EXACTUS® IFM10-EC EtherCAT Mux User's Guide
Ver. 1.2

BASF Corporation
Temperature Sensing Group
46820 Fremont Blvd.
Fremont, CA 94538-6540
Phone: (510) 490-2150
Fax: (510) 252-1871

http://www.exactus.basf.com

Additional support available:
BASF Temperature Sensing, Portland, Oregon
4011 SE International Way, Suite 604
Portland, OR 97222
Phone: (503) 794-4073
Fax: (503) 794-5591

Introduction:

The ***EXACTUS***® IFM10-EC Mux is an EtherCAT slave device allowing communication between a host system and up to ten pyrometers.

EtherCAT is a high-speed protocol used to monitor and control equipment using 100BASE-T connections. There are two basic types of equipment on an EtherCAT system, masters and slaves. Each slave has two 100BASE-T connections, typically RJ-45 jacks. Slaves are chained together, the second port of the first connected to the first port of the next, until at the end of the chain the last slave has an open second port (there is an exception – if the master has redundancy, the last slave's second port connects back to the master.)

A master sends poll packets to slaves. When a slave sees a packet on it's first port and its second port is connected, it forwards the packet to its second port. Otherwise, the packet is returned to the master. A single poll packet may contain multiple segments, each intended for a specific slave. As the packet is passed through each slave, the slave can modify the appropriate packet segment (for that slave) in real-time, so by the time a packet gets returned to the master all of the addressed slaves' data is contained therein.

Each slave is viewed as a 'window' of addressable memory which the master can read or write. The format of the data within each slave is described in an XML file which must be available to the master software. The XML file tells the master the names and locations of the data within the slave in order that the master can retrieve and display the slaves' output data, or send appropriate control signals as input to the slaves. The control or status data which passes between the master and the slave is called 'process data', and inside the EtherCAT slave the image which is presented to the master is called the TxPDO (Transmit Process Data Output.)

1. Product Overview

The ***EXACTUS***® IFM10-EC Mux communicates with up to 10 Exactus pyrometers. It contains two interfaces for communications to an external host PC: EtherCAT and Ethernet TCP/IP. The Ethernet TCP/IP is a temporary mode with can be use in conjunction with TemperaSure® graphical user interface software for configuring pyrometers.

Hardware Configuration (see Figure 1-1):

A. Run Status LED (**Run**), On = EtherCAT mode, blinking = TCP/IP mode
B. Error Status LED (**ERR**) On = error
C. Power Status LED (**PWR**) On = OK status
D. Reset Button (**R**)
E. Input 24VDC Power Connection
F. 3 address selection switches
G. 2 LAN Ports (**LAN A**, **LAN B**) [EtherCAT and Ethernet TCP/IP]
H. 10 Powered RS422 Pyrometer Ports (**CH1** to **CH10**)

Reset Button Function:

