S	2		0x0000	na			
MIN_CYCLE_T	21	S	Unsigned32	S	4		3200	1/32ms		Read only	
MEMORY_SIZE	22	S	Unsigned16	S	2		0	kbytes		Read only	
NV_CYCLE_T	23	S	Unsigned32	S	4		0	1/32ms		Read only	
FREE_SPACE	24	S	Float	D	4	0-100%	0	%		Read only	
FREE_TIME	25	S	Float	D	4	0-100%	0	%		Read only	
SHED_RCAS	26	S	Unsigned32	S	4		64000	1/32ms			Yes
SHED_ROUT	27	S	Unsigned32	S	4		64000	1/32ms			Yes
FAULT_STATE	28	S	Unsigned8	N	1	1: Clear; 2: Active	1	E		Read only	
SET_FSTATE	29	S	Unsigned8	D	1	1: Off; 2: Set	1: Off	E			Yes
CLR_FSTATE	30	S	Unsigned8	D	1	1: Off; 2: Clear	1: Off	E			Yes
MAX_NOTIFY	31	S	Unsigned8	S	1	20	20	none		Read only	
LIM_NOTIFY	32	S	Unsigned8	S	1	0..[MAX_NOTIFY]	20	none			Yes
CONFIRM_TIME	33	S	Unsigned32	S	4		64000	1/32ms			Yes
WRITE_LOCK	34	S	Unsigned8	S	1	1: Unlocked; 2: Locked	1: Unlocked	E			Yes
UPDATE_EVT	35	R	DS-73	D	14		0;0;0;0; 0x0900	na		Read only	
BLOCK_ALM	36	R	DS-72	D	13		0;0;0;0;0	na			Yes
ALARM_SUM	37	R	DS-74	mix	8		0;0;0;0	na			
ACK_OPTION	38	S	Bit String	S	2	0: Auto Ack Disabled; 1: Auto Ack Enabled	0:Auto Ack Disabled	na			
WRITE_PRI	39	S	Unsigned8	S	1	0...15	0				
WRITE_ALM	40	R	DS-72	D	13		0	none			Yes
ITK_VER	41	S	Unsigned16	S	2		4	none		Read only	

Continued on next page

Table 7. Continued

Manufacturer Specific											
Parameter Mnemonic	Rel. Index	Obj Type	Data Type Structure	Store	Size	Valid Range	Initial Value	Unit	Mode	Other	Range Check
TOT_HRS_USED	42	S	Unsigned32	D	4		0			Read only	
TOT_HRS_CONFIG	43	S	Unsigned32	N	4		0			Read only	
LCD_SELECTOR	44	S	Unsigned8	N	1	0: PV(TTB) 1: OUT(AIFB1) 2: PV+LCD_EGU 3: UT+LCD_EGU	0: PV(TTB)	E			Yes
LCD_EGU	45	S	Visible String	N	5		“_____”	na			
LCD_PRECISION	46	S	Unsigned8	S	1	0: 0 digits; 1: 1 digit; 2: 2 digits; 3: 3 digits	3: 3 Digits	E			Yes
SERVICE_CODE	47	S	Unsigned32	D	4		0		O/S		Yes
SW_REVISION	48	S	Visible String	N	6		“j-n-bb” e.g. “1-0-20”			Read only	
HW_REVISION	49	S	Visible String	N	4		“j-nn” e.g. “0-00”		O/S	Read only	
MODEL_NUMBER	50	S	Visible string	N	24		24 x ‘ ‘				
DEVICE_ID	51	S	Visible string	N	22		22 x ‘ ‘		O/S	Read only	
LCD_ADDR_MODE	52	S	Unsigned8	N	1	0: hexadecimal; 1: decimal	0: hexadecimal	E			Yes
INSTALL_DATE	53	S	Visible string	N	16		16 x ‘ ‘			Read only	

Table Abbreviations	
The following abbreviations apply to data in Tables 7, 9 and 16.	
Store:	
D	Storage class “dynamic”
N	Storage class “non volatile”
S	Storage class “static”
Obj Type:	
R	Object type “record”
S	Object type “simple”
Unit:	
E	Enumerated parameter
PVR	Primary Value Range
SR	Sensor Range
SVU	Secondary Value Unit
CU	Cal Unit
Mode:	
O/S	Out of Service

Description of Resource Block Parameters

The following table identifies the Resource Block's parameters.

Table 8. Description of Resource Block Parameters

Parameter	Description
TOT_HRS_USED	Total count of hours since the transmitter was last powered-up.
TOT_HRS_CONFIG	Total hours since last configuration change. Reset through write accesses to: TB.SENSOR_TYPE, TB.CAL_MODE, TB.LIN_TYPE, AIFB.XD_SCALE, AIFB.OUT_SCALE, AIFB.LIN_TYPE.
LCD_SELECTOR	Selects the numerical value (parameter) shown on the LC-Display. 0 = PRIMARY_VALUE of the Transducer Block (TB). 1 = OUT process variable of the Analog Input Function Block (AIFB). 2 = TB.PRIMARY_VALUE with units string in parameter LCD_EGU. 3 = AIFB.OUT with units string in parameter LCD_EGU.
LCD_EGU	Contains the string which can be displayed when parameter LCD_SELECTOR is set to use it. The 5 bytes are the text shown on the LCDs 5 x 11 segment digits. Example: "-5.6700KARAT".
LCD_PRECISION	This parameter selects the maximum precision of the value shown on the LCD's 5 large alphanumeric digits. If the size of the integer part of the value is too great, then the number of decimal places is reduced to fill the character space available. Maximum display value is ±99999. 0 = 0 digits 1 = 1 digit 2 = 2 digits 3 = 3 digits
SERVICE_CODE	For Moore Industries Use
SW_REVISION	TFZ software revision - visible string format of MII Software Version: "<major revision>-<minor revision>-<build number>" e.g. "1-0-20" = V1.0.20
HW_REVISION	TFZ hardware revision - visible string format of MII Software Version: "<major revision>-<minor revision>", e.g. "1-23" = V1.23.
MODEL_NUMBER	Holds the device model, which describes its hardware configuration.
DEVICE_ID	Moore Industries unique device identification - holds the MII serial number of the device. The DEVICE_ID parameter contributes to the FF DEVICE_ID object, described in <i>DEVICE ID</i> section of this manual.
LCD_ADDR_MODE	Decides the number base that the node address is displayed in 0 for hexadecimal; 1 for decimal. If the mode is set decimal, and the value is greater than 99 then dashes are displayed instead (i.e. '—').
INSTALL_DATE	Date string indicating when device was calibrated in the factory.

Temperature Transducer Block (Index Number 1200)

The Temperature Transducer Block (TB) contains temperature measurement data, including sensor and terminal temperature. It also includes information about the sensor type, engineering units, linearization, re-ranging, damping, temperature compensation and diagnostics.

Some of the units that the TB settings are expressed in are influenced by the AIFB.XD_SCALE parameter. When XD_SCALE's engineering units are changed to a different unit which is still compatible with TB.SENSOR_TYPE, then all other values expressed in engineering units in the TB, including TB.PRIMARY_VALUE_RANGE and TB.CAL_UNIT, will change to the same units.

Refer to the *List of Abbreviations* table on Page 14 for an explanation of abbreviations used in the table below.

Table 9. Temperature Transducer Block Parameters

Parameter Mnemonic	Rel. Index	Obj Type	Data Type Structure	Store	Size	Valid Range	Initial Value	Unit	Mode	Other	Range Check
STANDARD PARAMETER	0..6										
UPDATE_EVT	7	R	DS-73	D	14		0;0;0,0;0; 0x0900	na		Read only	
BLOCK_ALM	8	R	DS-72	D	13		0;0;0,0;0;0	na			
TRANSDUCER_DIRECTORY	9	S	Unsigned 16	N	2		0	none		Read only	
TRANSDUCER_TYPE	10	S	Unsigned 16	N	2	See Standard Tables Specification (FF-131)	101: Standard Temperature with calibration	E		Read only	
XD_ERROR	11	S	Unsigned 8	D	1		0	E		Read only	
COLLECTION_DIRECTORY	12	S	Unsigned 32	N	4		0	none		Read only	
PRIMARY_VALUE_TYPE	13	S	Unsigned 16	S	2	104: Process Temperature	104: Process Temperature	E	O/S		Yes
PRIMARY_VALUE	14	R	DS-65	D	5		0;0.0	PVR		Read only	
PRIMARY_VALUE_RANGE	15	R	DS-68	N	11		960.0; -240.0; 1001 : °C; 3: 3dec. places	PVR		Read only	
CAL_POINT_HI	16	S	Float	S	4		960.0	CU	O/S		Yes
CAL_POINT_LO	17	S	Float	S	4		-240.0	CU	O/S	Read only	Yes
CAL_MIN_SPAN	18	S	Float	N	4		120.0	CU		Read only	
CAL_UNIT	19	S	Unsigned 16	S	2	1000: °K 1001: °C 1002: °F 1003: °R 1211: mA 1240: V 1243: mV 1281: Ohm	1001: °C	E			
SENSOR_TYPE	20	S	Unsigned 16	S	2	See Table 18	128: Pt100_1_385	E	O/S		Yes
SENSOR_RANGE	21	R	DS-68	N	11	0-100%	960.0; 0.0; 1001: °C; 3: 3dec. places	SR		Read only	
SENSOR_SN	22	S	Visible String	N	32		32 x '-'	none		Read only	
SENSOR_CAL_METHOD	23	S	Unsigned 8	S	1	103: Factory Standard	103: Factory Standard	E	O/S		Yes

