



## Series IEF Insertion Electromagnetic Flow Transmitter

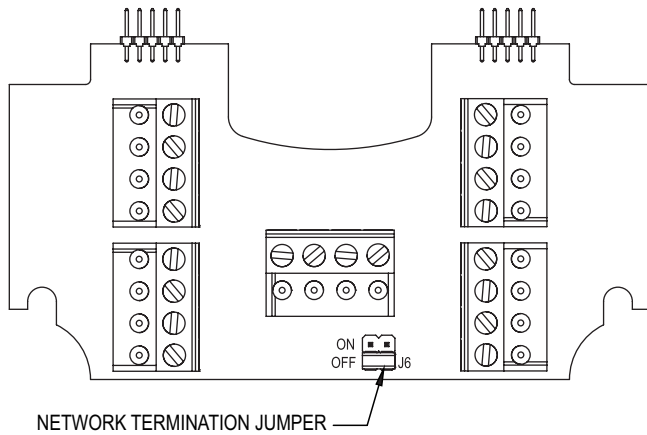
### BACnet / Modbus® - Operating Instruction

#### Network Termination Jumper

On the terminal block PCBA there is a jumper, J1 (see figure UUUU), that enables or disables a network termination resistor as defined below:

When the network jumper is placed in the ON position there is a 120 ohm termination resistor in place. When the network jumper is placed in the OFF position there is no termination resistor in place.

Default: OFF



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## Insertion Electromagnetic Flowmeter (IEF): Communication Overview

The Insertion Magmeter supports BACnet MS/TP and Modbus® RTU over 2-wire RS485.

Selection of protocol and configuration of serial parameters require the use of the display.

### BACnet Object Overview

#### Supported BACnet Objects

Object Type	Dynamically Creatable	Dynamically Creatable	Object Identifier	Object Name
Device	No	No	607xxx	Series IEF 607xxx
Analog Input	No	No	AV1	Velocity
Analog Value	No	No	AV1	Flow
			AV2	Total Flow
Binary Value	No	No	BV1	Reverse Flow
			BV2	Empty Pipe
			BV3	Reset Total Flow
BitString Value	No	No	BSV1	Status Flags

### BACnet Objects:

#### Device Object

Property	Default Value	Property Data Type	Access
Object Identifier	607xxx	BACnetObjectIdentifier	Read/Write
Object Name	"Series IEF 607xxx"	CharacterString(40)	Read/Write
ObjectType	DEVICE(8)	BACnetObjectType	Read
System Status	Operational(0)	BACnetDeviceStatus	Read
Vendor Name	"Dwyer Instruments, Inc."	CharacterString	Read
Vendor Identifier	607	Unsigned	Read
Model Name	"IEF-HN-10-COM"	CharacterString	Read
Firmware Revision	"x.x.x"	CharacterString	Read
Application Software Version	"x.x"	CharacterString	Read
Location		CharacterString(32)	Read/Write
Description		CharacterString(32)	Read/Write
Protocol Version	1	Unsigned	Read
Protocol Revision	14	Unsigned	Read
Protocol Services Supported	See BACnet Services below	BACnetServicesSupported	Read
Protocol Object Types Supported	See Table Above	BACnetObjectTypesSupported	Read
Object List	See Table Above	BACnetArray	Read
Active COV Subscriptions		List of BACnetCOVSubscription	Read
Maximum APDU Length Accepted	480	Unsigned	Read
Maximum APDU Length Accepted	NO_SEGMENTATION (3)	BACnetSegmentation	Read
APDU Timeout	6000	Unsigned	Read/Write
Number of APDU Retries	3	Unsigned	Read/Write
Max Master	127	Unsigned	Read/Write
Max Info Frames	1	Unsigned	Read
Device Address Binding	Empty	BACnetAddressBinding Unsigned	Read
Database Revision	1	BACnetARRAY[N] of	Read
Property List		BACnetPropertyIdentifier	
Serial Number	"xxxxxxxx"	CharacterString	Read

The default object identifier is 607xxx, where xxx is replaced by the MS/TP MAC address set in the Network Address menu. The object identifier value will change as the MS/TP MAC address changes. However, if a specific object identifier is written via BACnet, then that value is stored and changes to the MS/TP MAC address will no longer affect the object identifier.

Similarly, the default object name includes 607xxx. The object name will reflect the current object identifier. If a specific object name is written via BACnet, then that value is stored and changes to the object identifier will no longer affect the object name.

