



SpireMag Series T-MAG Electromagnetic BTU Meter

Features

The T-MAG BTU meter is the latest addition to the SpireMag series for accurate thermal energy measurement. It utilizes a high accuracy electromagnetic flowmeter to measure the flow volume of the chilled water, hot water or condensed water, and two matched temperature sensors to measure the supply and return temperature. The T-MAG provides abundant input/output and communication options which make it easy to be integrated into any meter reading system, PLC or BMS systems.



Insertion
Flow
Sensor



Full Bore
Flow Sensor

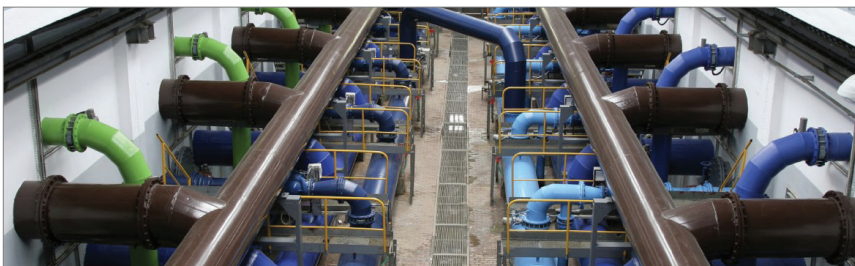


Main Unit

- High accuracy, billing grade. Up to 0.5% accuracy for flow, 0.15°F (0.08°C) for temperature difference. 0.3% accuracy available upon request
- Plug and play. All parameters are pre-configured in factory
- Integrated BTU measurement system. Single source responsibility
- Two flow sensor options: full bore sensor for high accuracy, insertion sensor for easy installation

- Bi-directional
- Short straight-pipe run, thus, suitable for any desired installation location
- No moving parts to wear and tear, save maintenance costs
- Standard output: 4-20mA, pulse, dry contact (relay)
- Optional MODBUS, BACnet or GPRS Wireless for easy BMS or PLC integration

DSTMAGQT-1501-Rev.9



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SpireMag Series T-MAG

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Applications

The T-MAG high-performance BTU meter accurately measures the thermal energy consumption or transportation of a heating / cooling system. It is an ideal choice for a wide range of applications in HVAC, heating/cooling energy production, energy transfer, building management, facility management, district heating and cooling, geothermal or solar hot water system monitoring, and more.

Some examples are:

- Chilled water HVAC
- Hot water HVAC
- Condensate and heating water circuits
- Boiler feed water
- Thermal storage, geothermal system, solar hot-water system
- District energy management and billing
- Commercial building tenant billing
- LEED / Green building verification, green credit application
- Energy consulting
- Power plant efficiency monitoring
- Facility management in shopping malls, campus, industrial parks, hospitals, commercial buildings, government buildings, airports and more

Introduction

Spire Metering's T-MAG electromagnetic BTU meter is designed to measure the energy of a water heating or cooling circuit. The meter consists of three parts, an electromagnetic flow sensor, a pair of temperature sensors and a main unit also known as an integrator or transmitter. The main unit is a powerful console which combines high accuracy flow measurement, temperature measurement and BTU calculation.

The flow sensor operates based on Faraday's Law. It measures the volumetric flowrate of a conductive medium in a closed pipeline. With a microprocessor and exclusive integrated circuit, Spire Metering's electromagnetic flow sensor has the following advantages: reliable performance, high accuracy, and ease of use. The advanced signal processing technologies ensure a wide measuring range. The large LCD display makes

readings and parameter settings easy to read and modify.

The temperature sensors are high accurate. They also come with a pair of RTDs which are paired and calibrated to achieve better than 0.15°F (0.08°C) accuracy for temperature difference measurement.

The BTU calculation is according to the EN1434 heat meter standard. The formulas have been carefully implemented in the microprocessor so to minimize computational error.

As the latest addition to the SpireMag series, the T-MAG offers various output options, such as 4-20mA, dry contact pulse, RS-485/ MODBUS, BACnet, and GPRS wireless. The T-MAG can easily be integrated with existing BMS building automation systems and PLC units.