1. Double click to switch Mux into Ethernet TCP/IP mode.
2. Single click to reboot Mux in EtherCAT mode.

Figure 1-1: IFM10-EC Balloon View

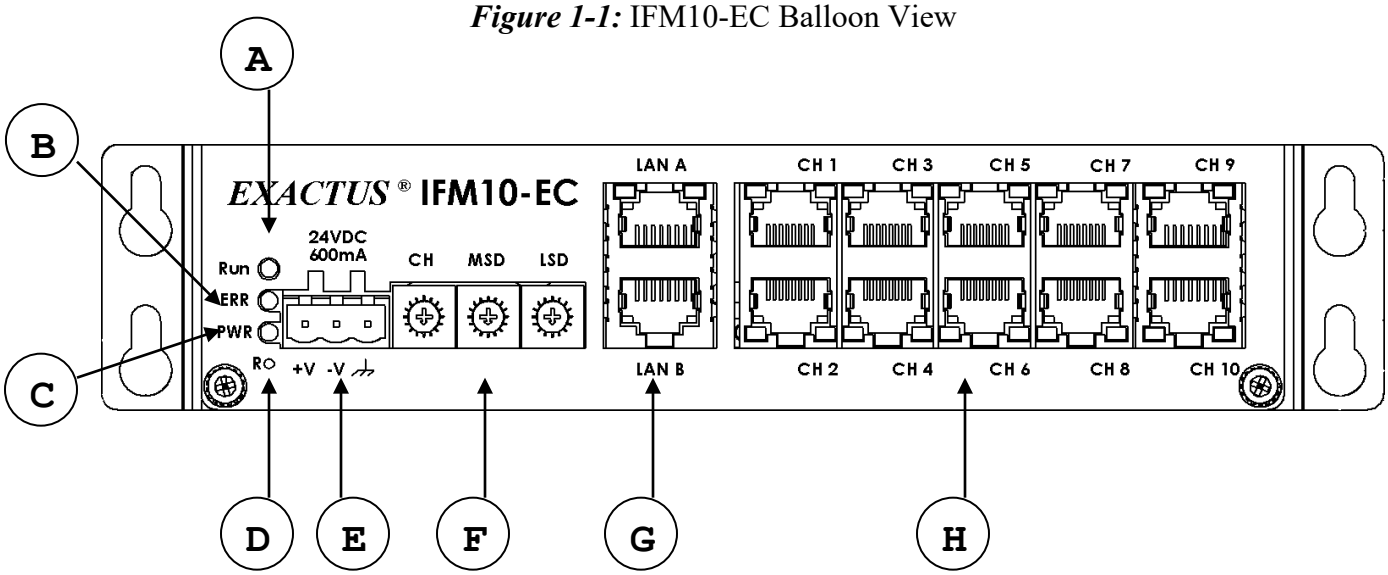
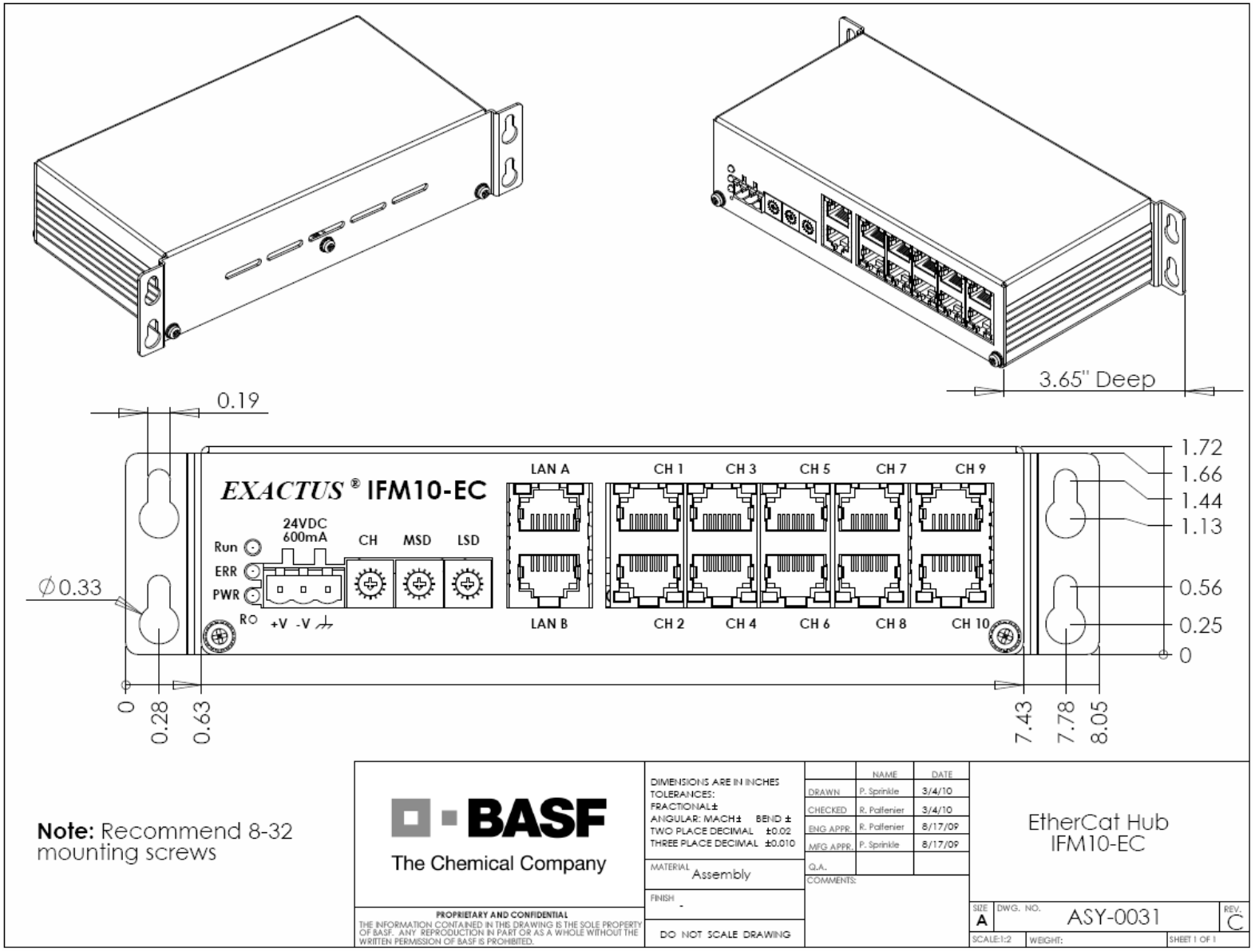