Continued on next page

Table 9. Continued

Parameter Mnemonic	Rel. Index	Obj Type	Data Type Structure	Store	Size	Valid Range	Initial Value	Unit	Mode	Other	Range Check
SENSOR_CAL_LOC	24	S	Visible String	S	32		32 x ''	none		Read only	
SENSOR_CAL_DATE	25	S	Date	S	7		0,0,0,1,1,84	none		Read only	
SENSOR_CAL_WHO	26	S	Visible String	S	32		32 x ''	none		Read only	
SENSOR_CONNECTION	27	S	Unsigned8	S	1	2: 2-wire 3: 3-wire 4: 4-wire	4: 4-wire	E	O/S		Yes
SECONDARY_VALUE	28	R	DS-65	D	5			SVU		Read only	
SECONDARY_VALUE_UNIT	29	S	Unsigned16	S	2	See Table 15 1000: K 1001: C 1002: F 1003: °R	1001: °C	E			Yes
MODULE_SN	30	S	Visible String	N	32		null	none		Read only	

Continued on next page

Table 9. Continued

Manufacturer Specific											
Parameter Mnemonic	Rel. Index	Obj Type	Data Type Structure	Store	Size	Valid Range	Initial Value	Unit	Mode	Other	Range Check
SENSOR_STATUS	31	S	Unsigned16	D	2		0	E		Read only	
BROKE_WIRE_DETECTION	32	S	Unsigned8	S	1	0: Off 1: On	1: On	E	O/S		Yes
RUN_AVG_FILTER	33	S	Unsigned8	S	1	1..16	4		O/S		Yes
INPUT_FILTER	34	S	Unsigned8	N	1	0: 60Hz 1: 50Hz	0: 60Hz	E	O/S		Yes
CAL_MODE	35	S	Unsigned8	S	1	0: no cal trim 1: 1 point trim 2: 2 point trim	0: no cal trim	none	O/S		Yes
CAL_VALUE_HI	36	S	Float	S	4		960.0	CU	O/S		Yes
CAL_VALUE_LO	37	S	Float	S	4		-240.0	CU	O/S		Yes
LIN_TYPE	38	S	Unsigned8	S	1	1: linear 255: custom curve fit	1: linear	E	O/S		Yes
TAB_ENTRY	39	S	Unsigned8	D	1	1 to 128	0: undefined	none			Yes
TAB_X_VALUE	40	S	Float	D	4		0.0	CU	O/S		
TAB_Y_VALUE	41	S	Float	D	4		0.0	CU	O/S		
TAB_OP_CODE	42	S	Unsigned8	D	1	0: no action; 1: start loading new table; 3: end of new table; 8: return to dormant state; 255: clear table	0: no action	none	O/S		Yes
TAB_STATUS	43	S	Unsigned8	D	1	0: un-initialized 1: good 2: unincr use old 3: undecr.use old 4: incomplete old 8: loading 9: checking 20: unincr. 21: undecr. 22: incomplete	0: uninitialized	none		Read only	
TAB_ACTUAL_NUMBER	44	S	Unsigned8	N	1	2 - 128	0: uninitialized	none		Read only	
UPPER_RANGE_VALUE	45	S	Float	S	4		960.0	PVR	O/S		
LOWER_RANGE_VALUE	46	S	Float	S	4		-240.0	PVR	O/S		
USE_RJC	47	S	Unsigned8	S	1	0: No 1: Yes	1: Yes	none			Yes

Description of Transducer Block Parameters

The parameters listed in the following table are used to configure the TFZ's application process to the required function. The parameters are organized into DD groups.

Table 10. Description of Transducer Block Parameters

Sensors with Calibration Calculation Group	
Parameter	Description
PRIMARY_VALUE_TYPE	Defines the type of calculation, from the list found in the Standard Table Specification (FF-131). For the TFZ, this is fixed at 104 - Process Temperature.
PRIMARY_VALUE	Primary process variable value and status that appears on channel 1.
PRIMARY_VALUE_RANGE	Defines the range of the PRIMARY_VALUE, and also the units and the decimal point position (number of significant digits to the right of the point).
CAL_POINT_HI	The PRIMARY_VALUE setting used for the field calibration (trimming) high point. Defines the upper trim point. Must be at least CAL_MIN_SPAN away from CAL_POINT_LO, and at or below the high range value of SENSOR_RANGE.
CAL_POINT_LO	The PRIMARY_VALUE setting used for the field calibration (trimming) low point. Defines the lower trim point. Must be at least CAL_MIN_SPAN away from CAL_POINT_HI, and at or above the low range value of SENSOR_RANGE.
CAL_MIN_SPAN	Defines the absolute minimum span between CAL_POINT_HI and CAL_POINT_LO. Will always be 10% of the PRIMARY_VALUE_RANGE span between 0% and 100% settings.
CAL_UNIT	Defines the engineering units to be used when field calibration (trimming) the device. Will always be the same as the PRIMARY_VALUE_RANGE units.
Base Sensors with Calibration Technology Group	
Parameter	Description
SENSOR_TYPE	Defines the type of sensor, from the list in the Standard Table Specification (FF-131). Refer to Table 18.
SENSOR_RANGE	Defines the sensor range, the units of those limits, and the decimal point position (number of significant digits to the right of the point).
SENSOR_SN	Shows the sensor serial number.
SENSOR_CAL_LOC	Last calibration location.
SENSOR_CAL_DATE	Last calibration date.
SENSOR_CAL_WHO	Identifies the body that last calibrated the sensor.
MODULE_SN	The module serial number.
Extended Temperature Sensor Technology Group	
Parameter	Description
SENSOR_CONNECTION	Defines the connections used by the sensor.
Secondary Value Technology Group	
Parameter	Description
SECONDARY_VALUE	Gives the body temperature. This is used as the reference junction temperature for reference junction compensation of thermocouples.
SECONDARY_VALUE_UNIT	Defines the engineering units to be used with SECONDARY_VALUE.