SpireMag Series T-MAG

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Specifications | With full bore flow sensor

Nominal Size	2"~8" (DN50~DN200)
Flow Accuracy	±0.3% / ±0.5% of reading for 8"(DN200) and smaller
Flow Measurement Range	0.3ft/s ~ 30ft/s (0.1m/s ~ 10m/s)
Flow Direction	Capable of measuring both forward and reverse flow and recognizing its direction
Temperature Range	Θ: 32°F ~ 300°F (0°C ~ 150°C)
Temperature Difference Range	ΔΘ: 4°F ~ 160°F (2°K ~ 90°K)
Temperature Difference Accuracy	±0.15°F (±0.08°C)
Medium Temperature	-10°C ~ +150°C (14°F ~ 302°F) with PTFE liner
Display and Keys	Large LCD display with backlight. Visible under sunlight or in the dark Display instantaneous energy, flow, total energy, total flow, supply temperature, return temperature, temperature difference, alarm and more Display units for energy – BTU, KBTU, KJ, MH, GJ, KWh, MWh Four keys for local programming and information access
Totalizers	Energy totalizer, flow totalizer
Output Signals	Analog output: 4 ~ 20mA. Load resistor ≤ 500Ω Digital output: Open Collector Transistor (OCT) interface. Can be programmed as: • Pulse output: pulse width 0.1s ~ 99.9s • Frequency output: 1 ~ 5,000Hz
Communication	RS-485 / MODBUS GPRS wireless available upon request BACnet available upon request
Protection Class	For electronic box: IP65 (outdoor) For sensor: IP65 (outdoor)
Lining Material	PTFE
Electrode Material	316L SS
Sensor Material	stainless steel for measuring tube, carbon steel for housing and flange
Pipe Connection	DIN or ANSI RF150# / ANSI RF300# flange
Nominal Pressure	2" (DN50): 2.5MPa (362psig) for DIN and 150lbs for ANSI RF150# flanges and 300lbs for ANSI RF300# flanges 2½" ~ 8" (DN65 ~ DN200): 1.6MPa (232psig) for DIN and 150lbs for ANSI RF150# flanges and 300lbs for ANSI RF300# flanges
Ambient Temperature	-25°C ~ +50°C (-13°F ~ 122°F)
Ambient Humidity	5~95%RH (relative humidity)
Medium Electrical Conductivity	≥ 20us/cm
Power Supply	18~36VDC or 110~240VAC, <15W
Structure Type	Remote type



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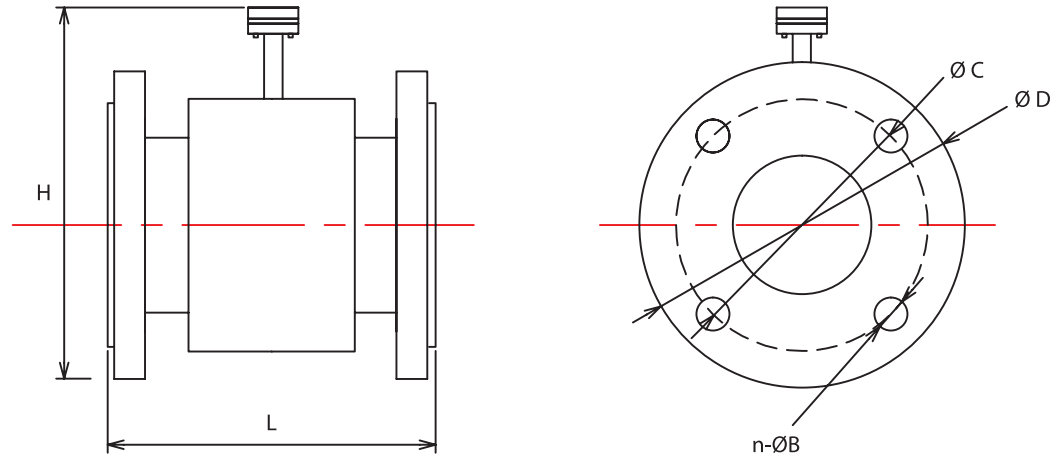
Specifications | With insertion flow sensor