Figure 1-2: IFM10-EC Dimensions



2. Product Specifications

General Specifications	
Operating Temperature	10 to 70°C
Storage Temperature	-20 to 85°C
Humidity	5 to 90% (non-condensing)
Environmental Air	No corrosive gasses permitted
Agency Approvals - Pending	UL 61010-01, CE EN61010-1, CB IEC61010-01, EMC EN61326-1

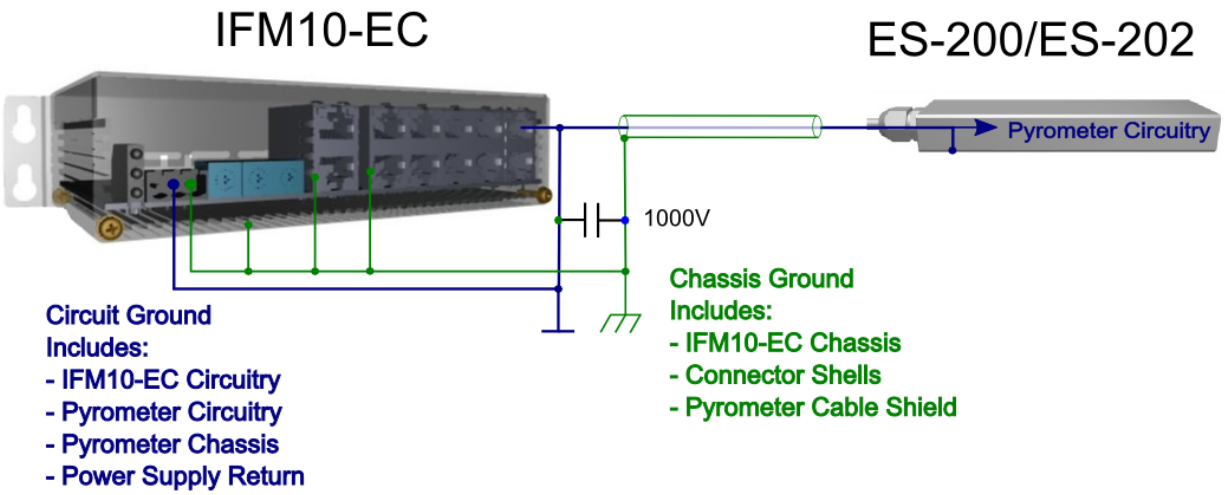
Mechanical/Certifications	
Size: H x W x D	1.72 x 6.80 x 3.65 inch
Weight	TBD g, TBD oz
Flange Wall Mount	0.88 x 7.70 inch

Input Power	
Input Voltage Range	Standard: 24VDC (12VDC - 30VDC)
Power Consumption with 10 Pyrometers	15 watts, 600mA (24VDC)
Pin Assignments	Pin 1 +V
	Pin 2 -V circuit ground
	Pin 3 chassis ground
Terminal Type - Removable	3 pin, 5.00 or 5.08mm plug

EtherCAT and TCP/IP Ports	
Communications	10/100 Base T Ethernet
Data Transfer Rate	10/100 Mbps
TCP/IP address default	192.168.1.80
Ethernet Port Connectors	RJ45

