Micro·X
User Manual

Version 1.98
19 April 2017

Revision History

Revision	Date	Description	Author
Version 1.6	07 November 2012	Updated manual to include Turbidity•Xchange™and updated product codes.	Erika Ladouceur
Version 1.61	06 December 2012	Updates.	Erika Ladouceur
Version 1.7	14 February 2013	Added NMEA-like output format	Dustin Olender
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Version 1.915	11 February 2014	Edited page 4	Jehan Zouak
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Version 1.95	28 May 2015	Updated for SeaCast 4	Andrew Beak-Taylor
Version 1.96	22 June 2015	Updated technical specifications	Jehan Zouak
Version 1.97	18 November 2015	Updated overview drawing	Jehan Zouak
Version 1.98	19 April 2017	CT•Xchange™ and regulatory information	Tony Nordstrom

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General Description of the Instrument

The AML Oceanographic X•Series instruments and Xchange™ sensors are a major advancement in ocean instrumentation. Swappable and interchangeable sensors dramatically improve the capabilities of ocean instrumentation in the following ways:

- Change the instrument sensor types while at sea within seconds, and without tools. A CTD can be changed to a sound speed profiler by exchanging sensor heads.
- To optimize the resolution and accuracy of sensor data, sensors can be swapped to change the measurement range. For example, a 6000 dBar P•Xchange pressure sensor can be swapped with a 500 dBar P•Xchange sensor; the salt water C•Xchange conductivity sensor can be swapped for a fresh water C•Xchange conductivity sensor.
- Sensors from one instrument can be swapped to another instrument to maintain mission-critical capabilities.
- Calibrated sensors can be sent from the factory to the instrument. The instrument is not pulled from active duty for calibration.
- Spare sensors ensure that an instrument can be immediately returned to active duty after sustaining damage.
- All calibration and traceability data resides within each Xchange™ sensor. Calibration data for all sensors is available from the instrument, and calibration certificates can be printed from AML Oceanographic SeaCast software when the instrument is connected.
- Logged data is stamped with sensor traceability and instrument configuration data.
- Only Xchange™ sensors are sent for calibration, leaving the instrument working in the field.

Micro•X is the miniature, single-sensor, externally powered, data via cable instrument of the X•Series family. It is designed primarily for sonar transducer array, and hull mounted applications. Communications with the Micro•X are accomplished with RS-232 or RS-485. Sampling rates are programmable by time (25 Hz to every 24 hours).

Micro•X is equipped with one Xchange™ sensor port. There are two options available for this port:

- A primary Xchange™ sensor port (C•Xchange, CT•Xchange, SV•Xchange)
- A secondary Xchange™ sensor port (T•Xchange, P•Xchange, Tu•Xchange, UV•Xchange)

A Micro•X with a primary Xchange™ sensor port cannot accept Xchange™ sensors designed for a secondary port, and vice versa.

Where Do I Start?

AML Oceanographic's X•Series instruments ship with several manuals on the USB stick:

- An instrument manual (this Micro•X manual) providing an overview on how to use and maintain the instrument;
- A SeaCast manual providing instructions on how to use the software to configure the instrument and review instrument data;
- Xchange™ sensor manuals (C•Xchange, CT•Xchange, SV•Xchange, P•Xchange, T•Xchange, Tu•Xchange, UV•Xchange) providing overviews on how to install and maintain each of the Xchange™ sensors;

If you are configuring an instrument for field use or lab testing, begin with the SeaCast manual.

If you are performing instrument maintenance, begin with the instrument manual.

If you are planning to swap an Xchange™ sensor, read the Xchange™ manual corresponding to your sensors.

If you are planning to use Micro•X with UV•Xchange, refer to the UV•Xchange manual.

Shipping & Receiving

Receiving an Instrument

When receiving an instrument, perform the following steps to ensure the instrument will be ready for deployment when required:

- Inspect the shipping container, looking for signs of damage. Damage to the shipping container could indicate damage to the instrument inside.
- The shipping package should include all of the following items
  - Micro•X board set (2 circuit boards)
  - One sensor port blanking plug
  - CD with manuals and documentation
- Inspect for damage
  - Check the connector sockets for corrosion, dirt, and salt deposits
  - Check the circuit boards for damage
  - Check the pressure case for dents and scrapes
  - Check the sensors for cracks or bends
- Ensure the Xchange™ sensor is installed tightly onto its mount. The blue locking sleeve should be tight, and sitting less than 1mm from the instrument end cap.
- Connect the instrument to a computer with the data cable and perform a scan or monitor if using SeaCast.

Returning an Instrument to the Factory

- If shipping for repair or recalibration, obtain an RMA number from the service centre.
- Pack the instrument in its original shipping box to prevent damage during shipping.

An RMA number can be requested using the contact options given in the Support section of this manual.

Using the Instrument

Pressure Ratings

Pressure ratings are given for Xchange™ sensors and the entire instrument. **Deployments should never exceed the lower of these two pressure ratings.** For example, a 500m instrument equipped with a 6000 dBar (0-6000m) P•Xchange™ sensor is limited to deployments of 500m depth or less. Similarly, a 6000m instrument equipped with a 500 dBar (0-500m) P•Xchange™ sensor is also limited to deployments of 500m depth or less.

It is desirable to optimize the accuracy of pressure measurements by using a P•Xchange™ sensor with a pressure the depth of the deployment.

> Caution: Do not exceed the specified pressure ratings of the P•Xchange™ sensor, Turbidity•Xchange™ sensor, or the instrument housing. Overpressure can result in damage to the sensors and the instrument.

Pre-Deployment Procedures
- Upon Receipt
    - Use the Shipping and Receiving instructions to verify the condition of the instrument.
    - Verify that all sensor calibrations are valid for the duration of the deployment. If not, swap the Xchange™ sensors for sensors with valid calibrations or send the Xchange™ sensors to a service centre for recalibration.
    - Lightly lubricate the underwater connectors with 3M silicone spray or equivalent.
- Before leaving the jetty
    - If applicable, verify the P•Xchange™ pressure range is correct for the deployment.
    - Connect the instrument to a computer using the data cable.