Continued on next page

Table 10. Continued

Manufacturer Specific Extensions	
Parameter	Description
SENSOR_STATUS	<p>Additional status word from the sensor.</p> <ul style="list-style-type: none"> Bit 0 = wire 1 broken (Note 1) Bit 1 = wire 2 broken (Note 1) Bit 2 = wire 3 broken (Note 1) Bit 3 = wire 4 broken (Note 1) Bit 4 = Analog input 1 saturated Bit 5 = Analog input 2 saturated Bit 6 = Out of range input value (RTD / thermocouple table limits exceeded) Bit 7 = RJC broken Bit 8 = No input Bit 9 = ADC failure (ADC interrupt is not firing) Bit 10 = run time error Bit 11 = bad lead resistance (3 wire RTD / resistance) Bit 12 = bad UFE configuration data Bit 13 = bad calibration data Bit 14 = linearization failure Bit 15 = calibration active <p>Note 1: If it is not possible to discern which wires are broken, then all wires currently configured for use are indicated as broken.</p>
BROKE_WIRE_DETECTION	<ul style="list-style-type: none"> 0 = disabled 1 = enabled
RUN_AVG_FILTER	Number of measurement values to use for the moving average filter (1..16).
INPUT_FILTER	<p>This parameter selects the notch frequency of the input filter.</p> <ul style="list-style-type: none"> 0 = 60Hz 1 = 50Hz
CAL_MODE	<p>Field calibration (trimming) mode.</p> <ul style="list-style-type: none"> 0 = no trimming 1 = 1-point trimming (only using lower trim point) 2 = 2-point trimming
CAL_VALUE_HI	The PRIMARY_VALUE measurement at the field calibration (trimming) high point. Is used as the upper trim value.
CAL_VALUE_LO	The PRIMARY_VALUE measurement at the field calibration (trimming) low point. Is used as the lower trim value.
LIN_TYPE	<p>Custom curve selector:</p> <ul style="list-style-type: none"> 1 = Linear with input; no custom curve use (PV is linear with sensor) 255 = Other; use custom curve linearization on PV
TAB_ENTRY	Index of custom curve table entry that is available in TAB_X_VALUE and TAB_Y_VALUE pairs. Writable to only when valid table is loaded, and a new table is not being loaded.
TAB_X_VALUE	Holds unlinearized PV values. If loading a new table, then contains the last X-value loaded (0.0 if none loaded yet), or the X-value of the table indexed by TAB_ENTRY if table is valid (0.0).
TAB_Y_VALUE	Holds linearized PV values, should custom linearization be enabled. If loading a new table, then contains the last Y-value loaded (0.0 if none loaded yet), or the Y-value of the table indexed by TAB_ENTRY if table is valid (0.0).
TAB_OP_CODE	<p>Used to control loading of new custom curve table.</p> <ul style="list-style-type: none"> 0 = No action; Solicits no change to the linearization status. 1 = Start new table; Prepare to collate a new table to receive data. Pairs of data are loaded into TAB_X_VALUE and TAB_Y_VALUE pairs according to size of table - up to maximum 128 points. 3 = End new table; Received table is checked. If it is valid then it is loaded as the custom curve table to use. 8 = Ready; Current table is verified. Result given in TAB_STATUS. 255 = Reset table; Table cleared down to two points - (0.0,0.0) and (100.0,100.0).

Continued on next page

Table 10. Continued

Parameter	Description
TAB_STATUS	Indicates table loading status: 0 = un-initialized 1 = valid table loaded 2 = new value should be increasing, but is not - using resident valid table 3 = new value should be decreasing, but is not - using resident valid table 4 = not enough values to make valid table - using resident valid table 8 = loading new table 9 = checking new table 20 = new value should be increasing, but is not 21 = new value should be decreasing, but is not 22 = not enough value to make valid table
TAB_ACTUAL_NUMBER	Size of loaded table.
UPPER_RANGE_VALUE	Level above which UFE indicates above upper limit (write -987654.0 to capture a new upper range value off the PV).
LOWER_RANGE_VALUE	Level below which UFE indicates below lower limit (write -987654.0 to capture a new lower range value off the PV).

Range Checks

Range Checks are performed in the TFZ for specific parameters. The following table details the allowed values of these parameters.

Table 11. Range Checks

Transducer Block	Permissible Value
CAL_POINT_HI	(CAL_POINT_LO + CAL_MIN_SPAN) up to EU_100 of PVR
CAL_POINT_LO	EU_0 of PVR up to (CAL_POINT_HI - CAL_MIN_SPAN)
PRIMARY_VALUE_TYPE	The PRIMARY_VALUE_TYPE is fixed to 104 = Process temperature.
CAL_UNIT	Same as TB.PRIMARY_VALUE_RANGE units. See Table 15 for possible values.
SENSOR_TYPE	See Table 18
SENSOR_CAL_METHOD	103 – Factory standard calibration.
SENSOR_CONNECTION	2 – 2 wires 3 – 3 wires 4 – 4 wires
SECONDARY_VALUE_UNIT	1000 – K 1001 – °C 1002 – °F 1003 – °R
Analog Input Function Block	Permissible Value
XD_SCALE, Unit index	Has to be the same as PRIMARY_VALUE_RANGE units for Analog Input block to avoid block error. See Table 15 for possible values.

The transducer block can generate the XD_ERROR and BLOCK_ALM subcodes shown below.

Table 12. XD_ERROR and Block Subcodes

Value	Error	Subcode Description
16	Unspecified error	An error has occurred that was not identified.
17	General error	An error has occurred that could not be classified as one of the errors below.
18	Calibration error	An error occurred during calibration of the device or a calibration error has been detected during operation of the device.
19	Configuration error	An error occurred during configuration of the device or a configuration error has been detected during operation of the device.
20	Electronics Failure	An electronic component has failed.
21	Mechanical Failure	A mechanical component has failed.
22	I/O Failure	An I/O failure has occurred.
23	Data Integrity Error	Indicates that data stored within the system may no longer be valid due to NVM checksum failure, data verify after write failure, etc.
24	Software Error	The software has detected an error. This could be caused by an improper interrupt service routine, an arithmetic overflow, a watchdog timer, etc.
25	Algorithm Error	The algorithm used in the transducer block produced an error. This could be due to an overflow, data reasonableness failure, etc.

The *Mapping of SENSOR_STATUS* table, below, defines how sensor status provided by the UFE software is mapped to the status of the PV/SV, the XD_ERROR and the Block Alarm Subcodes.

If there is an XD_ERROR alarm subcode, then the transducer block will indicate a block error. This will force the Transducer Block (and the AI Block) Out of Service.

Table 13. Mapping of SENSOR_STATUS

SENSOR_STATUS	Description	XD_ERROR, Block Alarm Subcode	PRIMARY_VALUE status Secondary_Value status	
			Quality	Sub-Status
Bit 0	Wire 1 broken	20	BAD	Sensor failure
Bit 1	Wire 2 broken	20	BAD	Sensor failure
Bit 2	Wire 3 broken	20	BAD	Sensor failure
Bit 3	Wire 4 broken	20	BAD	Sensor failure
Bit 4	Analog input 1 saturated	20	BAD	Sensor failure
Bit 5	Analog input 2 saturated	20	BAD	Sensor failure
Bit 6	Out of range input value	20	BAD	Sensor failure
Bit 7	RJC broken	20	BAD	Sensor failure
Bit 8	No input	20	BAD	Sensor failure
Bit 9	ADC failure (ADC interrupt is not firing)	20	BAD	Device failure
Bit 10	Run time error	24	BAD	Device failure
Bit 11	Bad lead resistance (3 wire RTD / resistance)	20	BAD	Sensor failure
Bit 12	Bad UFE configuration	19	BAD	Config. Error
Bit 13	Bad calibration data	18	BAD	Config. Error
Bit 14	Linearization failure (RTD / thermocouple table limits exceeded)	20	BAD	Sensor failure
Bit 15	Calibration active	20	BAD	Sensor failure

Table 14. Sensor Connections

Value	Connection Type Description
2	2 wires
3	3 wires
4	4 wires

Default Sensor Connections

When the SENSOR_TYPE is changed, the SENSOR_CONNECTIONS parameter is re-configured depending upon the new sensor type:

- mV or V– 2 wires
- Ohm– 4 wires
- RTD– 3 wires
- Potentiometer– 3 wires
- mA– 2 wires

Connection settings for resistance readings (Ohms) can be changed to 2-, 3- or 4-wire once configured for the required sensor type. The table below lists the unit codes supported by the TFZ.

Note:

For the SECONDARY_VALUE_UNIT, only temperature unit codes are allowed.

Table 15. Supported Unit Codes

Unit Code	Description
1000	Kelvin
1001	°C
1002	°F
1003	°Rankine
1211	mA
1243	mV
1281	Ohm
1342	% (used for potentiometer input)

Analog Input Block (Index Number 1100)

The Analog Input Function Block (AI) processes measurements from a sensor and makes them available to other function blocks. The output value from the AI block is displayed in engineering units and contains a status indicating the quality of the measurement. The AI block is widely used for its scaling functionality.

Note:

The AI block has its own filtering parameter called PV_FTIME. If filtering is performed in the AI block, damping will be applied to the output every macro cycle.

Refer to the *List of Abbreviations* table on Page 14 for an explanation of abbreviations used in the following table.

