Installation & Operation Manual

BCU Series
Clamp-on Ultrasonic Flow Meters

BROOKS® INSTRUMENT

Beyond Measure

Essential Instructions
Read before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. These products must be properly installed, operated and maintained to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, operating and maintaining Brooks Instrument products.

- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.

⚠ WARNING: Do not operate this instrument in excess of the specifications listed in the Instruction and Operation Manual. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.

- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.

⚠ WARNING: Prior to installation ensure this instrument has the required approval ratings to meet local and national codes. Failure to heed this warning can result in serious injury and / or damage to the equipment.

- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- Operation: (1) Slowly initiate flow into the system. Open process valves slowly to avoid low surges. (2) Check for leaks around the flow meter inlet and outlet connections. If no leaks are present, bring the system up to the operating pressure.
- Please make sure that the process line pressure is removed prior to service. When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place to prevent electrical shock and personal injury, except when maintenance is being performed by qualified persons.

⚠ WARNING: For liquid flow devices, if the inlet and outlet valves adjacent to the devices are to be closed for any reason, the devices must be completely drained. Failure to do so may result in thermal expansion of the liquid that can rupture the device and may cause personal injury.

European Pressure Equipment Directive (PED)

All pressure equipment with an internal pressure gauge greater than 0.5 bar (g) and a size larger than 25mm or 1" (inch) falls under the Pressure Equipment Directive (PED).

- The Specifications Section of this manual contains instructions related to the PED directive.
- Products described in this manual are in compliance with EN directive 2014/34/EU.
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Products larger than 25mm or 1" (inch) are in compliance with EN directive 2014/34/EU.
- Products of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

European Electromagnetic Compatibility (EMC)

The Brooks Instrument (electric/electronic) equipment bearing the CE mark has been successfully tested to the regulations of the Electro Magnetic Compatibility (EMC directive 2014/30/EU).

Special attention however is required when selecting the signal cable to be used with CE marked equipment.

Quality of the signal cable, cable glands and connectors:

Brooks Instrument supplies a limited selection of high quality cable(s) which meets the specifications for CE certification.

If you provide your own signal cable you should use a cable which is overall completely screened with a 100% shield.

"D" or "Circular" type connectors used should be shielded with a metal shield. If applicable, metal cable glands must be used providing cable screens clamping. The cable screen should be connected to the metal shell or gland and shielded at both ends over 360 Degrees.

The shield should be terminated to an earth ground. Card Edge Connectors are standard non-metallic. The cables used must be screened with 100% shield to comply with CE certification. The shield should be terminated to an earth ground. For additional instruction regarding Protective Earth (PE) Connections please refer to Section 2, **Electrical Interface** page 29.

For pin configuration: Please refer to the enclosed Instruction Manual.

ESD (Electrostatic Discharge)

⚠ CAUTION: This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.

Handling Procedure:

1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit boards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, SMOS, etc.) Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

Contents

Figures

Tables

How to Use This Manual

It is recommended to read this manual before installing, operating or troubleshooting your BCU Series Clamp-on Ultrasonic flow meter.

This manual is organized into the following sections:

The Quality System at Brooks Instrument conforms to the quality standards set forth in ISO 9001.

This instruction manual is intended to provide the user with all the information necessary to install, operate and maintain the BCU Series Clamp-on Ultrasonic flow meter.

Section 1	Introduction
Section 2	Installation
Section 3	Operation
Section 4	Maintenance & Troubleshooting
Back Cover	Warranty, Local Sales/Service Contact Information

Description

BCU Series Clamp-on Ultrasonic flow meters are used to provide accurate measurement of liquid flow. The heart of these instruments is the transit time ultrasonic sensor, with four transducers producing two ultrasonic signals with the direction of flow and two opposite the direction of flow. The flow rate is determined by the difference in transit times and the geometry of the measuring cell. The meter connects to the users control system via Ethernet based communications. In addition to flow rate, the meter provides totalized flow, temperature, and various alarms, warnings and diagnostics.

Performance Specifications

Table 1-1 Product Specifications

Performance	
Full-Scale Flow Range	Tube OD 1/4": 0 - 1,000 ml/min Tube OD 3/8": 0 - 4,000 ml/min Tube OD 1/2": 0 - 5,000 ml/min Tube OD 3/4": 0 - 15,000 ml/min Tube OD 1-3/8": 0 - 80,000 ml/min
Flow Accuracy[1,2]	Tube OD 1/4": ±1% of rate (<150 ml/min ±1.5 ml/min) Tube OD 3/8": ±1% of rate (<300 ml/min ±3 ml/min) Tube OD 1/2": ±1% of rate (<500 ml/min ±5 ml/min) Tube OD 3/4": ±1% of rate (<1,000 ml/min ±10 ml/min) Tube OD 1-3/8": ±1% of rate (<6,000 ml/min ±60 ml/min)
Zero Stability	Device output at zero flow shall not shift by more 0.2% of the device full scale per year
Temperature Coefficient	Zero : <0.05% of F.S. per °C Span: <0.1% of S.P. per °C
Attitude Sensitivity	Accuracy and performance shall not be affected by changes in device orientation when fluid is 100% liquid.
Sensor Materials	Measuring channel: ABS, Housing: anodized aluminum, polyamide, M8/M12: nickel plated brass
Tubing Materials	Recommended: Silicone, TPE Tygon, PE (flexible)
Dimensions	
Dimensions	66mm x 66mm x 66mm
Ratings	
Operating Temperature Range	0 to 60°C
Ingress Protection	IP66 rated, ensuring complete dust protection and resistance to powerful water jets from all directions
Electrical	
Electrical Connection	1x M8 Power 5-pin B Coded Connector 13.5-27 Vdc
Digital Communications	2x M12 Ethernet IP 4-pin D coded
Diagnostic	Embedded web-based interface for easy configuration, communications and troubleshooting