Nominal Size	3" ~ 40" (DN80 ~ DN1,000)
Flow Accuracy	±2% of reading
Flow Measurement Range	1.5ft/s ~ 30ft/s (0.5m/s ~ 10m/s)
Flow Direction	Capable of measuring both forward and reverse flow and recognizing its direction
Temperature Range	Θ: 32°F ~ 140°F (0°C ~ 60°C) Note: the flow sensor head is made from ABS.
Temperature Difference Range	ΔΘ: 4°F ~ 160°F (2°K ~ 90°K)
Temperature Difference Accuracy	±0.15°F (±0.08°C)
Medium Temperature	up to 60°C (140°F)
Display and Keys	Large LCD display with backlight. Visible under sunlight or in the dark Display instantaneous energy, flow, total energy, total flow, supply temperature, return temperature, temperature difference, alarm and more Display units for energy – BTU, KBTU, KJ, MH, GJ, KWh, MWh Four keys for local programming and information access
Totalizers	Energy totalizer, flow totalizer
Output Signals	Analog output: 4 ~ 20mA. Load resistor ≤ 500Ω Digital output: Open Collector Transistor (OCT) interface. Can be programmed as: • Pulse output: pulse width 0.1s ~ 99.9s • Frequency output: 1 ~ 5,000Hz
Communication	RS-485 / MODBUS GPRS wireless available upon request BACnet available upon request
Protection Class	For electronic box: IP65 (outdoor) For sensor: IP65 (outdoor)
Electrode Material	316 SS with polypropylene head
Sensor Material	ABS
Hot tapping	Ball valve optional Hot tapping tool kit available upon request
Operating Pressure	Above 200psi
Ambient Temperature	-25°C ~ +50°C (-13°F ~ 122°F)
Ambient Humidity	5~95%RH (relative humidity)
Medium Electrical Conductivity	≥ 50us/cm
Power Supply	18~36VDC or 110~240VAC, <15W
Structure Type	Remote type



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Dimensions and Pressure Rating of Flow Sensor (full bore only)

Nominal Size	Nominal Pressure	Dimension						Weight	
		L		H		D		kg	lbs
		mm	in	mm	in	mm	in		
50 (2")	2.5 MPa (362psig)	200	7.9	263	10.4	140	5.5	15	33.1
65 (2 1/2")	1.6 MPa (232psig)	200	7.9	283	11.1	180	7.1	18	39.7
80 (3")		200	7.9	290	11.4	195	7.7	20	44.1
100 (4")		250	9.8	318	12.5	215	8.5	25	55
125 (5")		250	9.8	350	13.8	245	9.6	28	61.7
150 (6")		300	11.8	380	15.0	280	11.0	30	66.1
200 (8")		350	13.8	430	16.9	335	13.2	50	110

Dimensions of Flow Cell (full bore only)

ANSI B16.5 150lb for DN sizes ≤ 8" (DN200)

Nominal Size	Dimension						Weight	
	L		D		H		Remote	
	mm	in	mm	in	mm	in	kg	lbs
50 (2")	200	7.9	152.4	6	260	10.2	15	33.1
65 (2 1/2")	200	7.9	177.8	7	280	11	18	39.7
80 (3")	200	7.9	190.5	7.5	285	11.2	20	44.1
100 (4")	250	9.8	228.6	9	315	12.4	26	57.3
125 (5")	250	9.8	254	10	345	13.6	28	61.7
150 (6")	300	11.8	279.4	11	370	14.6	30	66.1
200 (8")	350	13.8	342.9	13.5	430	16.9	55	121.3



SpireMag Series T-MAG

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Dimensions of Flow Cell (full bore only)

ANSI B16.5 300lb for DN sizes ≤ 8" (DN200)

Nominal Size	Dimension						Weight	
	L		D		H		Remote	
	mm	in	mm	in	mm	in	kg	lbs
50 (2")	200	7.9	263	10.4	165.1	6.5	15	33.1
65 (2 1/2")	200	7.9	285	11.2	190.5	7.5	20	44.1
80 (3")	200	7.9	294	11.6	209.5	8.2	24	52.9
100 (4")	250	9.8	327	12.9	254	10.0	31	68.3
125 (5")	250	9.8	354	13.9	279.4	11.0	36	79.3
150 (6")	300	11.8	388	15.3	317.5	12.5	40	88.2
200 (8")	350	13.8	450	17.7	381	15.0	70	154.3

Dimensions and Pressure Rating of Flanges (full bore only)