Table 16. Analog Input Function Block Parameters

Manufacturer Specific											
Parameter Mnemonic	Rel. Index	Obj Type	Data Type Structure	Store	Size	Valid Range	Initial Value	Unit	Mode	Other	Range Check
STANDARD PARAMETER	0..6										
PV	7	R	DS-65	D	5		Bad non-specific; 0.0	PV		Read only	
OUT	8	R	DS-65	D	5		Bad Out of Service; 0.0	OUT	Man		
SIMULATE	9	R	DS-82	D	11		0;0.0;0.0;0.0;1	none			
XD_SCALE	10	R	DS-68	S	11		100.0;0.0;1001;0	XD	O/S		
OUT_SCALE	11	R	DS-68	S	11		100.0;0.0;1001;2	OUT	O/S		
GRANT_DENY	12	R	DS-70	S	2		0; 0	na			
IO_OPTS	13	S	Bit String	S	2		0	na	O/S		
STATUS_OPTS	14	S	Bit String	S	2		0	na	O/S		
CHANNEL	15	S	Unsigned16	S	2	1 : PRIMARY_VALUE (sensor input); 2 : SECONDARY_VALUE (device body temperature)	1 : PRIMARY_VALUE	E	O/S		Yes
L_TYPE	16	S	Unsigned8	S	1	1:Direct; 2:Indirect; 3:Ind. Sqr.Root	2:Indirect	E	Man		Yes
LOW_CUT	17	S	Float	S	4	Non-negative	0.0	OUT	O/S	Positive	Yes
PV_FTME	18	S	Float	S	4	Non-negative	0.0	s		Positive	Yes
FIELD_VAL	19	R	DS-65	D	5		0;0.0	%		Read only	
UPDATE_EVT	20	R	DS-73	D	14		0;0;0.0;0.0;0x0900	na		Read only	
BLOCK_ALM	21	R	DS-72	D	13		0;0;0.0;0.0;0	na			
ALARM_SUM	22	R	DS-74	S	8		0;0;0.0	na			
ACK_OPTION	23	S	Bit String	S	2	0: Auto Ack Disabled; 1: Auto Ack Enabled	0	na			
ALARM_HYS	24	S	Float	S	4	0 to 50% of range	0.5	%		Positive	Yes
HI_HI_PRI	25	S	Unsigned8	S	1	0 to 15	0	none			Yes
HI_HI_LIM	26	S	Float	S	4		+Inf	OUT			
HI_PRI	27	S	Unsigned8	S	1	0 to 15	0	none			Yes
HI_LIM	28	S	Float	S	4		+Inf	OUT			
LO_PRI	29	S	Unsigned8	S	1	0 to 15	0	none			Yes
LO_LIM	30	S	Float	S	4		+Inf	OUT			
LO_LO_PRI	31	S	Unsigned8	S	1	0 to 15	0	none			Yes
LO_LO_LIM	32	S	Float	S	4		+Inf	OUT			
HI_HI_ALM	33	R	DS-71	D	16						
HI_ALM	34	R	DS-71	D	16						
LO_ALM	35	R	DS-71	D	16						
LO_LO_ALM	36	R	DS-71	D	16						

Description of Analog Input Block

Parameters

Parameters required to configure the AI Block are described below.

Channels

Select the channel that corresponds to the desired sensor measurement. The TFZ measures both the sensor temperature (Channel 1) and the terminal temperature (Channel 2).

L_TYPE

The L_TYPE parameter defines the relationship of the sensor measurement (sensor temperature) to the desired output temperature of the AI Block. This can be either a direct or indirect relationship.

Select direct when the desired output will be the same as the sensor measurement (sensor temperature).

Select indirect when the desired output is a calculated measurement based on the sensor measurement (e.g. ohm or mV). The relationship between both measurements is linear.

The XD_SCALE and OUT_SCALE each include four parameters: 0%, 100%, engineering units and precision (decimal point). Their use is determined by the L_TYPE setting.

When L_TYPE is Direct

When the desired output is the measured variable, set the XD_SCALE to represent the operating range of the process. Set OUT_SCALE to match XD_SCALE.

When L_TYPE is Indirect

When an inferred measurement is made based on the sensor measurement, set the XD_SCALE to represent the operating range that will be used in the process. Determine the inferred measurement values that correspond to the XD_SCALE's 0 and 100% points and set these for the OUT_SCALE.

Primary Value Unit

Select the desired measurement unit code using the XD_SCALE and OUT_SCALE parameters which are found in the Analog Input Function Block (refer to FF-890, section 4.4.3.9–Scaling Parameter Formal Model– for further details).

To avoid configuration errors when setting up the XD_SCALE units, select only engineering units that are fully supported by the TFZ. The supported units are: °K, °C, °F, °R, mA, mV, ohms and %.

When the engineering units of the AIFB.XD_SCALE are changed to new units that are compatible with the current Transducer Block configured sensor (TB.SENSOR_TYPE), then the Transducer Block Primary Value (i.e. TB.PRIMARY_VALUE_RANGE), and all related parameters will also be set to that units setting.

Filtering

The filtering feature changes the response time of the TFZ to smooth variations in output readings caused by rapid changes to the input. To adjust the filter time constant (in seconds), use the PV_FTIME parameter. To disable the filter feature, set the filter time constant to zero.

Process Alarms

Process Alarm detection is based on the OUT value. Configure the alarm limits of the following standard alarms to the desired settings.

HI_LIM (High)
HI_HI_LIM (High high)
LO_LIM (Low)
LO_LO_LIM (Low low)

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis (in percent of the PV span) can be set using the ALARM_HYS parameter. The priority of each alarm is set in the HI_PRI, HI_HI_PRI, LO_PRI and LO_LO_PRI parameters.

Alarm Priority

Refer to the table below for alarm priority levels.

Table 17. Alarm Priority Levels

Priority Status	Priority Description
0	The alarm condition is not used.
2	An alarm condition with a priority of 2 is reported to the operator.
3 - 7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8 - 15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Status Options

Status Options (STATUS_OPTS) supported by the AI Block are shown below.

Propagate Fault Forward

If status from the sensor registers as Bad, Device failure or Bad, Sensor failure, propagate it to OUT without generating an alarm. Use of the sub-status in OUT is determined by this option. Through this option, you may choose whether alarming (sending of an alert) will be done by the block or propagated downstream.

Uncertain if Limited

Set the output status of the Analog Input Block to *Uncertain* if the measured or calculated value is Limited.

BAD if Limited

Set the output status to *Bad* if the sensor exceeds a high, or falls below a low, limit.

Uncertain if Man Mode

Set the output status of the AI Block to *Uncertain* if the block is in MAN mode.

Note:

The TFZ must be in Out of Service mode to set the status option.

Input Settings

There are a number of basic Transducer Block parameters that directly govern the operation of the TFZ which include:

Input Type

Input Type is governed by the TB Sensor Type parameter. The options available come from five groups which include RTDs (by resistor type and 0°C resistance), thermocouples (by type), voltage, resistance (ohms), and potentiometers. For mV, resistance and potentiometer sensor types, different values are available.

Measurement Units

For non-temperature measurement input types, the units of the process value are limited by the measurement. Resistances are measured in ohms; potentiometer inputs are measured in percentage of wiper resistance against the full range resistance; voltage is measured in mV.

Temperature measurement input types can return results in one of four temperature units: °C, °F, °R, or K.

When the TB measuring units change, the AIFB.XD_SCALE units have to be separately changed to the same unit, or the AIFB will have a block error, resulting in a Bad status. Therefore, for ohms, potentiometers, voltage and temperature sensor types, the AIFB.XD_SCALE units will have to be set to ohms, %, mV and °C, respectively. If using a temperature sensor type, then AIFB.XD_SCALE units can be changed to another temperature unit, if required.

Input Filter

This setting is used to configure the analog to digital input filter. The filter is designed to reduce the effects of mains-induced noise. The input filter frequency value should be set to the frequency of the local AC supply, either 50Hz or 60Hz.

Broken Wire Detection

During operation, the TFZ sends random microamp pulses through input wiring to check for broken wiring or a burned out sensor. To utilize Broken Wire Detection, set the TB parameter to On. If a failure is detected, then the AIFB.OUT status will become Bad, and an error message will appear on the display indicating which wire is broken, or, if unable to determine which, simply that wires are broken.

Running Average Filter

This function is for smoothing the converted input signal. The TFZ provides this filter with a user-selected range between 1 and 16. Factory default is 4.

Note:

A higher Running Average Filter setting provides smoother output transitions, but reduces response time; conversely, a lower setting provides a faster response time, but may seem more unstable.

Sensor Range

When the input signal is outside of the user-defined sensor range, this constitutes a sensor error which is indicated on the FF network and displayed status. The default sensor range is readjusted in the TB Sensor Range parameter whenever a sensor type is changed. This follows any change in temperature units, and is held in the Upper and Lower Range values. The Upper and Lower Range values can be changed to different values, causing the out of range indication to occur even when the input signals are in accordance with the installation.

To set specific Upper and Lower Range values, you may enter them into the respective parameters. The values may also be captured. To capture an input, follow the steps below.

1. Apply the desired Upper or Lower Range input.
2. Enter the value -987654.0 into the range value being captured.
3. If the other range value is to be captured as well, then repeat steps 1 and 2 for that value.