APDU Timeout values are rounded to the nearest second (1000ms). Values less than 500 will be rounded to 0 and Number of APDU Retries will be set to 0.

#### Analog Input – Velocity

Property	Default Value	Property Data Type	Access
Object Identifier	AV1	BACnetObjectIdentifier	Read
Object Name	"Velocity"	CharacterString	Read
ObjectType	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED(0)	BACnetReliability	Read
Out Of Service	FALSE (0)	Boolean	Read/Write
Units	Feet-per-second (76)	BACnetEngineeringUnits	Read/Write
COV Increment	0.5	Real	Read/Write
Property List		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

#### COV Increment Value

Property	Default Value	Property Data Type	Access
0.5 ft/s	0.1 ft/s	10.0 ft/s	0.1 ft/s

Supported Units:

Feet-per-second (76), Feet-per-minute (77), Meters-per-second (74), Meters-per-minute (163), Meters-per-hour (164), Feet-per-hour (512)\*, Feet-per-day (513)\*, Meters-per-day (514)\*

\* Non-Standard BACnet unit

#### Analog Value – Flow

Property	Default Value	Property Data Type	Access
Object Identifier	AV1	BACnetObjectIdentifier	Read
Object Name	"Flow"	CharacterString	Read
ObjectType	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED(0)	BACnetReliability	Read
Out Of Service	FALSE (0)	Boolean	Read/Write
Units	Cubic-feet-per-second (142)	BACnetEngineeringUnits	Read/Write
COV Increment	0.5	Real	Read/Write
Property List		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

#### COV Increment Value

Property	Default Value	Property Data Type	Access
1.0 ft³/s	0.133 ft³/s	13.3681 ft³/s	0.1 ft³/s

Supported Units:

Cubic-feet-per-second (142), Cubic-feet-per-minute (84), Cubic-feet-per-hour (191), Cubic-feet-per-day (248), US-gallons-per-minute (89), US-gallons-per-hour (192), Liters-per-second (87), Liters-per-minute (88), Liters-per-hour (136), Cubic-meters-per-second (85), Cubic-meters-per-minute (165), Cubic-meters-per-hour (135), US-gallons-per-second (515)\*, US-gallons-per-day (516)\*, Liters-per-day (517)\*, Cubic-meters-per-day (518)\*

\* Non-Standard BACnet unit

#### Analog Value – Total Flow

Property	Default Value	Property Data Type	Access
Object Identifier	AV2	BACnetObjectIdentifier	Read
Object Name	"Total Flow"	CharacterString	Read
ObjectType	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED(0)	BACnetReliability	Read
Out Of Service	FALSE (0)	Boolean	Read/Write
Units	Cubic-feet (79)	BACnetEngineeringUnits	Read/Write
COV Increment	1.0	Real	Read/Write
Property List		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

#### COV Increment Value

Property	Default Value	Property Data Type	Access
1.0 ft³/s	0.133 ft³/s	13.3681 ft³/s	0.1 ft³/s

Supported Units:

Cubic-feet (79), US-gallons (83), Liters (82), Cubic-meters (80)

### Binary Value – Reverse Flow

Property	Default Value	Property Data Type	Access
<b>Object Identifier</b>	BV1	BACnetObjectIdentifier	Read
<b>Object Name</b>	"Reverse Flow"	CharacterString	Read
<b>ObjectType</b>	BINARY_VALUE (5)	BACnetObjectType	Read
<b>Present Value</b>	Inactive (0)	BACnetBinaryPV	Read
<b>Status Flags</b>	0	BACnetStatusFlags	Read
<b>Event State</b>	NORMAL (0)	BACnetEventState	Read
<b>Reliability</b>	NO_FAULT_DETECTED(0)	BACnetReliability	Read
<b>Out Of Service</b>	FALSE (0)	Boolean	Read/Write
<b>Property List</b>		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

This object provides a simple indication of the direction of process flow. When the process fluid is detected as flowing in the normal direction, the present value will return inactive(0). When the process fluid is detected as flowing in the reverse direction, the present value will return active(1).

This object supports COV subscription to allow a monitoring system to easily detect changes in flow direction.