[1] Accuracy depends on tubing, tubing variations, temperature, fluid properties, clamping and other conditions.
[2] Standard Calibration Conditions: Water at 23°C ± 2K; Warm up: at least 30 min; Zero calibration after clamp-on; Open tube outlet (pressure close to zero)

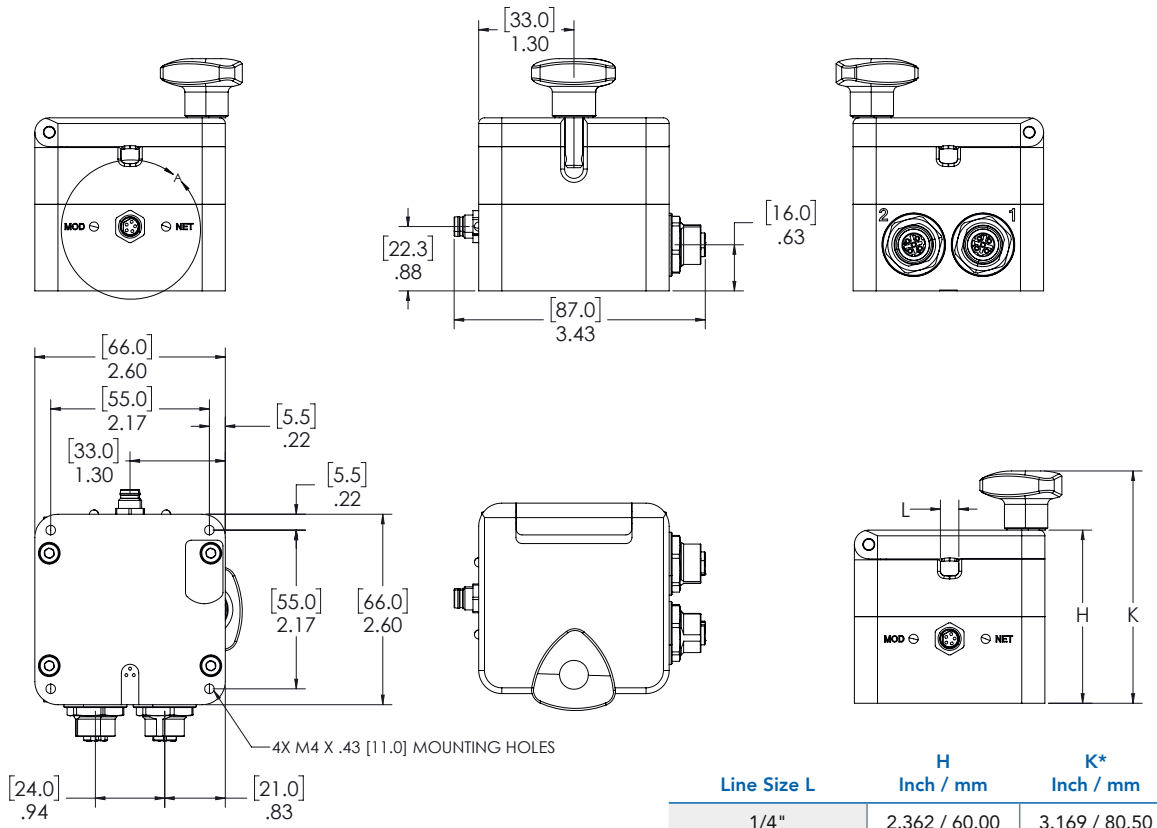
Note: Accuracy is based on standard calibration conditions as listed. Accuracy depends on tubing, tubing variations, temperature, fluid properties, clamping and other conditions (design of inlet and outlet section). The specified accuracy values are based on standardized test conditions. Depending on the application, accuracy – especially in the lower flow range – may be further improved by on-site adjustments.

Calibration Conditions

Sensors are factory calibrated under the following standard conditions:

- Tubing as listed in table 'Tubing properties', not sterilized
- Water at 23 °C ± 2 K
- Warm up: at least 30 min
- Zero calibration after clamp-on
- Open tubing outlet (pressure close to zero)

Dimensions



Line Size L	H Inch / mm	K* Inch / mm
1/4"	2.362 / 60.00	3.169 / 80.50
3/8"	2.362 / 60.00	3.169 / 80.50
1/2"	2.441 / 62.00	3.248 / 82.50
3/4"	2.638 / 67.00	3.445 / 87.50
1-3/8"	3.228 / 82.00	4.035 / 102.50

*Height when knob is in closed position.