TFZ

Programmable FOUNDATION Fieldbus™
Temperature Transmitter

TFZ Configuration

This section explains configurable parameters within the TFZ's Transducer and AI Function Blocks. Block parameters are used to configure how the TFZ operates on the Foundation fieldbus (FF) network.

Transducer Block Configuration

Note:

Before making changes to block parameter settings, you must set the block's mode to Out Of Service (OOS). It may be returned to the previous mode once your changes have been made.

Changing Sensor Configuration

The following outlines the steps required to change TFZ sensor configurations.

1. Change Transducer Block MODE_BLK.TARGET to OOS.
2. Change SENSOR_TYPE to the desired value.
3. Change SENSOR_CONNECTIONS to the desired parameter.

4. Change Transducer Block MODE_BLK.TARGET back to OOS.

Keep in mind that when XD_SCALE engineering units are selected, the unit associated to the PRIMARY_VALUE_RANGE parameter also changes to this setting. Aside from changing SENSOR_TYPE, this is the only way to change the engineering units in the sensor Transducer Block's PRIMARY_VALUE_RANGE parameter.

Conversion Rules for Temperature Units

The table below lists the allowed types of sensors. These are derived from the FF-131 Standard Table Specification.

Dependencies and Relationships

SENSOR_TYPE affects the following parameters:

PRIMARY_VALUE_RANGE
SENSOR_RANGE
CAL_POINT_HI
CAL_POINT_LO
CAL_MIN_SPAN
CAL_UNIT
SENSOR_CONNECTION BROKE_WIRE_DETECTION

Table 18. Sensor Types

Value	Sensor Type Description
103	Millivolts (same as 40030)
104	Ohm (same as 40040)
128	PT100_A_385(IEC 751)
129	PT100_A_392(JIS 1604)
130	PT200_A_385(IEC751)
131	PT500_A_385(IEC751)
132	NI120, Edison #7
133	CU10, Edison #15
134	T/C Type B (IEC 584-1 and NIST 175)
135	T/C Type C (NIST 175)
136	T/C Type E (IEC 584-1 and NIST 175)
137	T/C Type J (IEC 584-1 and NIST 175)
138	T/C Type K (IEC 584-1 and NIST 175)
139	T/C Type N (IEC 584-1 and NIST 175)
140	T/C Type R (IEC 584-1 and NIST 175)
141	T/C Type S (IEC 584-1 and NIST 175)
142	T/C Type T (IEC 584-1 and NIST 175)
148	PT1000_A_385(IEC 751)

Continued on next page

Table 18. Continued

Manufacturer Specific Sensor Types	
Value	Sensor Type Description
40030	Millivolts 0-1000mV range
40031	Millivolts 0-500mV range
40032	Millivolts 0-250mV range
40033	Millivolts 0-125mV range
40034	Millivolts 0-62.5mV range
40035	Millivolts 0-31.25mV range
40040	Ohms 0-4000 ohms range
40041	Ohms 0-2000 ohms range
40042	Ohms 0-1000 ohms range
40043	Ohms 0-500 ohms range
40044	Ohms 0-250 ohms range
40045	Ohms 0-125 ohms range
40050	Potentiometer 4000 ohm
40051	Potentiometer 2000 ohm
40052	Potentiometer 1000 ohm
40053	Potentiometer 500 ohm
40054	Potentiometer 250 ohm
40055	Potentiometer 125 ohm
40060	Volt
40070	Milliampere
65520	PT300_A_385 (IEC 751)
65521	PT400_A_385 (IEC 751)
65522	PT200_A_392 (MIL-T-24388)
65523	PT400_A_392 (MIL-T-24388)
65524	PT500_A_392 (MIL-T-24388)
65525	PT1000_A_392 (MIL-T-24388)
65526	PT100_A_3916 (JIS C1604-81)

Trimming

Trimming adjusts the measurement accuracy of the TFZ by matching the reading of its actual input to either a calibrated source or the device to which it is connected.

You may trim any point between 0% and 100% along the sensor range. Note that 1 Point trimming applies an offset to the sensor reading, while 2 Point trimming applies both an offset and a gain.

Trimming of the primary variable is facilitated with the use of a number of field calibration (trimming) block parameters. Some are derived from the FF902 Transducer Block common structure while the remainder support PV trim capabilities provided by Moore Industries' devices.

Trim URV (TB.CAL_POINT_HI), Trim LRP (CAL_POINT_LO), Trim min span (CAL_MIN_SPAN) and Trim units (CAL_UNIT) are derived from FF902, and define the field calibration (trimming) configuration. In addition, Trim mode (CAL_MODE) defines how the trim points are used. Trim URV (CAL_VALUE_HI) and Trim LRV (CAL_VALUE_LO) hold the trim values for the trim points.

To trim your device, follow the steps below.

1. Using the FF Configuration Tool, set the Transducer Block mode to OOS.
2. In the CAL_MODE parameter, choose whether to use 1 or 2 point trimming or to disable the feature. If you choose to disable trimming, skip to Step 9.
3. Apply your low input at the CAL_POINT_LO parameter.
4. Write the CAL_POINT_LO value into the CAL_VALUE_LO parameter. This will initiate trimming at the low point. If you are using 1 point trimming, skip to Step 9.
5. Wait until CAL_VALUE_LO changes and settles to reflect the untrimmed input value.
6. Apply your upper input at the CAL_POINT_HI parameter.

7. Write the CAL_POINT_HI value into the CAL_VALUE_HI parameter. This will initiate trimming at the upper point.
8. Wait until CAL_VALUE_HI changes and settles to reflect the untrimmed input value.
9. Using the FF Configuration Tool, change the Transducer Block mode to Auto.

Custom Curve

The Custom Curve feature allows you to set up your own custom curve table. This allows you to tell the transmitter what it should output when it receives a certain input.

Custom curve linearization of the primary variable is made possible by loading a table of up to 128 points into non-volatile storage by using the TAB parameters.

Linearization is accomplished by locating the pair of X-values between which the unlinearized PV resides. Linearization is then performed in order to map the unlinearized PV from the range between the X-values pair onto the range between the corresponding Y-values pair. The algorithm for linearization is the same as is shown in the *Trimming* section, with the trim points being substituted by the table's X-values, and the trim values being substituted by the table's Y-values.

If the unlinearized PV is outside of the table range, then the linear fit mapping is done using the nearest two points' X and Y values. Since two points are always required to do a linear fit, the smallest allowed table consists of two points. Therefore, the default table is a two point table containing the points (0,0) and (100,100).

In linearization tables, successive X-values must all consistently increase in value. There are no restrictions on the relationship between successive Y-values.

A new custom curve is loaded in the following manner:

1. Set the Transducer Block mode to OOS.

2. Set OpCode (TAB_OP_CODE) to *Start New Table*. Table status (TAB_STATUS) will state *Loading New Table*. Table Size (TAB_ACTUAL_NUMBER) will become zero to indicate that the new table is empty.
3. Load the first X-value into Table X-value (TAB_X_VALUE), then the corresponding Y-value into Table Y-value (TAB_Y_VALUE). Upon loading the Y-value, TAB_ACTUAL_NUMBER will be incremented. If it exceeds the maximum table size of 128 points, then subsequent loads of X-value or Y-value will return an *Exceeds Parameter Limits* error. Perform this step until all table points have been loaded.
4. Set TAB_OP_CODE to *End New Table*.
5. If the new table is valid, then TAB_STATUS will state *Table is Valid*, and will be ready for use. Go to Step 7.
6. If the new table is invalid, then TAB_STATUS will indicate an error status. At this point, there are three options.

Option 1: If another attempt is to be made to load the new table, then go to Step 2.

Option 2: If TAB_OP_CODE is set to *Ready*, then the current table will be retested for validity. If it is valid, then *Table is Valid* will be indicated, however the previous table will still be in use. Go to Step 7 to use the new table, Step 8 if you choose not to load a new custom curve or return to Step 2 to load a new table.

Option 3: If TAB_OP_CODE is set to *Reset Table*, then the current table will be reset to the default table. This guarantees a valid table, even if it will only produce a linear output. However, this does ensure that custom linearization is in a known state. You can go to Step 8 if you choose not to load a new custom curve or return to Step 2 to load a new table.
7. Change LIN_TYPE from *Linear to Input* to *Other* in order to enable custom linearization.
8. Set the Transducer Block MODE_BLK.TARGET parameter back to AUTO in order to enable usage of the linearized PV by Analog Input block.

You may read table points of a valid table by loading the point index into TAB_ENTRY, then reading back the TAB_X_VALUE and TAB_Y_VALUE.