### Binary Value – Empty Pipe

Property	Default Value	Property Data Type	Access
<b>Object Identifier</b>	BV2	BACnetObjectIdentifier	Read
<b>Object Name</b>	"Empty Pipe"	CharacterString	Read
<b>ObjectType</b>	BINARY_VALUE (5)	BACnetObjectType	Read
<b>Present Value</b>	Inactive (0)	BACnetBinaryPV	Read
<b>Status Flags</b>	0	BACnetStatusFlags	Read
<b>Event State</b>	NORMAL (0)	BACnetEventState	Read
<b>Reliability</b>	NO_FAULT_DETECTED(0)	BACnetReliability	Read
<b>Out Of Service</b>	FALSE (0)	Boolean	Read/Write
<b>Property List</b>		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

This object provides a simple indication of an error state where no process flow is in contact with the probe. When the process fluid is detected, the present value will return inactive(0). When the process fluid is not detected, the present value will return active(1).

This object supports COV subscription to allow a monitoring system to easily detect this error condition.

### Binary Value – Reset Total Flow

Property	Default Value	Property Data Type	Access
<b>Object Identifier</b>	BV3	BACnetObjectIdentifier	Read
<b>Object Name</b>	"Reset Total Flow"	CharacterString	Read
<b>ObjectType</b>	BINARY_VALUE (5)	BACnetObjectType	Read
<b>Present Value</b>	Inactive (0)	BACnetBinaryPV	Read/Write
<b>Status Flags</b>	0	BACnetStatusFlags	Read
<b>Event State</b>	NORMAL (0)	BACnetEventState	Read
<b>Reliability</b>	NO_FAULT_DETECTED(0)	BACnetReliability	Read
<b>Out Of Service</b>	FALSE (0)	Boolean	Read/Write
<b>Property List</b>		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

Writing a value of 1 to the present value of this object will reset the value of Total Flow to 0. Writing a value of 0 has no effect.

### BitString Value – Status Flags

Property	Default Value	Property Data Type	Access
Object Identifier	BSV1	BACnetObjectIdentifier	Read
Object Name	"Status Flags"	CharacterString	Read
ObjectType	BITSTRING_VALUE (39)	BACnetObjectType	Read
Present Value	{FFFFFFFF FFFF}	BitString	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED(0)	BACnetReliability	Read
Out Of Service	FALSE (0)	Boolean	Read/Write
Property List		BACnetARRAY[N] of BACnetPropertyIdentifier	Read

This object provides a means for the meter to convey additional error status to a BACnet client. See the table below for a definition of each bit.

Bit	Meaning
0	Error: Reading/Writing Non-volatile storage
1	Reserved
2	Error: Process measurement error
3	Error: Meter recovered from watchdog reset
4	Error: Factory configuration invalid
5	Error: Wiring board not installed/detected
6	Error: Power Supply board not installed/detected
7	Reserved
8	Error: Measurement board not installed/detected
9	Error: Excitation board not installed/detected
10	Error: Calibration Data Invalid
11	Error: Process Temperature Probe Failure

### BACnet Services

**ReadProperty (DS-RP-B) ReadPropertyMultiple(DS-RPM-B)**  
**WriteProperty (DS-WP-B) WritePropertyMultiple(DS-WPM-B)**

### Device Communication Control Service (DM-DCC-B)

This device supports the Device Communication Control Service BIBB. The optional time duration in minutes is also supported. This device is configured with a password that must be provided to successfully execute this command. The password is "Dwyer".

### Reinitialize Device Service (DM-RD-B)

This device supports the Reinitialize Device Service BIBB. The supported device states are COLDSTART and WARMSTART. All other states return error. This device is configured with a password that must be provided to successfully execute this command. The password is "Dwyer".

### SubscribeCOV Service (DS-COV-B)

This device supports the SubscribeCOV Service BIBB to allow easy monitoring of input data.

- Up to seven (7) concurrent subscriptions
- Confirmed and Unconfirmed COV Notifications
- Fixed lifetime value up to 86400 seconds (24 hours).
- Indefinite lifetime supported.