Figure 1-1 Dimensional Drawing BCU

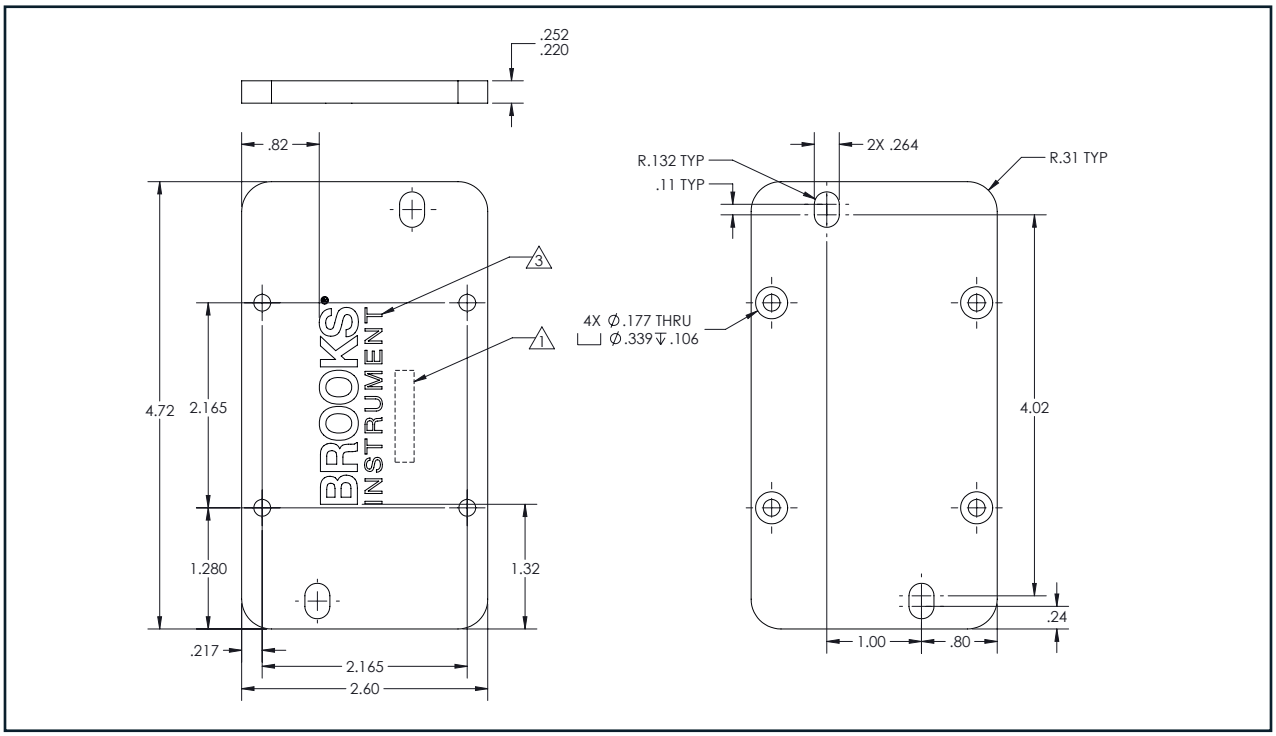
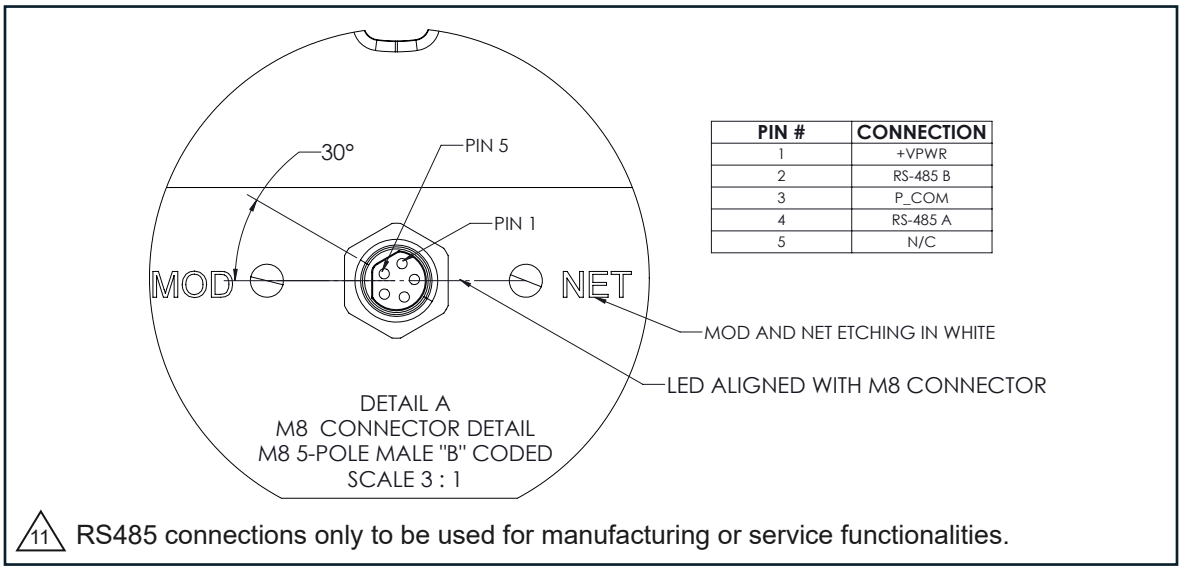
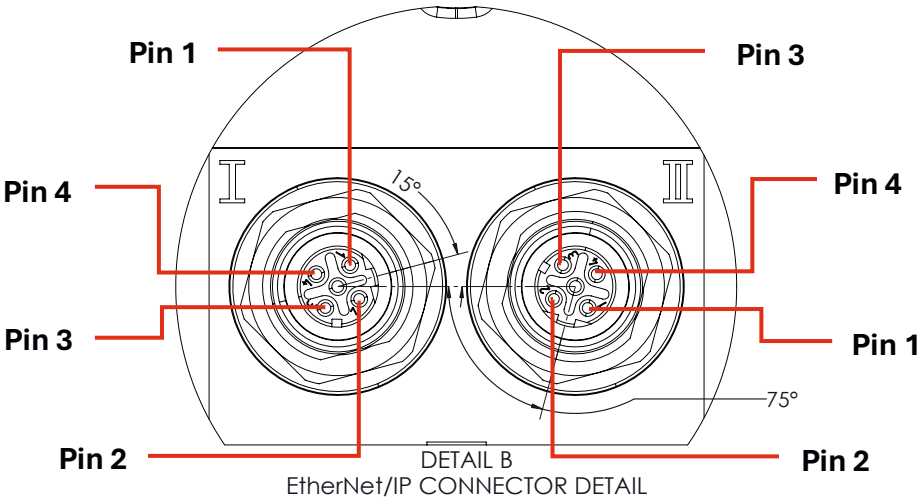