Analog Input Block Configuration

The following section provides information regarding configurable parameters in the AI Block. A minimum of four parameters must be configured in order to obtain a viable value from the AI Block.

Note:

Before making changes to block parameter settings, you must set the block's mode to Out Of Service (OOS). It may be returned to the previous mode once your changes have been made.

Configuring a Reading as a Process Temperature Display

To configure a reading as a process temperature display, follow the steps below.

1. Change the AI Block's MODE_BLK.TARGET parameter to OOS.
2. Change CHANNEL to Process Value.
3. Change L_TYPE to Direct.
4. Change XD_SCALE UNITS_INDEX to be displayed in the desired unit.
5. Change OUT_SCALE UNITS_INDEX to be displayed in the desired unit.
6. Change the OUT_SCALE's 0 and 100 scale to reflect the same values as those of the XD_SCALE.
7. Return the AI Block's MODE_BLK.TARGET parameter back to AUTO mode.
8. Configure the schedule of the Block.
9. Download the Schedule into the Link Master.

Configuring a Reading as a Body Temperature Display

To configure a reading as a body temperature display, follow the steps below.

1. Change the AI Block's MODE_BLK.TARGET parameter to OOS.
2. Change CHANNEL to Sensor Body Temperature.
3. Change L_TYPE to Direct.
4. Change XD_Scale UNITS_INDEX to be displayed in the desired unit.
5. Change OUT_SCALE UNITS_INDEX to be displayed in the desired unit.
6. Change OUT_SCALE's 0 and 100 scale to reflect the same values as those of the XD_SCALE.
7. Return the AI Block's MODE_BLK.TARGET parameter back to AUTO mode.
8. Configure the Schedule of the Block.
9. Download the Schedule into the Link Master

Linking on the FOUNDATION Fieldbus Network

In order for a TFZ to broadcast process variable data on the FF network, it must be properly linked with another FF device. Of the three blocks in the TFZ, it is only the AIFB that can be usefully connected in this fashion, typically to an AOFB, or PID. However, it cannot be connected to another AIFB, as that can only receive an input from a Transducer Block.

Use a Configurator to link the TFZ's AIFB with another device's receiving block, and then download the network configuration. It will then become possible to monitor the AIFB mode. The AIFB must remain Out of Service unless there is a healthy link with another FF network device.

If a healthy FF network link has been established and the AIFB remains OOS, then the issue is being caused by the TFZ. Possibilities may include a problem with the Transducer or AI Block configurations or the Resource Block being in OOS mode.

Bench Check

To achieve a basic internal configuration that allows the AIFB to be placed in either Manual or Automatic modes, proceed with the bench check instructions below.

1. Place the Resource Block mode to AUTO.
2. Set the Transducer Block target mode to OOS.
3. Change the Sensor Type to PT100 A 385 (IEC 751).
4. Connect a 4-wire, 100 ohm sensor to the TFZ. This should result in an approximate reading of zero appearing in the Transducer Block Primary Value, Value, with the Status and substatus reading Bad, OutOfService, NotLimited.
5. Place the Transducer Block's target mode to AUTO, and observe the Primary Value Status change to Good_NonCascade, NonSpecific, NotLimited.
6. Place the AIFB target mode to OOS. This prepares the device for the configuration change shown below.
7. Change the AIFB.XD_SCALE Units Index to °C, the AIFB.OUT_SCALE to the same as AIFB.XD_SCALE, and AIFB.L_TYPE to Direct. Also, change AIFB.CHANNEL to Process Value.
8. In the AIFB Diagnostics, check that the target mode in the BLOCK_ERR parameter is OOS.
9. Change the AIFB target mode to AUTO. The BLOCK_ERR value will change to 0x0000.
10. Note that the AIFB.OUT Value will now reflect the TB.Primary Value, of approximately zero.
11. Change the RB.LCD precision to 3 digits, and RB.LCD selector to OUT (AIFB1). This will normally result in the near zero value being shown to a resolution sufficient enough to view the least significant digit changing approximately every second on the TFZ's display.
12. Next, change the AIFB target mode to OOS. The display will stop updating until the AIFB is placed back into AUTO mode. This demonstrates how the AIFB.OUT value is updated on the FF network.

TFZ

Programmable FOUNDATION Fieldbus™
Temperature Transmitter

Installation

Installation consists of physically mounting the device within your existing FOUNDATION Fieldbus system and completing the electrical connections. For intrinsically-safe installation, refer to the *Intrinsically-Safe Applications* section of this manual

Mounting the TFZ

The TFZ HP (hockey-puck housing) can be mounted with rails, flanges or in one of our larger housings, such as a BH, D-BOX or SB.

Making the Electrical Connections

In FOUNDATION fieldbus systems, the Host does not provide power to the connected devices. Refer to Figure 4 for a generic diagram describing installation of the TFZ into your system. For detailed information, please refer to your FOUNDATION fieldbus power supply's documentation. For intrinsically-safe installation, refer to the *Installation in Hazardous Locations* section of this manual.

Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any Moore Industries product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making any other connections.
- All input signals to, and output signals from, Moore Industries' products should be wired using a shielded, twisted pair technique. Shields are to be connected to an earth or safety ground at the unit itself.
- The maximum length of unshielded input and output signal wiring should be 2 inches.

CE Conformity

Installation of any Moore Industries' products that carry the CE marking **must** adhere to the guidelines in the *Recommended Ground Wiring Practices* section in order to meet the EN 61326 requirements set forth in the applicable EMC directive.

Operation

Once configured, installed, and supplied with the correct power, the TFZ Programmable FOUNDATION Fieldbus Temperature Transmitter begins to operate immediately. Depending upon environmental conditions, it can be expected to operate unattended for extended periods of time.

Maintenance

Moore Industries suggests a quick check for terminal tightness and general unit condition every 6-8 months. Always adhere to any site requirements for programmed maintenance.

Customer Support

If service assistance is ever required for a device in your application, refer to the back cover of this manual for the telephone numbers to Moore Industries' customer service department.

If possible, make a note of the model number of the unit before calling. For fastest assistance, have the following information available: serial number, the job number and purchase order number under which it was shipped.

Installation in Hazardous Locations

This section contains important information regarding installation of the TFZ in Hazardous Area Locations .

The diagram on the following page must be used for units that are to operate in areas requiring intrinsically-safe instrumentation.

Refer to the *Special Conditions* outlined below before proceeding with installation.

Special Conditions of Use

The following instructions must be adhered to when the TFZ is used in hazardous locations and potentially explosive atmospheres.

I. Intrinsically Safe (Ex ia) Applications (Zones 0 and 1)

1. The TFZ Temperature Transmitter shall be installed in an enclosure which maintains an ingress protection rating of IP20.
2. For Zone 0 installations, the final enclosure shall not contain more than 10% in total of aluminum, magnesium, titanium and zirconium, or 7.5% in total of magnesium, titanium and zirconium.
3. For Zone 1 installations, the final enclosure shall not contain 7.5% in total of magnesium.
4. Using the box provided on the name plate, the user shall permanently mark the protection type chosen for the specific installation. Once the type of protection has been marked, it shall not be changed.
5. The COM port shall not be used in the hazardous area.

II. Type N (Ex n) Applications (Zone 2)

1. If installed as Category 3 equipment, the Model TFZ Temperature Transmitter shall be installed in an enclosure which maintains an ingress protection of IP54 and meets the enclosure requirements of EN60079-0 and EN60079-15.
2. The Model TFZ Temperature Transmitter shall contain external transient protection to prevent the supply voltage from exceeding 46.2V including tolerance.
3. Using the box provided on the name plate, the user shall permanently mark the protection type chosen for the specific installation. Once the type of protection has been marked, it shall not be changed.
4. The COM port shall not be used in the hazardous area.

Safety Concerns

For your safety, read the following information carefully before proceeding with installation.

WARNING: EXPLOSION HAZARD – FOR DIVISION 2 HAZARDOUS LOCATIONS. DO NOT DISCONNECT EQUIPMENT WHEN A FLAMMABLE ATMOSPHERE IS PRESENT.

WARNING: SUBSTITUTION OF COMPONENTS IS NOT ALLOWED AS IT MAY IMPAIR THE INTRINSIC SAFETY (ZONES 0 & 1, DIVISION 1) OF THE UNIT AND/OR THE NON-INCENDIVE/ TYPE N (DIVISION 2, ZONE 2) CIRCUIT. DO NOT OPEN THE UNIT WHEN EITHER ENERGIZED OR WHEN AN EXPLOSIVE GAS/DUST ATMOSPHERE IS PRESENT. DISCONNECT POWER BEFORE SERVICING. READ AND UNDERSTAND THE MANUFACTURER'S INSTALLATION AND OPERATING PROCEDURES, AND ADHERE TO ALL APPLICABLE ELECTRICAL CODES, SAFETY INSTRUCTIONS AND REGULATIONS.