Configuring Sampling Parameters using SeaCast

SeaCast is free software provided for use with AML Oceanographic instruments. It can be used to set up an instrument for profiling or monitoring data, as well as downloading, graphing, and exporting the collected data.

Full details on the instrument configuration process and the software's capabilities can be found in the SeaCast manual.

Configuring Sampling Parameters through the Terminal

Instruments can also be configured for deployment using a terminal emulation program like *HyperTerminal*, *RealTerm*, or *Tera Term*. Communications with the instrument must be established using the correct communications port and settings. The communications settings are 8 data bits, 1 stop bit, no parity, no flow control, and the desired baud rate.

The following steps must be completed by issuing text commands:

Step	Possible Commands
Set Sampling Parameters	SET SAMPLE RATE CONTINUOUS
	SET SAMPLE RATE 5/s
	SET P INC 1
	SET SOUND INC 2

The above table provides example commands only; many additional sampling regimes can be established using available commands. Please consult the Commands section of the Appendix for full syntax details on the commands you wish to use.

Accounting for Atmospheric Pressure Variations at the Surface

Climate and altitude changes can create fluctuations in atmospheric (barometric) pressure. AML's pressure sensors are sensitive enough to detect these variations. When this happens, the instrument's pressure channel may not read exactly zero when data is taken prior to submersion in the water. Nearly all absolute pressure sensors experience atmospheric pressure offsets if they are sufficiently sensitive.

To compensate for this atmospheric pressure offset, AML instruments have the ability to reset the pressure sensor's zero point. This can be initiated using AML Oceanographic SeaCast software or a Terminal emulator command. The compensation does not affect the calibration of the pressure sensor, and can be turned off or recalculated at any time. The compensation factor is applied through the entire calibrated pressure range. Note that this compensation cannot be applied to a built-in Paroscientific Digiquartz sensor, as found in bathyMetrec·X.

Once the atmospheric pressure compensation is applied, it will be applied to all pressure sensor data until it is turned off or recalculated. The setting is written to memory, so it remains set when the instrument is powered down.

Using SeaCast
Refer to the SeaCast User Manual for instructions on enabling "Zero Depth."

Using a Terminal Emulator

- Establish serial communications with the instrument on your computer. Refer to the "Communications" section of this manual for more information.
- Once connection is established, ensure the instrument is stationary, and is not submerged in water.
- To turn ON Atmospheric pressure compensation, issue the *ZERO ON* command. This will calculate and apply the offset required to compensate for current atmospheric pressure conditions.
- To turn OFF Atmospheric pressure compensation, issue the *ZERO OFF* command. This will disable the offset.
- Issuing the *ZERO* command again will calculate a new offset based on current conditions

Monitoring Real Time Data

- Ensure the pre-deployment procedures have been completed (see page 4).
- Ensure that the desired sampling settings have been selected and applied.
- Plug the data/power cable into the instrument. If you power the instrument over a long cable, please note the following:
  - o Voltage drop due to cable resistance increases with cable length. The voltage drop on a standard AML cable, with a standard Micro•X, is about 1 volt per 100m of cable.
  - o The instrument's lowest voltage is 8 volts.
  - o The instrument's maximum voltage is 26 volts.
  - o The voltage at the instrument, while sampling, must be above the shutdown level for the instrument to operate.
- If using a Pressure•Xchange™ sensor, use the *ZERO* command while the instrument is in air (NOT submerged) to zero the barometric pressure offset.
- Begin monitoring data using SeaCast or HyperTerminal.
- Send the instrument down to the desired depth and return it to the surface.

Post-Deployment Procedures

- When the instrument is pulled from the water it should be rinsed with fresh water.
- Dry the area around the connectors with a clean cloth or compressed air prior to disconnecting the plugs or cables. Do not blow compressed air into the Pressure•Xchange™ sensor. Doing so may damage the sensitive pressure transducer diaphragm.
- Remove the cable. Place dummy plug in the connector to protect it.
- Dry the instrument and stow it securely.

Configuring the Instrument for Data on Power Up

Perform the following steps:

- Open a terminal emulation program such as HyperTerminal. Ensure the serial port has been selected in the program. If the instrument has been set to a specific baud rate with the *SET DETECT* command, the terminal emulation program must be configured for that baud rate.
- Connect the instrument to the computer using the data/power cable.
- Using the terminal emulation program, issue the following commands to the instrument:
  - *SET STARTUP NOHEADER*   (disables the power up header information)
  - *SET STARTUP MONITOR*   (enables data output on power up)
  - *SET SAMPLE RATE 2/S*   (sets the desired sampling rate)
  - *SET DETECT 07*   (sets fixed 38400 baud rate)
    Note: Details on the *SET DETECT* command can be found in the appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.
- Plug the data/power cable into the instrument to turn the instrument on.

Disabling Data on Power Up

Perform the following steps:

- Open a terminal emulation program such as HyperTerminal. Ensure the serial port has been selected in the program. If the instrument has been set to a specific baud rate with the *SET DETECT* command, the terminal emulation program must be configured for that baud rate.
- Connect the instrument to the computer using the data/power cable.
- Unplug the data/power cable from the instrument to turn the instrument off.
- Hold down the <ENTER> key.
- Plug the data/power cable into the instrument to turn the instrument on.
- Release the <ENTER> key once the prompt '>' is displayed.
- Using the terminal emulation program issue the following commands to disable data on power up:
  - *SET STARTUP HEADER*   (enables the power up header information)
  - *SET STARTUP PROMPT*   (disables data output on power up)
  - *SET SAMPLE RATE 2/S*   (selects the desired sampling rate)
  - *SET DETECT A7*   (sets 10 autobaud attempts then defaults to 38400 baud)
    Note: Details on the *SET DETECT* command can be found in the appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.