Figure 1-2 Dimensional Drawing BCU, Mounting Plate



PIN #	CONNECTION
1	+VPWR
2	RS-485 B
3	P_COM
4	RS-485 A
5	N/C

Figure 1-3 Electrical Connections, Power



Connector	Function
1	TD+
2	RD+
3	TD-
4	RD-

Figure 1-4 Electrical Connections, Signal

Table 1-2 Model Code

Code Description	Code Option	Option Description
I. Base Model Number	BCU	Brooks Clamp-on Ultrasonic Flow Meter
II. Line Size	0250	Tube OD: 1/4 inch (6.4mm)
	0375	Tube OD: 3/8 inch (9.5mm)
	0500	Tube OD: 1/2 inch (12.7 mm)
	0750	Tube OD: 3/4 inch (19.1 mm)
	1375	Tube OD: 1-3/8 inch (34.9 mm)
III. Device Output (Digital Communication)	E	EtherNet/IP
IV. Housing Material	A	Aluminum
V. Revision	A	Revision A
VI. Full Scale Flow Rate	XX.XL	Calibrated Full Scale Flow (Liters/Min)
VII. Calibration	AA	Standard Calibration
	ZZ	Special Calibration
VIII. Diagnostic Package	S	Standard
IX. Quality Certifications	A	Standard Calibration Certificate
	B	Calibration Certification Traceable to NIST
	C	Certificate of Conformance
	D	Calibration Certification Traceable to NIST and Certificate of Conformance
X. Customer Special Request (CSR)	XXXX	Customer Special Request

Sample Model Code

I		II	III	IV	V		VI		VII	VIII	IX		X
BCU	-	0250	E	A	A	-	01.0L	-	AA	S	A	-	XXXX

General

⚠ WARNING

Operating Procedure: Do not operate this instrument outside the specifications listed in Section 1. Before bringing the unit into operation, make sure device is securely mounted, tubing is installed properly and that all necessary electrical connections have been made.

Receipt of Equipment

When the equipment is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding their liability. A report should be submitted to Brooks Instrument. Visit the Brooks Instrument website at www.brooksinstrument.com/en/service-support.

Remove the envelope containing the packing list. Carefully remove the instrument from the packing case. Make sure spare parts, accessories and documentation are not discarded with the packing materials. Inspect for damaged or missing parts.

Recommended Storage Practice

If intermediate or long-term storage is required, it is recommended that the instrument be stored in accordance with the following:

a. In the original vacuum bag and shipping container.

b. In a sheltered area with the following conditions: Ambient temperature 70°C (160°F) maximum and 0°C (32°F) minimum.

c. Relative humidity 45% nominal, 60% maximum, 25% minimum.

Upon removal from storage a visual inspection should be conducted to verify the condition of equipment is “as received”.

Return Shipment

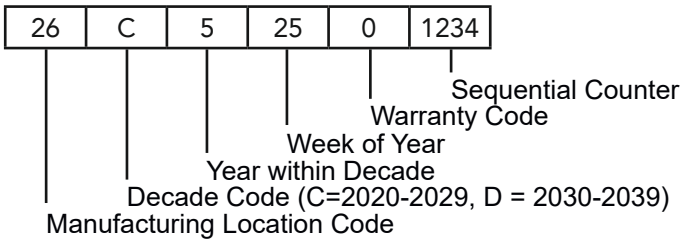
Prior to returning any instrument to the factory for any reason, visit our website for instructions on how to obtain a Return Materials Authorization Number (RMA #) and complete a Decontamination Statement to accompany it: www.brooksinstrument.com/en/service-support. All instruments returned to Brooks also require a Material Safety Data Sheet (MSDS) for the fluid(s) used in or on the instrument. This includes any process fluid that might have leaked onto the surface of the device, any cleaning fluids or cleaning agents that might be used during general maintenance of the device or the area around the device, and any cleaning fluids or cleaning agents used to prepare the device for return shipment. Failure to provide this information will delay processing of the instrument. Instrument must have been cleaned in accordance with the following:

⚠ WARNING

Before returning the device, thoroughly clean all surfaces to ensure the device is free from any chemical or biological hazards

Serial Number

Current Brooks Instrument serial number format became effective January 1st, 2015. Serial number is 11 characters long with the following format:



Transit Precautions

To safeguard against damage during transit, transport the instrument to the installation site in the same container used for transportation from the factory if circumstances permit.

General Safety Instructions

The following basic safety instructions apply:

- Install and operate the sensors only if you have the required qualifications and experience.
- Valid technical standards and applicable installation regulations must be observed.
- All conditions specified in the ‘Technical Data Sheet’ must be observed without exception. Exceeding or falling below the specified limit values, even temporarily, is not permitted.
- Never use the sensors in potentially explosive atmospheres. If you have sensors that are certified for potentially explosive atmospheres and sensors that are not, make absolutely sure that the sensor types cannot be interchanged. Observe the corresponding labeling.
- When installing sensors in systems with increased mechanical hazards: If applicable, choose a protected installation position or protect the sensors and all associated accessories from damage (e.g. by covering them).
- Acoustic short-circuiting (sensor malfunction) possible due to liquid in the measuring channel. Ensure that there are never any liquids in the sensors measuring channel during operation.
- The sensors and accessories must never be immersed.
- Do not use the sensors and their accessories if they show visible damage. Take the sensors and accessories out of operation immediately in the rare event that functional errors occur.
- The sensors and accessories must never be opened. They do not contain any user serviceable parts. Repairs must always be carried out by the manufacturer.

Further safety instructions that must be observed can be found before the corresponding steps, if applicable. They are specially marked.

Requirements for Personnel

All personnel involved in:

- the adaptation of meters for planned measuring task (parameterization or calibration),
- installation of meters and electrical connection and
- operation of meters (e.g. changing the tube or cleaning)

must be qualified for the special task. All groups must have read and understood the entire Installation and Operation manual. Authorized personnel must be instructed for the relevant work steps. All necessary information from the manufacturer must be made available.

Mechanical Installation

Choose a mounting location where the meter is protected from heat (e.g. direct sunlight), extreme temperature changes, and risk of mechanical damage. Changing ambient temperature has an influence on the speed of sound in the liquid. Therefore, the diffraction conditions change when the sound wave passes through individual boundary surfaces. Also, the viscosity and thus the flow profile change with temperature variations.