AVERTISSEMENT – RISQUE D'EXPLOSION. NE PAS DEBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, A MOINS QU'IL NE S' AGISSE D'UN EMPLACEMENT NON DANGEREUX.

Refer to the Safety Concerns section on the previous page before continuing with installation.

DO NOT SCALE DRAWING	CONTROL DRAWING	DRAWING NUMBER 100-100-72 (Page 1 of 3)	REVISION C
TOLERANCES (UNLESS NOTED) DECIMALS = ± 0.005mm .XX = ± 0.03 / 0.76 .XXX = ± 0.010 / 0.25 HOLES = ± 0.002 / 0.05-0.05 ANGLES = ± 30°	DRAWN GUS.H. Elias 07/07 CHECKED S.W. 07/07 ENGINEER GUS.H. Elias 07/07 SCALE NONE	REVISED BY ECO 16967 DATE 5/13 BY CW APPROVAL CB	
TITLE Field Installation Diagram: TFZ [HP] & TPZ [HP] Intrinsically Safe System For Hazardous 'Classified' Locations			
NOTICE RE PROPRIETARY INFORMATION: This drawing and the information contained herein are the proprietary property of Moore Industries International, Inc. (MI) and should not be reproduced or disclosed to any third party without the written consent of an authorized officer of MI.			
<p style="text-align: center;">CERTIFIED PRODUCT</p> <p>This is a controlled 'Related' or 'Schedule' drawing. No modifications are permitted without the notification and final approval of the Certification Engineer (related dwgs.) or the Certifying Agency (schedule dwgs.).</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">* TFZ [HP] or TPZ [HP]: PC-Programmable Foundation Fieldbus & PROFIBUS Temperature & Signal Transmitters with Display.</p> <p style="font-size: x-small;">Caution: The 3-Pin 'COM' Port Must Not Be Used In Hazardous 'Classified' Locations.</p> <p style="font-size: x-small;">TFZ (only) - Front panel write-protect & simulate switches. Caution: Not to be used in hazardous areas.</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Sensor Type - mV.</p> <p>POT, RTD, Ω, T/C: U_o, V_{oc} or $V_t = 6.51$ Vdc I_o, I_{sc} or $I_t = 34.75$ mA $P_o = 55.97$ mW $C_a, C_o = 20.53$ μF, Gr. A/B, IIC $C_a, C_o = 498.53$ μF, Gr. C/D, IIB $C_a, C_o = 998.53$ μF, Gr. D, IIA $L_a, L_o = 25$ mH, Gr. A/B, IIC $L_a, L_o = 100$ mH, Gr. C/D, IIB $L_a, L_o = 200$ mH, Gr. D, IIA</p> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">I.S. Entity Parameters (Power/Loop, +PS & -PS):</p> <p>V_{max} or $U_i = 30$ Vdc I_{max} or $I_i = 300$ mA P_{max} or $P_i = 1.3$ W $C_i = 0$ F $L_i = 7.15$ μH</p> <p style="font-size: x-small;"> C_a or $C_o \geq C_i + C_{cable}$ L_a or $L_o \geq L_i + L_{cable}$ V_{max} or $U_i \geq V_{oc}$ or V_t I_{max} or $I_i \geq I_{sc}$ or I_t </p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">IECEx Ex FM US 0518</p> <p style="font-size: x-small;"> For areas classified with "Dust-Hazard" (Class II, Division 1, Groups E, F & G; Class III), the TFZ/TPZ devices must be mounted in approved protective enclosures that are rated and suitable for use in the designated areas. Use +85°C rated electrical wire. Enclosure cover must be closed tightly. </p> </div>	
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Non-Hazardous (Safe) Area</p> <p>Unspecified Apparatus (1)</p> <p>Barrier or other Associated Apparatus (2)</p> <p style="text-align: center;">Ground Path Resistance Must Not Exceed 1 Ω</p> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">Hazardous 'Classified' Locations/Areas</p> <p>US (NEC 500/505) / Canada (C22.2-1010.1)</p> <p style="text-align: center;"><u>Intrinsically Safe & Non-Incendive</u></p> <p>Class I, Zone 0, AEx ia IIC, (T4 / T5 / T6)* Class I; Divisions 1 & 2; Groups A-D</p> <p>ATEX: Ⓢ II 1G Ex ia IIC, Ⓢ II 3G Ex nA IIC ; (T4 / T5 / T6)* IECEx: Ex ia IIC Ga, Ex nA nL IIC (TFZ), Ex nA IIC (TPZ), (Tcode*)</p> <p>*Temperature Codes: T4@85°C, T5@70°C, T6@55°C Operating Temperature Range: -40°C ≤ Tamb ≤ +85°C</p> </div>	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Notes:</p> <ol style="list-style-type: none"> 1- Apparatus which is unspecified except that it must not be supplied from, or contain under normal or abnormal conditions a source of potential with respect to earth in excess of 250 VRMS or 250 VDC which is considered to be the Safe Area's maximum voltage. 2- The Barrier or other Associated Apparatus must be approved by the "specific" (CSA/IECS/FM/ULCIE/ISA/SIRA/TUV, etc.) certifying agency for I.S. connections in "Class I-III, Division 1, Groups A-G" locations. There is no output voltage (Voc, Vt or Vo); just digital communication. A Shunt Zener Barrier is NOT required for Non-Incendive (or Class I, Division 2 or Type N) installations. 3- The combined Capacitance and Inductance of the inter-connecting cables and the PC-Programmable Transmitter must not exceed the values indicated on the Associated Apparatus. 4- +PS/-PS terminal leads may be connected to multiple agency-approved devices. 5- For US applications, installation must be in accordance to 'ANSI-12.06.01' (Installation of I.S. Systems for Hazardous 'Classified' Locations) and the National Electric Code 'ANSI/NFPA 70'. Also, a dust-tight conduit seal must be used when installed in Class II and Class III environments. For applications in Canada, adhere to the 'Canadian Electric Code C22.1' most current publication on I.S. installation guidelines. For CENELEC/ATEX and IECEx applications, adhere to 'EN 60079-14:1997' or any equivalent IEC-based, most current and pertaining publication on I.S. installation guidelines. 6- Warning: Substitution of components is NOT allowed as it may impair the Intrinsic Safety of the unit and/or the Non-Incendive circuit. DO NOT open the unit when either energized or if an explosive gas/dust atmosphere is present. Disconnect power before servicing. Also read, understand and adhere to the manufacturer's installation and operating procedures. 7- The maximum power parameters of the COM port (to be used only in safe/non-hazardous areas) are: $V_{max} = 3.0$ VDC, $I_{max} = 300$ μA, $P_{max} = 240$ μW. </div>	



DO NOT SCALE DRAWING	
TOLERANCES (UNLESS NOTED)	DRAWN GUS H. ELIAS
DECIMALS = $\frac{1}{16}$ inch/mm	CHECKED S.W.
X = $\pm .1$ / 2.54	ENGINEER GUS H. ELIAS
.XX = $\pm .03$ / 0.76	SCALE
.XXX = $\pm .0100$ / 25	
HOLESES = $\pm .003$ / .076 / .05	
ANGLES = $\pm 30^\circ$	

CATEGORY	CONTROL DRAWING
TITLE	Field Installation Diagram: TFZ [HP] & TPZ [HP] -- FISCO --
DATE	07/07
SCALE	NONE
REVISION	For Hazardous 'Classified' Locations