Maintaining the Instrument

Periodic Maintenance

Periodic preventative maintenance will prolong the life of the instrument. The following steps are recommended:

- If the instrument is very dirty or oily, allow it to soak in warm, soapy water before cleaning with a rag or soft brush. When finished, rinse with fresh water to remove any residual soap or dirt.
- Before each use:
    - Check for proper installation of the Xchange™ sensor.
    - Check for nicks and cuts on the cable.
- After each use:
    - Clean and rinse the instrument using fresh water.
    - Dry the instrument completely, and store it in a cool, dry place.
- Monthly:
    - Apply a layer of Molykote 44 medium silicone grease to the female half of the connection as shown and fully insert the plug. Wipe away any excess that squeezes out. This will lubricate both male and female connectors.
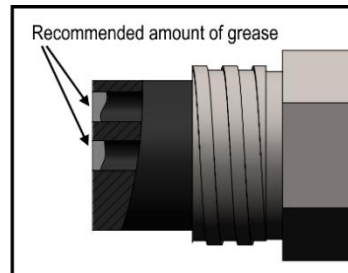
- Yearly:
    - Send the instrument or Xchange™ sensors to a service centre for diagnostics and re-calibration

Communications

PC Settings

Micro•X will communicate with either RS-232 or RS-485 serial connections depending on how the instrument was ordered from the factory. The computer to which the instrument is connected must be set up as follows:

- 8 bits
- 1 stop bit
- No parity
- No hardware handshaking
- Baud rate of 600, 1200, 2400, 4800, 9600, 19,200 or 38,400 baud

After power up, Micro•X will wait for an ASCII carriage return. The instrument will automatically detect whether communications are RS-232 or RS-485 as well as the baud rate.

Output Formats

Output formats can be modified. If the required modifications are not supported by the commonly used command list in the next section, please contact the factory for support with custom output formats.

Formatting can be changed in the following ways:

- The number of decimal places for each channel
- Turn on or off
    - power up information (header)
    - automatic monitoring on power up

Default Output Format

The output from Micro•X is space delimited values. The following table shows the output units for each Xchange™ sensor:

Sensor	Units	Default Format
SV•Xchange™	m/s	1234.567
Conductivity•Xchange™	mS/cm	12.346
CT•Xchange™ Conductivity	mS/cm	12.345
CT•Xchange™ Temperature	C	12.345
Pressure•Xchange™	dBar	1234.56
Temperature•Xchange™	C	12.345
Turbidity•Xchange™	NTU	1234.56
UV•Xchange™	-	1 (1 indicates UV on, 0 indicates UV off)

Default Example Outputs

Example outputs for a sound velocity Xchange™ sensor are shown below. User inputs in the output capture shown below are in bold type.

```
Micro.X Sound Velocity Version 1.01 SN:007797
AML Oceanographic Ltd.
SV.Xchange Sensor SN:131190, Calibrated 01/22/10

>scan
 1475.847
>monitor
 1475.857
 1475.853
 1475.881
 1475.850
 1475.870
 1475.859
>display options
[Instrument]
Type=Micro.X Sound Velocity
SN=007797
Firmware=1.01
SampleUnits=continuous
SampleInterval=0
DisplayHeader=yes
StartupMode=Prompt
DetectionMode=a5
SVAveraging=1
RX=on
TrailingSpace=off
SQ=off
ConductivityFormat=23
SVFormat=43
StartupRawReal=Real
ConductivityUnits=mS/cm
SVUnits=m/s
AddressMode=off
AddressByte=09
SerialParity=none
SerialEcho=on
CommunicationsDelay=0
SVZeroSuppressionUnits=minute
SVZeroSuppressionInterval=1

[Channel 1]
SensorName1=SV.Xchange
BoardSN1=007797
SensorSN1=131190
CalDate1=01/22/10
CalBy1=MD~
CalRange1=1375-1625 m/s
CalAccuracy1=-0.008 m/s avg
A=-2.171728E-07
B= 9.828663E-08
C=-5.891780E-07
D= 1.966747E-07
E=-1.887395E-05
F= 1.972120E-07
>
```

NMEA-like Output Format

Micro•X can be configured to produce an output similar to that regulated by the National Marine Electronics Association (NMEA) as follows:

$AML,TUN,301.2,SN,600013*38

Where $AML is always present, TUN identifies the next value as turbidity in NTU, and the sensor serial number is also displayed. * identifies the end of the data, and the following two characters are the NMEA checksum in hexadecimal. It is calculated by XORing all the characters in the string except the $ and * characters. The following table lists all format codes.

Code	Description	Units
CM	Conductivity	milliSiemens/centimeter (mS/cm)
CS	Conductivity	Siemens/meter (S/m)
CR	Conductivity Ratio	---
DOM	Dissolved Oxygen	milligrams/Liter (mg/L)
PD	Pressure	deciBar (dBar)
PP	Pressure	Pressure per square inch (psi)
PM	Pressure	Meters (m)
PF	Pressure	Feet (ft)
SVM	Sound Velocity	meters/second (m/s)
SVF	Sound Velocity	feet/second (ft/s)
SN	Serial Number	---
TC	Temperature	Celsius (C)
TF	Temperature	Fahrenheit (F)
TUN	Turbidity	Nephelometric Turbidity Units (NTU)

To configure NMEA-like output, the following commands are used with a terminal emulation program, such as Hyperterminal:
- *SET NMEAON*   (turns on NMEA-like format)
- *SET NMEAOFF*   (turns off NMEA-like format)

The *AUTOMONITOR* command is often used when NMEA-like output is enabled. It allows *Monitor* mode to be automatically entered after a period of no activity on the user terminal. Time is 0 for no timeout (i.e. the command line waits forever for a command) to 255 seconds. To configure *AUTOMONITOR* the following commands are used:
- *SET AUTOMONITOR 10*   (*Monitor* starts after 10 sec of inactivity)
- *SET AUTOMONITOR 30*   (*Monitor* starts after 30 sec of inactivity)
- *SET AUTOMONITOR 0*   (*Monitor* deactivated)