Nominal Size	DIN Flange (mm)				ANSI 150lbs Flange (in)				Nominal Pipe Size (NPS)	ANSI 300lbs Flange (in)				
	Nominal Pressure	D	ØB	n	ØC	D	ØB	n		ØC	D	n	ØB	ØC
50 (2")	2.5 MPa (362psig)	140	14	4	110	6	5/8	4	4 3/4	2"	6 1/2	8	5/8	5
65 (2 1/2")	1.6 MPa (232psig)	180	18	4	145	7	5/8	4	5 1/2	2 1/2"	7 1/2	8	3/4	5 7/8
80 (3")		195	18	8	160	7 1/2	5/8	4	6	3"	8 1/4	8	3/4	6 5/8
100 (4")		215	18	8	180	9	5/8	8	7 1/2	4"	10	8	3/4	7 7/8
125 (5")		245	18	8	210	10	3/4	8	8 1/2	5"	11	8	3/4	9 1/4
150 (6")		280	23	8	240	11	3/4	8	9 1/2	6"	12 1/2	12	3/4	10 5/8
200 (8")	335	23	12	295	13 1/2	3/4	8	11 3/4	8"	15	12	7/8	13	



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Grounding Selection (for full-bore flow sensor only)

In general, extra grounding accessory is not needed for water flow in metal pipes which have normally been connected to Earth ground already. However, if the pipe is plastic or the pipe is not Earth grounded, you may consider the following accessories.

Type	Applications
Grounding Ring	Economical. Applicable to non-conductive pipeline such as plastic pipeline. However, it is not required for the sensor with polytetrafluoroethylene (PTFE) liner.
Grounding Flange	Higher cost but better grounding. Applicable to non-conductive pipeline such as plastic pipeline. However, it is not required for the sensor with polytetrafluoroethylene (PTFE) liner.

Nominal Diameter Selection (for full-bore flow sensor only)

- Electromagnetic flowmeter covers a wide range of flow, thus, you may select the nominal diameter of the flow sensor to be the same as that of the process pipe.
- If there are solid particles in the measured medium, a flow velocity range of 1~3m/s (3~10ft/s) is recommended.
 - If the actual flow velocity is over this range yet inconvenient to reduce, it is recommended to select a nominal diameter larger than that of the process pipe. As such, the flow velocity in the measuring tube of the sensor can be properly decreased and the abrasion of electrode and liner caused by the particles can be alleviated.
 - If the actual flow velocity is below this range yet inconvenient to increase, it is recommended to select a nominal diameter smaller than that of the process pipe. As such, the flow velocity in the measuring tube of the sensor can be properly increased in order to avoid particle deposition and related accuracy degradation.
- If the flow rate is too small yet a high accuracy measurement is required, you may select a sensor nominal diameter smaller than that of the process pipe. This is to increase the velocity thus to increase the accuracy.

When you select a flow sensor with a nominal diameter that is different from the process pipe, a pipe size reducer or expander (pipe adapter) should be connected upstream and downstream to the flow sensor. The center taper angle of the pipe adapters should be no more than 150° and there should be a straight pipe at least 5 times the process pipe diameter between the pipe adapter and the flange of the flow sensor.

To help sensor size selection, please consult the following table which shows the flow rate of each size at different flow velocities.





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Comparison Table of Flow Velocity and Flowrate

Velocity <small>m/s(ft/s)</small> Flowrate <small>m³/h (gpm)</small> Diameter <small>mm (inch)</small>	0.01 (0.03) (Min)	1 (3.28)	2 (6.56)	3 (9.84)	4 (13.12)	5 (16.4)	15 (49.2) (Max)
50 (2")	0.07 (0.31)	7.07(31.11)	14.13(62.20)	21.2(93.31)	28.2(124.41)	35.3(155.51)	106.0(466.53)
65 (2 1/2")	0.12 (0.53)	11.95(52.58)	23.89(105.12)	35.8(157.69)	47.7(210.25)	59.7(262.81)	179.2(788.43)
80 (3")	0.18(0.79)	18.1(79.64)	36.19(159.24)	54.3(238.86)	72.3(318.48)	90.4(398.10)	271.4(1194.31)
100 (4")	0.28(1.23)	28.27(124.41)	56.5(248.81)	84.8(373.22)	113.1(497.63)	141.3(622.04)	424.1(1866.11)
150 (6")	0.63(2.80)	63.61(279.92)	127.2(559.83)	190.8(839.75)	254.4(1119.66)	318.1(1399.58)	954.2(4198.74)
200 (8")	1.13(4.98)	113.1(497.63)	226.1(995.26)	339.3(1492.88)	452.3(1990.51)	565.4(2488.14)	1696.4(7464.42)



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How to Order

Please select one option (ID) from each category.