Recommended installation procedures:

a. Meter should be mounted to a stable surface that is free from mechanical shock and vibration. Secure using mounting holes on bottom of BCU meter (4x M4 x 0.43” [11mm]). An earth ground connection at the meter mounting screw is recommended.

   Note: Device complies with Industrial EtherNet/IP performance level when mounted to an earth ground reference and complies with Commercial EtherNet/IP performance level otherwise.

   An optional mounting kit (P/N 499Z037AAA) can be used if top screw mounting is preferred. The mounting kit comes with mounting plate (P/N 613H322BFT) and four (4) M4 x 10 BHCS screws (P/N 613H322BFT).Figure 1-5 BCU Mounting Plate

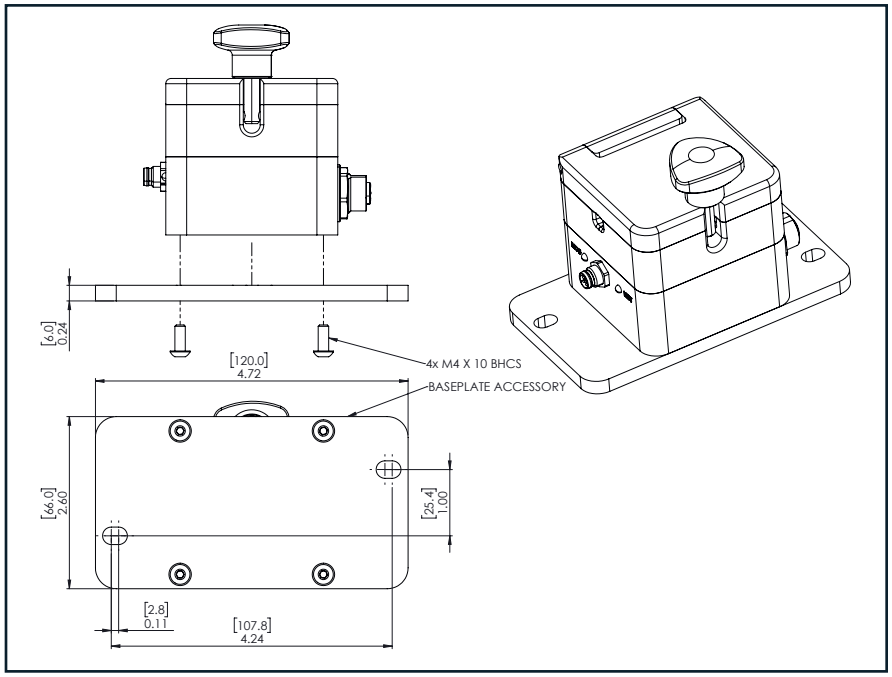


Figure 2-1 BCU Mounting Plate

b. Leave sufficient room for access to the electrical connections.

c. Leave sufficient room to access and open the top lid to insert the flexible tubing. User must be able to access and turn the lid locking screw handle and open the lid. The lid height is approximately 66mm (2.6in).

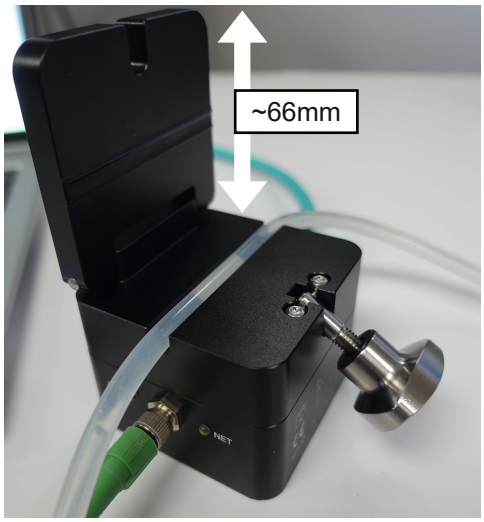


Figure 2-2 BCU Top Lid Clearance

d. Install in a manner to ensure the tube remains full of liquid when in operation.

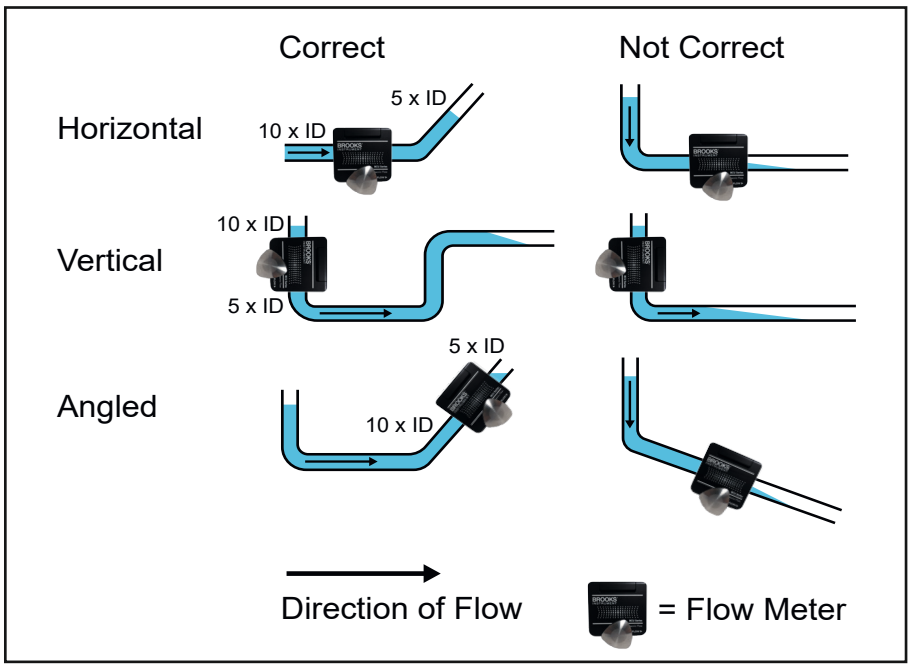


Figure 2-3 BCU Mounting Orientation Guidance

e. Install in a manner that allows the meter to be easily removed.