Example Outputs

>**set nmeaon**
NMEA-like output enabled
>**monitor**
$AML,TUN,514.3,SN,600013*3B
$AML,TUN,514.4,SN,600013*3C
$AML,TUN,514.2,SN,600013*3A
$AML,TUN,514.1,SN,600013*39
> **set nmeaoff**
NMEA-like output disabled
>**monitor**
514.6
514.8
514.9
515.1
>**set automonitor 10**
Automonitor set to10 sec

Support

Troubleshooting

Instrument fails to communicate:
- Is the connector damaged?
- Check the cables
    - Is the data/power cable connected to the instrument and computer?
    - Are there any cuts in the cable?
    - If using a cable other than an AML cable, it should be configured as a null modem cable.
    - If using multiple cable lengths, the extensions should **not** be configured as null modem cables.
- If using external power over a long cable, check the voltage drop over the cable. Measure the voltage across a 10 watt, 27Ω resistor across pins 1 and 4 of the cable. The voltage should be between 9.9 and 26 volts.
- Are the communication settings in the program used on the computer correct?
    - Comm port selection
    - 8 bits
    - 1 stop bit
    - No parity
    - No hardware flow control
    - Baud rate between 600 and 38,400 baud
- Are the communication settings in the instrument correct?
    - Was the instrument specifically set to one baud rate last time? If so, use that baud rate to resume communications.
    - Was the instrument set to only RS-232 or only RS-485 last time? If so, resume communications in the required protocol.
    - Was the instrument set to *RX OFF* last time? If so, a carriage return must be sent to the instrument immediately after power is applied to interrupt this mode.
    - Was the instrument set to monitor on power up mode? If so, a carriage return must be sent to the instrument immediately after power is applied to interrupt this mode. To interrupt monitor on power up, hold down the ENTER key while applying power to the instrument

Instrument generates noisy data:
- Is the connector damaged, dirty, or corroded?
- If connected to external power, is there noise on the power supply? Switch-mode power supplies are common sources of noise.
- Nearby EMI sources such as electric motors, generators, and transformers can create noise. If possible, move the instrument and its cables away from the noise source.
- Are the sensor/s clean?
- Are there bubbles on or in the sensor/s?
- Are the sensor/s damaged?
- Is there something nearby affecting the water temperature?

Contact AML Oceanographic

Service
To request an RMA or technical support
>Email: service@AMLoceanographic.com
>Phone: 1-250-656-0771
>Phone: 1-800-663-8721 (NA)
>Fax: 1-250-655-3655

Sales
For all general sales inquiries
>Email: sales@AMLoceanographic.com
>Phone: 1-250-656-0771
>Phone: 1-800-663-8721 (NA)
>Fax: 1-250-655-3655

Website
http://www.AMLoceanographic.com

Customer Portal
My AML Oceanographic is AML's online data centre. This secure area within our website is designed to offer one easy location for interested individuals and organizations - distributors, customers, prospects, and other members of our community - to manage their interactions with AML. *My AML Oceanographic* will allow you to:

- View and manage your assets (instruments and sensors)
- Consult instrument diagnostic summaries
- View and download calibration and conformity certificates
- View and manage your technical support cases
- Consult and download sales estimates, sales orders, and invoice copies
- View account balances and generate account statements
- Assess inventory availability at AML

To access the Customer Portal, please navigate to the *Support* button - located on the top right of the AML Oceanographic home page - select *Customer Centre* from the options on the drop down menu and follow the instructions provided.

Mailing and Shipping Address
AML Oceanographic
2071 Malaview Ave.
Sidney, BC, Canada
V8L 5X6

Appendices

Commands

When using SeaCast, the full command set is not usually necessary. However, text commands are available. Below is a listing of commonly used commands. Note that some commands are only available on instruments equipped with the appropriate Xchange™ sensors.

Communications Commands

Command	Description	Requires
DISPLAY FORCE	Displays current com mode (ie RS232, RS485, AUTO)	
DISPLAY DETECT	Displays the baud rate detection settings.	
SET DETECT a b	Sets the baud rate detection. "a" sets the number of autobaud detection attempts before the instrument reverts to the default baud rate set by "b." Setting 'a'=0 forces the instrument to a fixed baud rate determined by "b." '"b"= 1 = 600 baud 4 = 4800 baud 7 = 38400 baud 2 = 1200 baud 5 = 9600 baud 8 = 57600 baud 3 = 2400 baud 6 = 19200 baud 9 = 115200 baud	

Sampling Rate Commands

Command	Description	Requires
DISPLAY SAMPLE RATE	Displays the time-based sampling rate.	
SET SAMPLE n t	Sets the desired sampling rate. "n" is a number and "t" is the time units. Using the slash (/) character should be read as "per." For instance, 5 s means sampling happens every 5 seconds. 5/s means 5 samples per second. Examples are: SET S C sets the sampling to continuous (25 Hz) SET S 5 /s 5 samples per sec SET S 1 s Sample 1 time every 1 second SET S 2 /m 2 samples per minute SET S 5 m Sample 1 time every 5 minutes SET S 2 /h 2 samples per hour SET S 24 h Sample 1 time every 24 hours	
SET SV ZEROSUPPRESSION n [seconds | minutes]	Suppresses 0 m/s SV readings for n seconds or minutes up to a maximum of 900s or 15m. Instead, the last non-zero reading is displayed until n seconds or minutes have passed or the next non-zero SV reading resets the timer. Examples are as follows: SET SV ZEROSUPPRESSION 10 seconds Suppresses 0 m/s SV readings for up to 10 seconds or until next non-zero reading. SET SV ZEROSUPPRESSION 1 minute Suppresses 0 m/s SV readings for up to 1 minute or until next non-zero reading.	
DISPLAY SV ZEROSUPPRESSION	Displays the zero suppression setting. The zero suppression setting is also included in the output from a DISPLAY OPTIONS command.	