*Attention

For Flow Sensor Size, DN indicates Metric Unit system and should be written as T-MAG-F-DN0050 for DN50 (50mm) meter size. IN indicates English Unit system and should be written as T-MAG-F-IN0200 for 2" meter size.

T-MAG-

Flow Sensor Type	ID
Insertion, accuracy 2% (for size of DN80/3" or larger)	I
Full bore, accuracy 0.5%	F
Full bore, accuracy 0.3%	FH

Unit System	ID
Metric System	DN
English System	IN

Flow Sensor Size*	ID
DN50 (2")	0050 (0200)
DN65 (2 1/2")	0065 (0250)
DN80 (3")	0080 (0300)
.....
DN200 (8")	0200 (0800)

Nominal Pressure	ID
2.5 MPa (362psig) / DN50 (2")	1
1.6MPa (232psig) / DN65-200 (2 1/2" ~ 8")	2
1.0MPa (145psig) / For Insertion type only	3
ANSI 300lb /for ANSI flange only	4

Liner Material	ID
None (for insertion sensor)	A
PTFE	B

ID	Flow Sensor Cable
A	15m / 45ft (Default)
B	30m / 90ft
C	50m / 150ft
D	None for Integral Type

ID	Grounding
0	None
1	Ground ring
2	Ground flange
3	Tri-electrode

ID	Pipe Joint for Flow Sensor
A	Insertion
B	DIN Flange
C	ANSI RF150# Flange
D	ANSI RF300# Flange

ID	Output
0	Pulse + 4~20mA (default)
1	Pulse + 4~20mA + RS485 / Modbus

ID	Electrode Material
0	316 SS with polypropylene head (for insertion sensor)
1	316L SS (OCr18N112M02Ti)
2	HC (Hastelloy C)

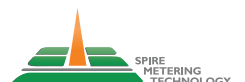
Required Accessories

Power Supply Cable	Model No.
110VAC (American Plug)	WA-PWC-1
220VAC (European Plug)	WA-PWC-2
Temperature Sensor (for details, please refer to the RTD probe datasheet)	Model No.
Insertion PT100 Probe with Thermowell and 5m/15ft Lead	PT100IN-X-Y-5M
Insertion PT100 Probe with Thermowell and 10m/30ft Lead	PT100IN-X-Y-10M
Insertion PT1000 Probe with Thermowell and 5m/15ft Lead	PT1000IN-X-Y-5M
Insertion PT1000 Probe with Thermowell and 10m/30ft Lead	PT1000IN-X-Y-10M

Note: X=B: for pipe DN50-65(2"~2 1/2"); X=C: for pipe DN80~125/3~5"; X=D: for pipe DN150~200/6"~8";
The cable for the temp sensor is a three-core wire.

Optional Accessories

External Adapter	Model No.
485-BACnet / MSTP Adapter (to connect to a BACnet Gateway)	WA-BACMSTP
485-GPRS Adapter (to connect wirelessly)	WA-YR228





SpireMag Series T-MAG

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Example

Model# T-MAG-F-DN0100-1-B-1-1-B-0-A

Stands for T-MAG BTU meter, full bore type, size DN100, 2.5MPa pressure rating, PTFE lining, 316LSS electrode, Pulse + 4~20mA + RS-485 output, DIN flange, no grounding, 15m(45ft) cable.

Model# WA-PWC-2

Stands for 220VAC power supply with European style power plug.

Model# PT1000IN-C-Y-5M

Stands for insertion temperature sensor PT1000 with thermal well for pipe DN80~125/3~5" and 5 meter long lead.



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Memo



SpireMag Series T-MAG

Electromagnetic BTU Meter

Memo

About Spire Metering Technology

Spire Metering is a global leader in flow and energy management solutions. Through continuous innovation, we transform cutting-edge technologies into affordable, reliable solutions for accurate flow and energy measurement. Spire Metering offers water, heat, electricity and gas meters as well as AMR/AMI and billing solutions. Let us help you with your application today.