f. It is recommended that a positive shutoff valve be installed downstream of the meter to allow for proper zeroing after installation.

g. Install in a manner to ensure appropriate upstream and downstream straight tube runs (approx. 10 × inner tube diameter on inlet, approx. 5 × on outlet). See Table 1-3 for typical

Table 2-1 Typical Tube OD/ID and Recommended Minimum Straight Tube Runs

Base Model and Line Size	Typical Tube Inner Diameter (inches / mm)	Recommended Minimum Straight Tube Runs	
		Inlet (inches / mm)	Outlet (inches / mm)
BCU0250	(1/8) 0.125 / 3.2	1.25” / 32	0.5” / 16
BCU0375	(1/4) 0.25 / 6.3	2.5 / 64	1.3 / 32
BCU0500	(5/16) 0.313 / 8	3.13 / 80	1.6 / 40
BCU0750	(1/2) 0.5 / 12.7	5 / 127	2.5 / 64
BCU1375	(1) 1.0 / 25.4	10 / 254	5 / 127

Electrical Interfacing

The available physical interfaces on the Ethernet/IP™ SLAMF Device are listed below:

- 5 pin M8 threaded male connector for power (Figure 1-3).
- Two (2) M12 4 pole threaded female connectors labeled “1” and “2” for Ethernet/IP™ communications (Figure 1-4).

Note: Device complies with Industrial EtherNet/IP performance level when mounted to an earth ground reference and complies with Commercial EtherNet/IP performance level otherwise.

Power Supply

Power connection to the device is made via pins 1 and 3 on the 5 pin M8 connector. A power supply voltage of 13.5 to 24 Vdc is required for proper operation.

⚠ CAUTION

Care must be taken when connecting the mating M8 power cable to ensure the key is properly aligned. Damage to the device connector and or mating cable connector may result if the cable connection is not aligned properly.

⚠ WARNING

User must ensure the minimum required voltage and current is available at the flow meter taking into consideration any losses in the interconnecting cable.

EtherNet/IP communications

As noted in the Electrical Interfacing Section above, each BCU device has two (2) M12 4 Pole, Female “D” Coded Connectors labeled 1 and 2 (Figure 1-4). Network connections can be made to either or both ports, depending on the network topology. The BCU Series EtherNet/IP device will support star, linear and DLR (Device Level Ring) topologies. For more detail on the BCU Series EtherNet/IP communications, see our BCU EtherNET/IP supplemental manual available on the Brooks Instrument website in the Documents & Downloads section at https://www.brooksinstrument.com/en/documentation.

⚠ CAUTION

Compliance with EMC directive 89/336/EEC, requires that the equipment be fitted with fully screened signal I/O (Ethernet) cables with at least 80% shielding. The cable shielding should be connected to the M12-connector’s metal shell and have 360° shielding at both ends.

Interconnection with Peripheral Equipment

M8 & M12 mating cables can be purchased as accessory items.

Table 2-2 M8 Power Cables

Description	Length	Part Number
M8 Power Cables (Flying Leads)	6 ft [2 m]	124X049AAA
M8 Power Cables (Flying Leads)	16 ft [5 m]	124X050AAA

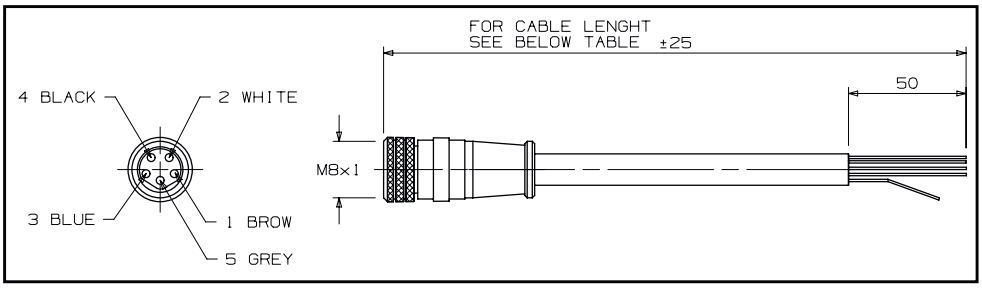


Figure 2-4 BCU M8 Power Cable

Table 2-3 M12 Communication Cables

Description	Length	Part Number
M12 Communications Cables	6 ft [2 m]	124Y316AAA
M12 Communications Cables	10 ft [3 m]	124Y317AAA
M12 Communications Cables	26 ft [8 m]	124Y318AAA
M12 Communications Cables	50 ft [15 m]	124Y319AAA
M12 Communications Cables	75 ft [23 m]	124Y320AAA
M12 Communications Cables	98 ft [30 m]	124Y321AAA

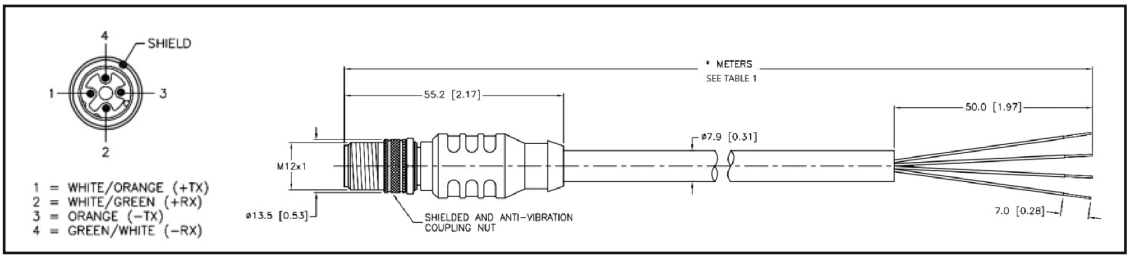


Figure 2-5 BCU M12 Power Cable

Configuration and Settings

This section provides information regarding the general settings and default values established in each device prior to shipment from the factory. Relevant attributes can be adjusted to adapt the device for your unique application requirements.