Pyrometer Ports	
Number of input Ports (channels)	10
Connectors	RJ-45
Pin Assignments	Pin 1 Tx+ (A) to pyrometer
	Pin 2 Tx- (B) to pyrometer
	Pin 3 Rx+ (A) from pyrometer
	Pin 4 NC (no connection)
	Pin 5 NC (no connection), Circuit Ground
	Pin 6 Rx- (B) from pyrometer
	Pin 7 Supply +6VDC
	Pin 8 Circuit Ground
Shell	Chassis Ground
LED Indicators	Green: Data from pyrometer, Amber: Data to pyrometer
Electrical Protocol	RS-422 Full Duplex
Bit Protocol	Asynchronous, 8-bit, 1 stop
Max. Data Rate	921,600 bits/second
Protection	ESD protection on all communication lines, Pyrometer power supply protected against shorts

Figure 1-3: IFM10-EC Grounding Diagram



3. System Boot-up

The IFM10-EC MUX has no power switch, so the DC power cord must be used to apply and remove power from the device. When DC power is first applied to the MUX, the system clears the indicator LEDs, initializes all sub-systems and communications channels and then begins looking for Exactus pyrometer at each of the pyrometer ports. The system is able to discover the type of pyrometer and configure the port as needed. The MUX is ready for operation approximately 5 seconds after DC power has been applied.

The default mode after a MUX boot is EtherCAT mode. An EtherCAT host must configure the MUX before data can be retrieved from the pyrometers. The specifications the host needs to configure the MUX are stored in an XML file which is specific to this model of MUX.

There are three LED indicators on the IFM10-EC labeled, top to bottom, 'Run', 'Err', and 'Pwr'. The following table describes the LED patterns and what they indicate:

LED	Pattern	Meaning
RUN	Off	EtherCAT mode, init state
	Short blink every 2 seconds	EtherCAT mode, pre-op state
	Slow blink	EtherCAT mode, safe-op state
	On	EtherCAT mode, op state
	Short blink off every 2 seconds	TCP/IP mode
ERR	Off	Normal Operation
	One blink per second	EtherCAT configuration error
	Two blinks	Pyro watchdog timeout
	Three blinks	Pyro ambient over-temp
	Four blinks	MUX ambient over-temp

4. Pyrometer Communication

In EtherCAT mode, the pyrometers are set to output data using the Exactus Legacy protocol, which is optimized for fast delivery of temperature and/or current data for real-time processing by a host. The pyrometers are configurable via TemperaSure (in TCP/IP mode) and settings can be set and saved in the pyrometers' flash memory. In EtherCAT mode, whenever a reading is received from a pyrometer, it is immediately stored in the EtherCAT Process Data Output (PDO) and is available for the host to retrieve at any time thereafter. A 32-bit counter is associated with each pyrometer and stored along with the pyrometer's data in the PDO. Whenever the pyrometer reading is updated in the PDO, this counter is incremented. Using this counter, the host can determine how many readings have been collected from each pyrometer since the last data retrieval via EtherCAT.

5. Mounting

- The back of the IFM10-EC has two flanges for easy attachment to a panel or wall. Us #8 size screws to attach the instrument to the panel or wall.
- It is recommended that the IFM10-EC be mounted in a cabinet or NEMA enclosure rated for area of use.

6. Maintenance

- The equipment does not require periodic maintenance. If the equipment becomes dusty or dirty, clean it by disconnecting the DC power and wiping it down with a soft, slightly damp cloth.
- If the Mux is mounted in a cabinet, door should remain closed as often as possible. A lock should be used if necessary.
- The ambient temperature of the Mux should be checked in the operating environment at its highest temperature. The temperature should not exceed 70ºC. Doing so will not damage the electronics but may affect the temperature measurement accuracy. If the temperature exceeds 80ºC, failure is possible. Use radiation shielding or the optional purge air to keep the electronics cool.
- If the Mux is mounted in a cabinet, check the inside of the cabinet for dirt, oil, water, etc. If discovered, take appropriate action to prevent damage to the electronic components.

7. WARNINGS

- If the equipment is not used in a manner consistent with manufacturer instructions and specifications, the protections provided by the equipment may be impaired

- Use of probe without the IMF10-EC Mux may degrade measurement quality. The Mux isolates the probe from electrical noise and provides power conditioning.