Output Format Commands

Command	Description	Requires
DISPLAY STARTUP	Displays the power up output settings.	
SET LATITUDE dd.dddddd	Sets the current latitude within a range of -90 to +90 degrees. Latitude is used in calculating depth from pressure. Contact AML for more information.	
SET PRESSURE UNITS x/y	Sets units for real output to x/y. Where x/y = dbar, psi, metres, feet. When changing units to feet or metres the user must set latitude, as the depth calculation corrects for surface gravity. Contact AML for more information	
SET TEMPERATURE UNITS x/y	Set units for real output to x/y. Where x/y = celsius, fahrenheit.	
SET STARTUP PROMPT	Sets the instrument to wait for user commands on power up.	
SET STARTUP SCAN	Sets the instrument to output one scan on power up, and then wait for a user command.	
SET STARTUP MONITOR	Sets the instrument to start monitoring data on power up	
SET STARTUP NOHEADER	Disables the instrument identification header output on powerup.	
SET STARTUP HEADER	Enables the instrument identification header output on powerup.	
SET NMEAON	Turns NMEA-like format on	
SET NMEAOFF	Turns NMEA-like format off	
SET AUTOMONITOR n	Automatically starts MONITOR after n seconds of command line inactivity (0≤n≤255). If n=0 AUTOMONITOR is disabled	

General Commands

Command	Description	Requires
SCAN	Measures and outputs one scan of data	
MONITOR	Scans at the set sampling rate.	
VERSION	Displays the instrument identification header.	
DISPLAY OPTIONS	Displays the instrument status and user settings.	
ZERO ON	Corrects the barometric offset to set zero pressure at surface for current barometric pressure.	P•X
ZERO OFF	Disables barometric offset.	P•X
DETECT	Checks each slot in logger board to identify what is plugged in and displays sensor / board type and serial number or "empty" for each slot.	

Technical Specifications

Sensors

Primary Xchange™ Sensors					
Type	Range	Accuracy	Precision	Resolution	Response Time
Conductivity•Xchange™	0 to 2 mS/cm	0.01 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow rate
Conductivity•Xchange™	0 to 70 mS/cm	0.01 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow rate
Conductivity•Xchange™	0 to 90 mS/cm	0.01 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow
SV•Xchange™	1375 to 1625 m/s	0.025 m/s	0.006 m/s	0.001 m/s	47 µs
CT•Xchange™ Cond.	0 to 100 mS/cm	**0-90**: ±0.01 mS/cm **90-100**: <±0.05 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow
CT•Xchange™ Temp.	-5 to 60 °C	**-5-45**: ±0.005 °C **45-60**: <±0.05 °C	0.003 °C	0.001 °C	100 ms

Secondary Xchange™ Sensors					
Type	Range	Accuracy	Precision	Resolution	Response Time
Temperature•Xchange™	-2°C to 32°C	0.005°C	0.003°C	0.001°C	100 ms
Temperature•Xchange™	-5°C to 45°C	0.005°C	0.003°C	0.001°C	100 ms
Temperature•Xchange™	0°C to 65°C	0.005°C	0.003°C	0.001°C	100 ms
Pressure•Xchange™	50, 100, 200, 500, 1000, 2000, 4000, 5000, 6000 dBar	0.05%FS	0.03%FS	0.02%FS	10 ms
Turbidity•Xchange™	0-100 NTU	0.1 NTU	0.1 NTU	0.01 NTU	< 0.7s
Turbidity•Xchange™	0-400 NTU	0.2 NTU	0.2 NTU	0.01 NTU	< 0.7s
Turbidity•Xchange™	0-1000 NTU	0.5 NTU	0.5 NTU	0.1 NTU	< 0.7s
Turbidity•Xchange™	0-3000 NTU	1 NTU	1 NTU	0.1 NTU	< 0.7s

Electrical
- Communications Board
  - RS-232 Comm board **or**
  - RS-485 Comm board
- Sensor Boards
  - Sound velocity or conductivity Xchange™ sensor board **or**
  - Pressure and temperature Xchange™ sensor board
- Factory set RS232 or RS485 (½ duplex ASCII)
- Autobaud to 38,400

Power

- External Power Supply: 8 to 26 VDC

Current Draw at 12VDC		
Type	Sensor	Current Draw (mA)
Primary	Conductivity•Xchange™	71
Primary	CT•Xchange™	66
Primary	SV•Xchange™	63
Secondary	Temperature•Xchange™	45
Secondary	Pressure•Xchange™	36
Secondary	Turbidity•Xchange™	40
Secondary	UV•Xchange™ (single stack)	265
Secondary	UV•Xchange™ (quad stack)	432

Pressure Case
- Environmental Limits
  - Storage: -40°C to 60°C
  - Usage: -20°C to 45°C

Housing						
Status	Type	Depth Rating	Diameter	Length	Weight (in water)	Weight (in air)
Standard	Delrin	500 m	33mm (1.3")	214mm (8.4")	0.09 Kg (0.2 lbs)	0.24 Kg (0.52 lbs)
Optional	Titanium	6000 m			0.25 Kg (0.55 lbs)	0.39 Kg (0.86 lbs)

Bulkhead Connectors					
Type	Status	Pins	Sex	Material	Manufacturer
Bulkhead	On Delrin housings	Micro 6	Female	Titanium	Subconn
Bulkhead	On titanium housings	Micro 6	Female	Titanium	Subconn

Sampling Capabilities
- Frequency
    - Time: From 25 samples per second to 1 sample per 24 hours
- Configurations
    - Single scan or continuous output
    - On command or autonomous on power up

Included Items
- Micro•X instrument
- Connector dust cover
- One sensor blanking plug
- USB stick with manuals and documentation

Software
- SeaCast

Ordering Codes

Instruments

PDC-MIX-P1S0-60	Micro•X,Primary (SV or C), 6000 dbar, Titanium pressure housing
PDC-MIX-P0S1-05	Micro•X Secondary (P, T, or Tu), 500 dbar, Delrin pressure housing
PDC-MIX-P0S1-60	Micro•X Secondary (P, T, or Tu), 6000 dbar, Titanium pressure housing