The BCU Series meters have an embedded web-based interface to support setup as well as monitoring and troubleshoot activities. These devices also support access to a wide range of attributes via the EtherNet/IP communications interface. Supplemental manuals for the web-based interface and EtherNet/IP communications are available on the Brooks Instrument website in the Documents & Downloads section at https://www.brooksinstrument.com/en/documentation.

Table 2-4 General Meter Settings

Attribute / Tag	Units	Default	Description
fmDataUnits / Flow_Units	CIP_ENGUNIT	5137 (ml/min)	Sets Engineering Units of 'Flow' and other related attributes in this class. See CIP SpeBCU EtherNet/IP Supplemental manual for a list of values. A request to set this to an unsupported value will return an error response.
rtbTotalizerUnits / Totalizer_Units		11,778 (Liters)	Engineering Units used to report totalizer values
fsCorrectionFactor / Flow_ Correction_Factor		1	Scaler/gain to correct for offset from calibration conditions, such as tube type or fluid properties. All flow measurements are multiplied by this scaler/gain. 0.01 < gain < 100.0 (prevent using to change units)
fsErrorTimeSec / Error_Time	seconds	3	How long to wait before a disturbed measurement becomes an error. When measurement is disturbed, such as a large air bubble, the sensor will hold last value. 0 to 9999 sec
fsZeroDurationMs / Zero_Op_ Duration	msec	2000	Amount of time used by device to perform zero operation. 10 to 65535 ms
fsMaxZeroLimitMlpm / Zero_Max_ Limit	Flow_Units	0	Zero inhibited if flow exceeds +- limit before, during or immediately after completion of a zero operation. If a 'Bad_ Zero_Warning' status occurs, the previous Zero Offset will be restored. A value of 0 disables this diagnostic. 0 to 9999 ml/min
fsReverseFlow / Reverse_Flow_ Direction		0	Allows changing so that Positive Flow is Opposite of Flow Arrow marked on lid. 0 = Positive Flow is in direction of Flow Arrow marked on lid (Left to Right) 1 = Positive Flow is opposite of direction of Flow Arrow marked on lid (Right to Left)
fsNegFlowEnabled / Enable_ Negative_Flow		1	Allows Negative Flow values to be indicated and included in Totalized Volume calculations, otherwise any Negative Flow will be reported as Zero (0) and Not Reduce Totalized Volume. 0 = Any Negative Flow value will be set to Zero (0) and not effect the Totalized Flow. 1 = Allows Negative Flow Values to be indicated and included in the Totalized Volume.

Table 2-4 General Meter Settings (Cont.)

Attribute / Tag	Units	Default	Description
fsNegVolEnabled / Enable_ Negative_Volume		0	Allows Totalized Volume to go below 0 (Negative). If Negative Flow is Enabled, any Negative Flow will reduce the Totalized Volume, independent of this setting. 0 = Totalized Volume cannot go Negative 1 = Totalized Volume can go Negative if enough Negative Flow Occurs.
fmLowFlowCutoff / Low_Flow_ Cutoff	Flow_Units	0	ABS(Flow) < Low_Flow_Cutoff will be 0. Any value below the absolute value of the Low Flow Cut off will handled as zero flow.
fmFlowAvgNumSamples / Flow_ Avg_Num_Samples		125	1x disables, choices (1, 2, 4, 8, 16, 32, 64, 125, 250, 500, 1k, 2k, 4k, 8k, 16k) Increasing the numbers of samples slows the response to step changes.
fmFlowAvgType / Flow_Avg_Type		1	0 = Arithmetic/Segmented, sum of samples divided by # of samples, Flow updated after # of samples is collected 1 = Moving Average, Flow updated every sample (4 msec).
fmAlarmTripPointHigh / High_ Flow_Alarm_TP	Flow_Units	450,000	The 'Flow' threshold above which an 'Active_Alarms_High_Flow' status will occur. Defaulted after Configured Full-Scale (CFS) is set
fmAlarmTripPointLow / Low_ Flow_Alarm_TP	Flow_Units	-450,000	The 'Flow' threshold below which an 'Active_Alarms_Low_Flow' status will occur. Defaulted after Configured Full-Scale (CFS) is set
fmAlarmDelayLow / Low_Flow_ Alarm_Time	msec	10,000	The time that 'Flow' must exceed/stay within the High Alarm Trip Point threshold before the Status Condition is reported/cleared.
tmValue / Temperature	Celsius		Temperature sensor value.
tmWarningTripPointHigh / High_ Temp_Warn_TP	Celsius	60	Sets the 'Temperature' threshold above which an 'Active_ Warnings_High_Temp' status will occur. 0 to 60 °C Operating, -20 to 70 °C Storage
tmWarningTripPointLow / Low_ Temp_Warn_TP	Celsius	0	Sets the 'Temperature' threshold below which an 'Active_ Warnings_Low_Temp' status will occur.
tmWarningHighDelay / High_ Temp_Warn_Delay	msec	10,000	Sets the time that 'Temperature' must exceed/stay within the Temperature High Warning Trip Point thresholds before the Warning Status Condition is reported/cleared.
tmWarningLowDelay / Low_ Temp_Warn_Delay	msec	10,000	Sets the time that 'Temperature' must exceed/stay within the Temperature Low Warning Trip Point thresholds before the Warning Status Condition is reported/cleared.
rtbCalibrationDueHours / Cal_ Due_Hours	hours	8760	Time remaining in hours until device recalibration recommended. When timer reaches 1, Calibration Due Warning status shall be set. Writing 0 disables warning.

Fluid Connections

⚠ CAUTION

Fluid in measuring channel can impact measurement accuracy!