DRAWING NUMBER	100-100-72 (Page 2 of 3)	REVISION	C
REVISED BY	SEE SHEET 1	DATE	
BY		APPROVAL	CB

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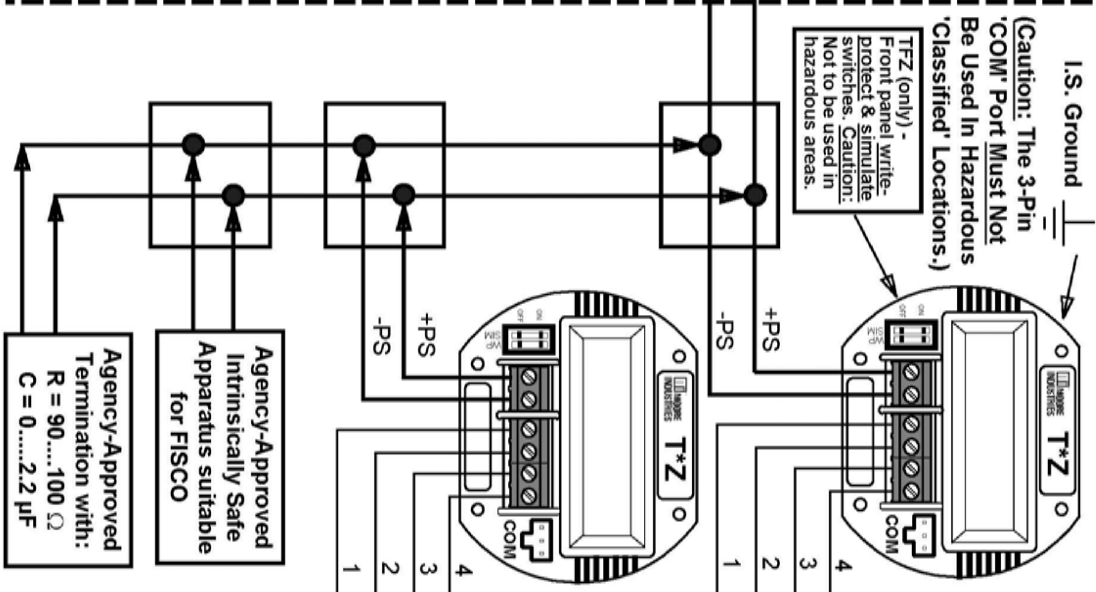
CERTIFIED PRODUCT
This is a controlled 'Related' or 'Schedule' drawing. No modifications are permitted without the notification and final approval of the Certification Engineer (related dwgs.) or the Certifying Agency (schedule dwgs.).

Non-Hazardous (Safe) Area

Barrier or other Agency-Approved Apparatus suitable for FISCO

Ground Path Resistance Must Not Exceed 1 Ω

Refer to Page 3 of 3 for notes on FISCO.



I.S. Ground
(Caution: The 3-Pin 'COM' Port Must Not Be Used In Hazardous 'Classified' Locations.)
TFZ (only) - Front panel write-protect & simulate switches. Caution: Not to be used in hazardous areas.

Sensor Type - mV.
POT, RTD, Ω , T/C:
 U_o, Voc or $V_t = 6.51$ Vdc
 I_o, Isc or $I_t = 34.75$ mA
 $P_o = 55.97$ mW
 $C_a, C_o = 20.53$ μ F, Gr. A/B, IIC
 $C_a, C_o = 498.53$ μ F, Gr. C/D, IIB
 $C_a, C_o = 998.53$ μ F, Gr. D, IIA
 $L_a, L_o = 25$ mH, Gr. A/B, IIC
 $L_a, L_o = 100$ mH, Gr. C/D, IIB
 $L_a, L_o = 200$ mH, Gr. D, IIA

Same Sensor Type parameters as indicated above

FISCO Parameters (+PS & -PS):
 V_{max} or $U_i = 24$ Vdc
 I_{max} or $I_i = 380$ mA
 P_{max} or $P_i = 5.32$ W
 $C_i = 0$ F
 $L_i = 7.15$ μ H

Model TFZ & TPZ Temperature Transmitters are suitable for a FISCO system in accordance with IEC 60079-27.



* TFZ or TPZ: PC-Programmable Foundation Fieldbus & PROFIBUS Temperature & Signal Transmitters with Display.

	DO NOT SCALE DRAWING		CATEGORY CONTROL DRAWING		DRAWING NUMBER 100-100-72 (Page 3 of 3)		REVISION C
	TOLERANCES (UNLESS NOTED) DECIMALS = $\frac{\text{inch}}{\text{mm}}$ X = ±.1 / 2.5 XX = ±.03 / 4 XXX = ±.0100 / 7 HOLES: ±.003 / .002 / .0025 / .0035 ANGLES: ± 30' / 0.2		DRAWN Gus H. Elias 07/07	CHECKED S.W. 07/07	REVISED BY SEE SHEET 1		DATE
TITLE Field Installation Diagram: TFZ [HP] & TPZ [HP] -- FISCO Notes -- For Hazardous 'Classified' Locations		ENGINEER Gus H. Elias 07/07		NOTICE RE PROPRIETARY INFORMATION: This drawing and the information contained herein are the proprietary property of Moore Industries-International, Inc. (MI) and should not be reproduced or disclosed to any third party without the written consent of an authorized officer of MI.			
SCALE NONE							

The FISCO Concept allows the interconnection of Intrinsically Safe apparatus to associated apparatus not specifically examined in such combination (refer to Page 2 of 3). The criterion for such interconnection is that the voltage (V_{max} or U_i), the current (I_{max} or I_i), and the power (P_i), which Intrinsically Safe apparatus can receive and remain Intrinsically Safe, considering faults, must be equal to or greater than the voltage (U_o , V_o , V_t), the current (I_o , I_s , I_t) and the power (P_o) which can be provided by the associated apparatus (supply unit). In addition, the maximum unprotected residual capacitance (C_i) and inductance (L_i) of each apparatus (other than the terminators) connected to the Fieldbus must be less than or equal to 5nF and 10µH, respectively.

In each I.S. Fieldbus segment only one active source, normally the associated apparatus, is allowed to provide the necessary power for the Fieldbus system. The allowed voltage (U_o , V_o , V_t) of the associated apparatus used to supply the bus must be limited to the range of 14Vdc to 24Vdc. All other equipment connected to the bus cable has to be passive, meaning that the apparatus is not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately-powered equipment needs a galvanic isolation to insure that the Intrinsically Safe Fieldbus circuit remains passive.

- The cable used to interconnect the devices needs to comply with the following parameters:

- 1- Loop Resistance $R' = 15 - 150 \Omega/\text{km}$
- 3- Capacitance per unit length $C' = 80 - 200 \text{ nF}/\text{km}$

or,

- 5- $C' = C' \text{ Line}/\text{Line} + C' \text{ Line}/\text{Screen}$ (if the Screen is connected to one line)
 - 6- Length of Spur Cable = 30 meters (maximum)
 - 7- Length of Trunk Cable = 1 km
 - 8- Length of Splice = 1 meter (maximum)
- Terminators: At each end of the Trunk cable, an Agency-Approved (FM, CSA, UL, ATEX, ANZEX, etc...) line terminator with the following parameters is considered suitable: $R = 90 - 100 \Omega$ & $C = 0 - 2.2 \mu\text{F}$

Installation Notes for FISCO & Entity Concepts:

- a) No revisions can be made to this certified drawing prior to notifying FM Approvals (the certifying agency).
- b) Associated apparatus manufacturer's installation guidelines must be followed when installing and commissioning this equipment (TFZ & TPZ).
- c) The FISCO Associated Apparatus must be Agency-Approved (FM, CSA, UL, ATEX, ANZEX, etc...).
- d) Control equipment connected to FISCO barrier must not use or generate more than 250 Vrms or Vdc.
- e) Resistance between FISCO Intrinsically Safe Ground and Earth Ground must be less than 1.0 Ω .
- f) Installation should be in accordance with ANSI/ISA-RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous 'Classified' Locations" and the National Electric Code (ANSI/NFPA 70), and/or applicable CEC and IEC regulations and requirements for installing and commissioning such devices.
- g) The FISCO Concept allows interconnection of Fieldbus Intrinsically Safe apparatus with FISCO associated apparatus when the following is true:
 - (V_{max} or U_i) \geq (V_o , V_t or U_o) (I_{max} or I_i) \geq (I_s , I_t or I_o) (P_{max} or P_i) \geq (P_o)

Installation Notes for Non-Incendive & Type N Concepts:

For Non-Incendive (Class I, Division 2, Groups A, B, C & D), and for Class II/III, Divisions 1 & 2, Group E, F & G, and for Type N hazardous applications, install per the NEC/CEC/IEC using threaded metal conduit. Intrinsic Safety barrier is not required. The maximum supply voltage is 32Vdc. A dust-tight seal must be used at the conduit entry when the device is used in Class II & III locations.

WARNING: Explosion Hazard -- Do not disconnect equipment unless power has been switched off or the area is known to be Non-Hazardous. Substitution of components is not allowed as it may affect the circuit design integrity and possibly impair suitability for hazardous locations.

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
 - a) A note listing the symptoms that indicate the unit needs repair
 - b) Complete shipping information for return of the equipment after repair
 - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES, BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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