Sensors / Devices

XCH-SV-STD	SV•Xchange™ (1375-1625m/s) Range
XCH-SV-1120	SV•Xchange™ (1100-2000m/s) Range
XCH-SV-0520	SV•Xchange™ (500-2000m/s) Range
XCH-CND-RA002	C•Xchange™ Right Angle, Ultra Freshwater (0-2mS/cm) Range
XCH-CND-RA070	C•Xchange™ Right Angle, Oceanographic (0-70mS/cm) Range
XCH-CND-RA090	C•Xchange™ Right Angle, Oceanographic (0-90mS/cm) Range
XCH-CND-ST002	C•Xchange™ Straight, Oceanographic (0-70mS/cm) Range
XCH-CND-ST070	C•Xchange™ Straight, Ultra Freshwater (0-2mS/cm) Range
XCH-CT-RA090-n545	CT•Xchange™ Right Angle, Oceanographic (0-90mS/cm, -5 to 45 C) Range
XCH-TMP-n232	T•Xchange™ (-2 to 32 C) Range
XCH-TMP-n545	T•Xchange™ (-5 to 45 C) Range
XCH-TMP-065	T•Xchange™ (0 to 65 C) Range
XCH-PRS-0050	P•Xchange™ 50 dBar
XCH-PRS-0100	P•Xchange™ 100 dBar
XCH-PRS-0200	P•Xchange™ 200 dBar
XCH-PRS-0500	P•Xchange™ 500 dBar
XCH-PRS-1000	P•Xchange™ 1000 dBar
XCH-PRS-2000	P•Xchange™ 2000 dBar
XCH-PRS-4000	P•Xchange™ 4000 dBar
XCH-PRS-5000	P•Xchange™ 5000 dBar
XCH-PRS-6000	P•Xchange™ 6000 dBar
XCH-TRB-0100-03	Tu•Xchange™ (0-100 NTU) Range, 300m
XCH-TRB-0100-05	Tu•Xchange™ (0-100 NTU) Range, 500m
XCH-TRB-0400-03	Tu•Xchange™ (0-400 NTU) Range, 300m
XCH-TRB-0400-05	Tu•Xchange™ (0-400 NTU) Range, 500m
XCH-TRB-1000-03	Tu•Xchange™ (0-1000 NTU) Range, 300m
XCH-TRB-1000-05	Tu•Xchange™ (0-1000 NTU) Range, 500m
XCH-TRB-3000-03	Tu•Xchange™ (0-3000 NTU) Range, 300m
XCH-TRB-3000-05	Tu•Xchange™ (0-3000 NTU) Range, 500m
XCH-UV-LLLV	UV•Xchange, 3 lower power sideways facing modules + vertical module
XCH-UV-V	UV•Xchange, single vertical module

Accessories

MBR-MIX-STD	Micro•X mounting bracket assembly

Regulatory Information

This product is compliant within the requirements of CE standards.

Warranty

AML Oceanographic warrants the instrument for a period of two years from the date of delivery. AML will repair or replace, at its option and at no charge, components which are found to be defective. The warranty applies only to the original purchaser of the instruments. The warranty does not apply if the instrument has been damaged, by accident or misuse, and is void if repairs or modifications are made by any other than authorized personnel.

This warranty is the only warranty given by AML. No warranties implied by law, including but not limited to the implied warranties of merchantability and fitness for a particular purpose shall apply. In no event will AML be liable for any direct, indirect, consequential, or incidental damages resulting from any defects or failure of performance of any instrument supplied by AML.