Care should be taken to ensure no moisture is present in the flow measurement channel or on the outside of the tube section to be inserted into the flow measurement channel. DO NOT use coupling medium in measuring channel. Any moisture or coupling medium might affect the acoustic coupling and therefore the measurement accuracy.

Incorrect tube insertion can damage the measuring channel!

DO NOT use tools, especially sharp tools (e.g. screw drivers or scissors) to press tubing into measuring channel. Be careful not to damage tube when inserting and clamping. Never insert damaged tubing into measuring channel.

Incorrect insertion of the tube can also affect the measuring accuracy!

If tube is altered (e.g. bent, stretched) during insertion, the meter may provide incorrect measurement results. Do not stretch the tube before placing into measuring channel unless recommended by Brooks Instrument.

BCU flow meters are characterized by a special design of the measuring channel and cover. This design helps to ensure reproducible tube insertion with optimal acoustic coupling and thus a very high clamp-to-clamp repeatability. Deviations after changing the tube may still occur. These deviations can be minimized by observing the following instructions:

Plan tube changes so that all coupling conditions and other mechanical installation parameters remain as comparable as possible:

- Use the same type of tubing (material, dimensions) to ensure identical tube fit (i.e. acoustic coupling).
- Ensure tube inlet and outlet alignment are consistent.
- Document alignment and spacing of bends as well as clamping position, if required.
- Establish standardized procedures for tube replacement, if applicable, and instruct all users before tube changes.

Inserting Tube into Measuring Channel

1. Open top lid of BCU meter to access measuring channel by turning the lid lock knob counterclockwise until it releases the tube and lid.
2. The lid lock knob is hinged. Move the lid lock knob away from the top lid to the front of the device.
3. Open the now released hinged lid to expose the currently installed tube, if applicable.
4. Remove and properly handle or dispose of the existing tube, if applicable.
5. Insert new tube into the measuring channel ensuring mechanical installation parameters remain as comparable as possible to prior tube installation, if applicable.

6. Close the hinged lid while taking care that the tube is properly seated in the measuring channel.
7. Move the lid lock knob on top of the lid. Slowly turn the knob clockwise until finger tight, ensuring there are no pinch points on the tube while tightening.
8. Fill the tube with liquid and switch on your device or machine – if not already done – to start the measurement. Note: For correct readings, the sensors must be full of liquid and zeroed under no flow conditions before measuring.
9. Flow values and sensor status are sent via the configured outputs. In case of an error, the sensor will output the defined signal

Zero Procedure

1. Prepare the instrument for zeroing:
    a. Install the instrument according to the instructions in this manual.
    b. Apply power to the instrument.
    c. Run process fluid to be measured through the instrument to fill the tube.
    d. Allow temperature of the instrument to stabilize, such that it approximates the normal process operating temperature.
2. Once the instrument has reached process temperature, close the external shutoff valve downstream from the instrument, or otherwise ensure there is no flow. Confirm flow has stopped and any pressure differential across the instrument has been eliminated.
3. Make sure that the instrument is completely filled with the process fluid under normal process conditions of temperature, pressure, density, etc. Make sure there is no entrapped gas in the sensor tube and ensure a zero flow condition through the instrument.

⚠ CAUTION

Flow through the instrument during zeroing procedure will result in an inaccurate zero setting.

Make sure fluid flow through the instrument is completely stopped during the zeroing procedure.

4. After confirming that fluid flow through the instrument is completely stopped, actuate the zero function via the embedded web-based interface or via the EtherNET/IP command.
5. A successful zero operation on the meter will be indicated by a solid green color status LED. A solid red color status LED indicates a failed zero process. A non-steady flash will indicate a failed condition. A failed condition can only be cleared by a power cycle.
6. Once the status LED turns green, zero process is complete and the instrument is ready for operation. Please note that zero command will only be accepted when the flow signal is less than the user settable zero max limit. Zero max limit is factory set to allow zeroing of any value. The user is encouraged to set the zero max limit value to prevent an accidental zero command from being initiated when flow is present, through the device.

Operating Procedure

⚠ WARNING

Before operating the flow meter, ensure tube has been installed properly and all electrical connections have been properly terminated.

The BCU Series EtherNet/IP™ device supports auto-negotiation of the communications link. Both ports support data rates of 10/100 Mbps and Half/Full duplex communications. The device may be directly connected to the Ethernet NIC on a desktop or laptop PC for configuration and commissioning activities. BCU EtherNET/IP network configuration is DHCP.

Please refer to the BCU EtherNet/IP supplemental manual for a complete list of attributes and instructions on how to connect and operate this device with your PLC or DCS system.

The user may also wish to connect with the device to address the various alarms settings and attributes via the BCU embedded web-based interface. Simply connect your BCU to a laptop, computer or network computer. The network address for the web-based interface is 192.168.1.100.

There are no routine maintenance procedures required to keep your BCU Series Clamp-on Ultrasonic flow meter in good operating condition.

⚠ CAUTION

It is important that this meter only be service by properly trained and qualified personnel

⚠ WARNING

This device must be serviced by factory personnel only. There are no customer serviceable components within the device. Disassembly of this device voids all warranties, explicit or implied.

See BCU EtherNet/IP supplemental manual for details on alarms warnings and diagnostics. For further assistance contact Brooks Instrument Technical Service for after sales support.

⚠ WARNING

If it becomes necessary to remove the instrument from the system, power to the device is disconnected at the power supply.

LIMITED WARRANTY

Visit www.BrooksInstrument.com for the terms and conditions of our limited warranty.

BROOKS SERVICE AND SUPPORT

Brooks is committed to assuring all of our customers receive the ideal flow solution for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration and is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.

Visit www.BrooksInstrument.com to locate the service location nearest to you.

START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required.
For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

SEMINARS AND TRAINING

Brooks Instrument can provide seminars and dedicated training to engineers, end users and maintenance persons.

Please contact your nearest sales representative for more details.

Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

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