### Modbus® Functions

The device supports the following functions

Function Name	Function Code
Read Holding Registers	03
Read Input Registers	04
Write Single Register	06
Write Multiple Registers	16

### Modbus® Registers

Input Registers

Register	Description	Data Type	Range
0001	Velocity	32bit Float	
0003	Flow	32bit Float	
0005	Total Flow	32bit Float	
0007	Reverse Flow	Unsigned 16bit Integer	0 – Normal
0008	Empty Pipe		1 – Reverse
0009 - 0010	Status Flags	Unsigned 16bit Integer	0 – Process detected
8001 - 8016	Model Number		1 – Process not detected
8017 - 8020	Serial Number	Unsigned 16bit Integer	See BACnet BitString
8021 - 8028	Firmware Version		Object "Status Flags"
8029 - 8032	Date Code	String	"IEF-HN-10-COM"
		String	"xxxxxxx"
		String	"x.x.x"
		String	"xxxxxxx"

The String data type is read as a stream of ASCII characters with the first character sent in the MSB of the first register and the second character sent in the LSB of the first register and so on. If the string is shorter than the allotted size, the remaining bytes will be zero padded.

## Holding Registers

Register	Description	Data Type	Range
<b>0001 – 0020</b>	Device Name	String	
<b>0021</b>	Velocity Unit	Unsigned 16bit integer	0 – 7
<b>0022</b>	Flow Unit	Unsigned 16bit integer	0 – 15
<b>0023</b>	Volume Unit	Unsigned 16bit integer	0 – 3
<b>0024</b>	Reset Total Flow	Unsigned 16bit integer	0 or 1
<b>0025</b>	Reset Device	Unsigned 16bit integer	0 or 1

**Device Name:** A string, up to 40 characters long, that will be displayed on the LCD (if present). When reading or writing, all 20 registers must be requested. Strings less than 40 characters shall be 0 padded.

**Velocity Unit:** Selects the unit of velocity for the value in the velocity register. See Table 1.

**Flow Unit:** Selects the unit of flow for the value in the Flow register. See Table 2.

**Volume Unit:** Selects the unit of volume for the value in the Total Flow register. See Table 3.

**Reset Total Flow:** When a value of 1 is written to this register, the value in the Total Flow register is reset to 0. Writing a value of 0 has no effect. This register will always return a 0 when read.

**Reset Device:** When a value of 1 is written to this register, the device will perform a warm reset after 5 seconds. Writing a value of 0 has no effect. This register will always return 0 when read.

TABLE 1: VELOCITY UNIT VALUES	
Value	Unit
*0	Feet-per-second (ft/s)
1	Feet-per-minute (ft/min)
2	Feet-per-hour (ft/hr)
3	Feet-per-day (ft/day)
4	Meters-per-second (m/s)
5	Meters-per-minute (m/min)
6	Meters-per-hour (m/hr)
7	Meters-per-day (m/day)

TABLE 2: FLOW UNIT VALUES	
Value	Unit
*0	Cubic-feet-per-second (ft <sup>3</sup> /s)
1	Cubic-feet-per-minute (ft <sup>3</sup> /min)
2	Cubic-feet-per-hour (ft <sup>3</sup> /hr)
3	Cubic-feet-per-day (ft <sup>3</sup> /day)
4	Gallons-per-second (gal/s)
5	Gallons-per-minute (gal/min)
6	Gallons-per-hour (gal/hr)
7	Gallons-per-day (gal/day)
8	Liters-per-second (L/s)
9	Liters-per-minute (L/min)
10	Liters-per-hour (L/hr)
11	Liters-per-day (L/day)
12	Cubic-meters-per-second (m <sup>3</sup> /s)
13	Cubic-meters-per-minute (m <sup>3</sup> /min)
14	Cubic-meters-per-hour (m <sup>3</sup> /hr)
15	Cubic-meters-per-day (m <sup>3</sup> /day)

TABLE 3: VOLUME UNIT VALUES	
Value	Unit
0	Cubic-feet (ft <sup>3</sup> )
*1	Gallons (gal)
2	Liters (L)
3	Cubic-meters (m <sup>3</sup> )

\* Default unit

## Multi-Address Support

Multi-Address support allows a register to be read or written to using different byte orientations specified by the address range. For example, input register 0003 can also be read at 2003, 4003 and 6003 with different byte orientations as listed in Table 7. Registers that do not have multi-address support are only available in Big-Endian byte orientation (Modbus® standard).

	Address Range	Float/32bit Values				16Bit Values	
		Register 1		Register 2		Register 3	
Byte Order		MSB			LSB	MSB	LSB
<b>Big-Endian</b>	1-2000	A	B	C	D	A	B
<b>Byte Swap</b>	2001-4000	B	A	D	C	B	A
<b>Word Swap</b>	4001-6000	C	D	A	B	A	B
<b>Little-Endian</b>	6001-8000	D	C	B	A	B	A