Technical Overview Drawings

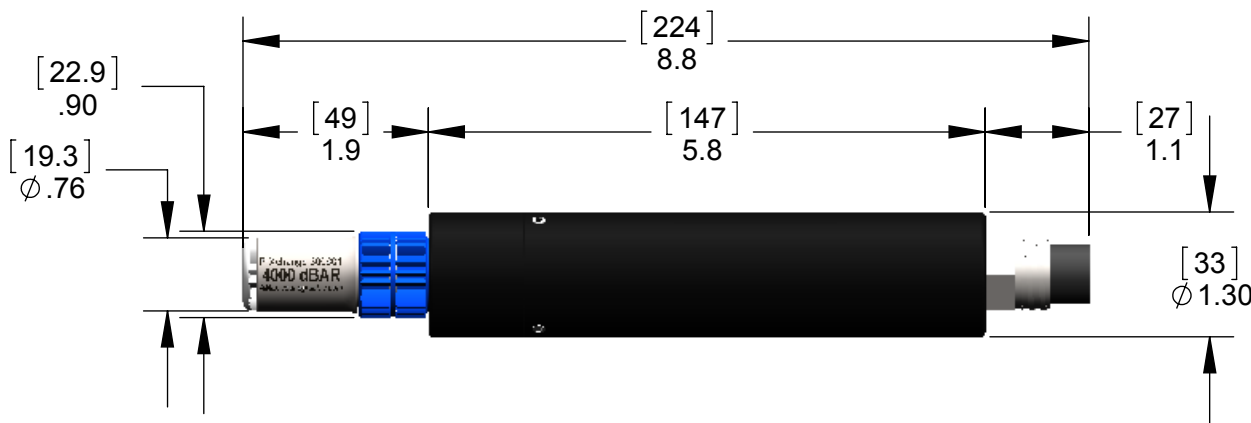| REVISION TABLE				
REV	DESCRIPTION		BY	DATE

MICRO X
MECHANICAL SPECIFICATION
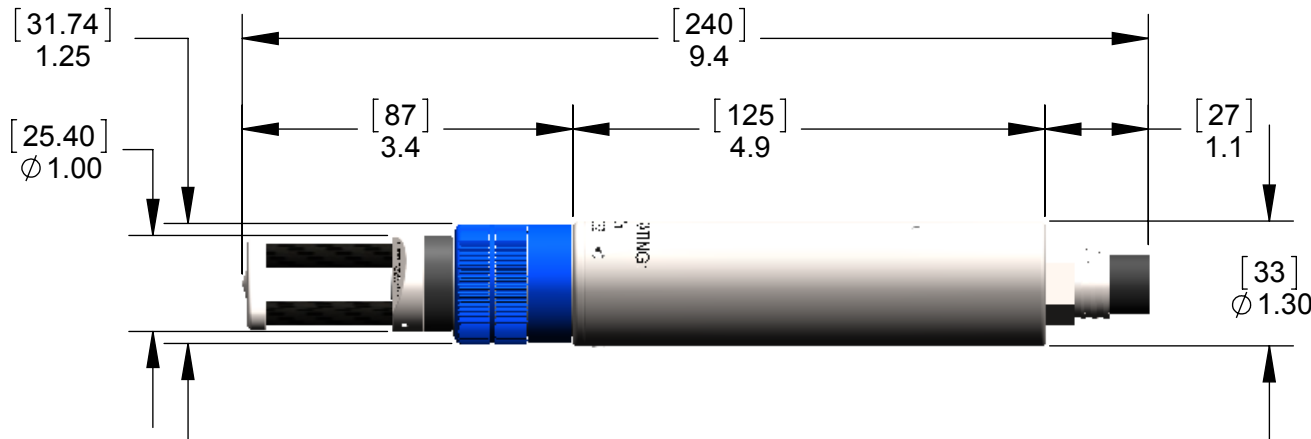
Micro X P1S0
AML Part Number: PDC-MIX-P1S0-05/60

Materials:
- Delrin - 500m Pressure Rating
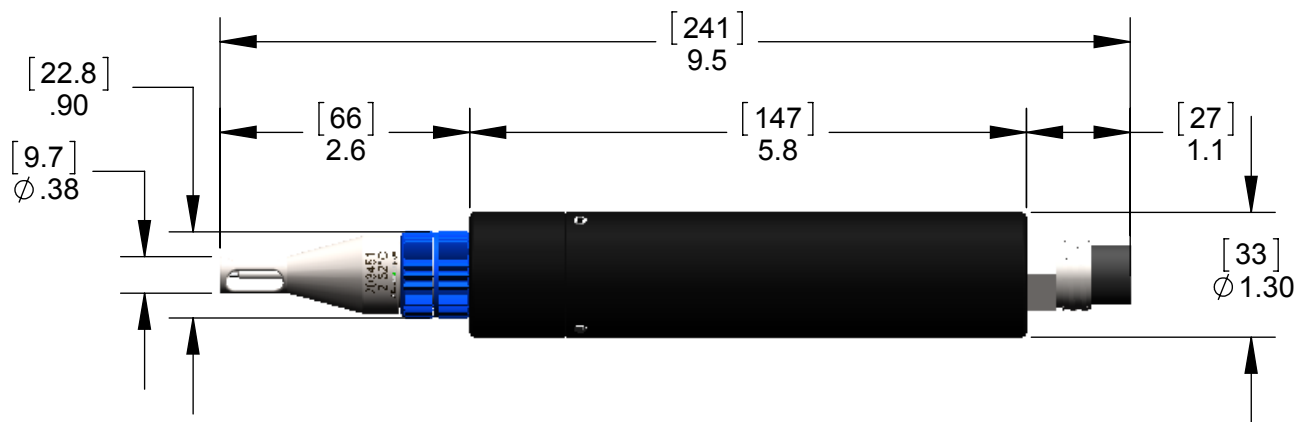- Titanium - 6000m Pressure Rating

Notes:
1. Only available in Titanium. Delrin shown for legacy products.
2. Shown with SV Xchange sensor (XCH-SV-STD) installed.

Micro X P0S1
AML Part Number: PDC-MIX-P0S1-05/60

Materials:
- Delrin - 500m Pressure Rating
- Titanium - 6000m Pressure Rating

Note: Shown with P Xchange sensor (XCH-PRS-XXXX where XXXX is max pressure in meters or dBar) installed.

Micro X P0S1
AML Part Number: PDC-MIX-P0S1-05/60

Materials:
- Delrin - 500m Pressure Rating
- Titanium - 6000m Pressure Rating

Note: Shown with T Xchange sensor (XCH-TMP-n232 or XCH-TMP-n245) installed.

NOTES:

1. DIMENSIONS IN [MILLIMETERS] INCHES
2. PRESSURE HOUSING RATINGS:
   A. DELRIN: 500m
   B. TITANIUM: 6000m

Model	Mass	
	Delrin	**Titanium**
Micro X with SV Xchange	0.52 lbs (0.24 kg) AIR 0.20 lbs (0.09 kg) WATER	0.86 lbs (0.39 kg) AIR 0.55 lbs (0.25 kg) WATER
Micro X with P Xchange	0.53 lbs (0.24 kg) AIR 0.21 lbs (0.10 kg) WATER	0.86 lbs (0.39 kg) AIR 0.55 lbs (0.25 kg) WATER
Micro X with T Xchange	0.51 lbs (0.23 kg) AIR 0.20 lbs (0.09 kg) WATER	0.86 lbs (0.39 kg) AIR 0.55 lbs (0.25 kg) WATER

AML OCEANOGRAPHIC
Xchange your old ideas
2071 Malaview Avenue W., Sidney B.C. Canada V8L 5X6 (250) 656 0771 Fax: (250) 655 3655

TITLE: Micro & Micro X Mechanical Overview - Critical Dimensions

DRAWN	DRAWING NO.:	REV	AML NO.
I.L.	MC1-GA-03259-B		SEE NOTES

DATE: MAY 25/11

MATERIAL: N/A

3rd ANGLE PROJECTION   SIZE B

SLD FILE NO.: MC1-MA-03179-A

SHEET NO.: Sheet1 of 3

TOLERANCES:
ANGLES: ± 1°
FRACTIONS: ± 1/32
HOLE SIZES: ± 0.005(0.13)
0.00: ± 0.015(0.38)
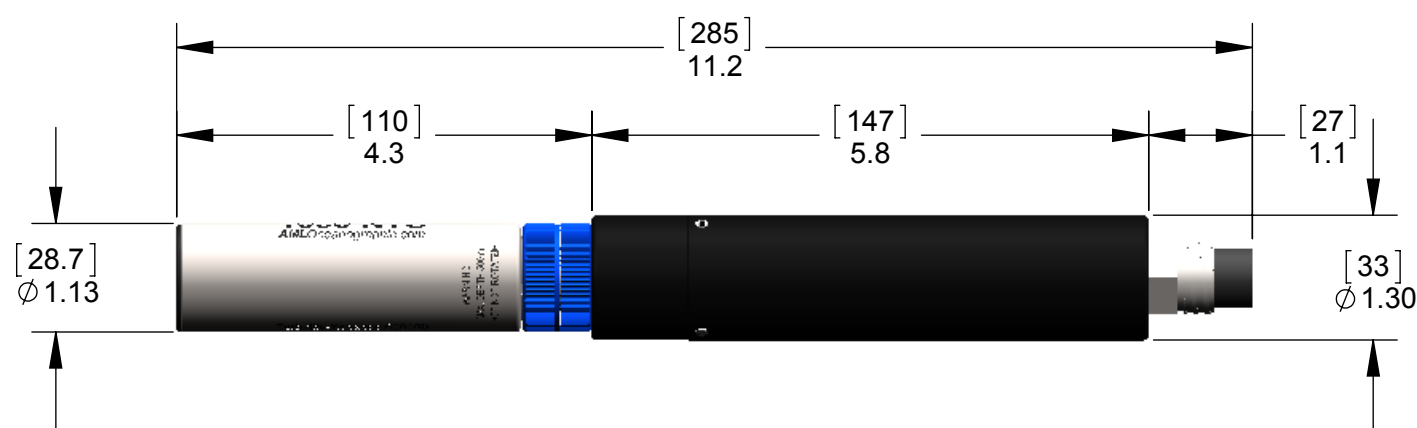0.000: ± 0.005(0.13)

UNLESS OTHERWISE SPECIFIED:
ORIGINAL SCALE:1:4
DIM'S ARE IN INCHES (MM)
SURFACE FINISH: 63

REVISION TABLE

REV	DESCRIPTION	BY	DATE

MICRO X
MECHANICAL SPECIFICATION

$\begin{bmatrix} 285 \end{bmatrix}$
11.2

$\begin{bmatrix} 110 \end{bmatrix}$
4.3

$\begin{bmatrix} 147 \end{bmatrix}$
5.8

$\begin{bmatrix} 27 \end{bmatrix}$
1.1

$\begin{bmatrix} 28.7 \end{bmatrix}$
$\varnothing$ 1.13

$\begin{bmatrix} 33 \end{bmatrix}$
$\varnothing$ 1.30

Micro X P0S1
AML Part Number: PDC-MIX-P0S1-05/60

Materials:
• Delrin - 500m Pressure Rating
• Titanium - 6000m Pressure Rating

Note: Shown with Turbidity Xchange sensor (XCH-TRB-XXXX where XXXX is the maximum turbidity in NTU) installed.

NOTES:

1. DIMENSIONS IN [MILLIMETERS] INCHES
2. PRESSURE HOUSING RATINGS:
   A. DELRIN: 500m
   B. TITANIUM: 6000m

Model	Mass	
	Delrin	**Titanium**
Micro X with Turbidity Xchange	0.82 lbs (0.37 kg) AIR 0.39 lbs (0.18 kg) WATER	1.16 lbs (0.52 kg) AIR 0.74 lbs (0.34 kg) WATER

AML OCEANOGRAPHIC
Xchange your old ideas

2071 Malaview Avenue W., Sidney B.C. Canada V8L 5X6   (250) 656 0771 Fax: (250) 655 3655

TITLE: Micro & Micro X Mechanical Overview - Critical Dimensions

DRAWN	DRAWING NO.:	REV	AML NO.
I.L.	MC1-GA-03259-B		SEE NOTES

DATE	MATERIAL:
MAY 25/11	N/A

SIZE B

3rd ANGLE PROJECTION

SLD FILE NO.:	SHEET NO.
MC1-MA-03345	Sheet2 of 3

TOLERANCES:
ANGLES: ± 1°
FRACTIONS: ± 1/32
HOLE SIZES: ± 0.005(0.13)
0.00:   ± 0.015(0.38)
0.000:   ± 0.005(0.13)

UNLESS OTHERWISE SPECIFIED:
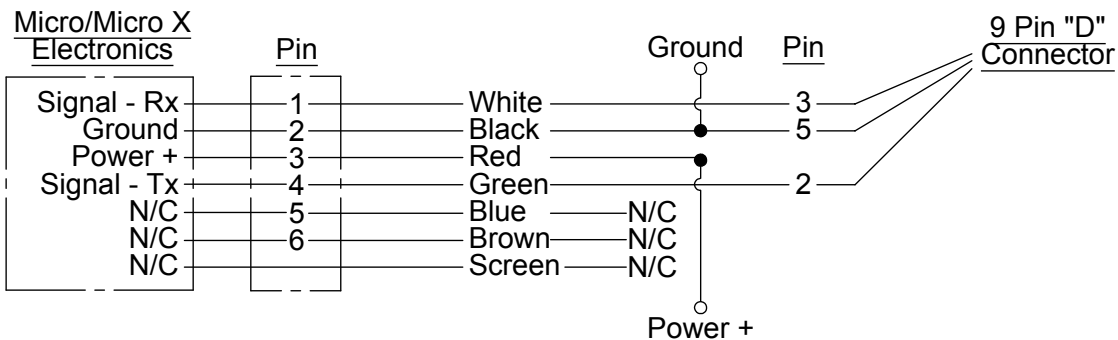ORIGINAL SCALE:1:4
DIM'S ARE IN INCHES (MM)
SURFACE FINISH: 63 √

REVISION TABLE

REV	DESCRIPTION	BY	DATE

MICRO AND MICRO-X ELECTRICAL INTERFACE SPECIFICATION

RS-232 COMMUNICATIONS

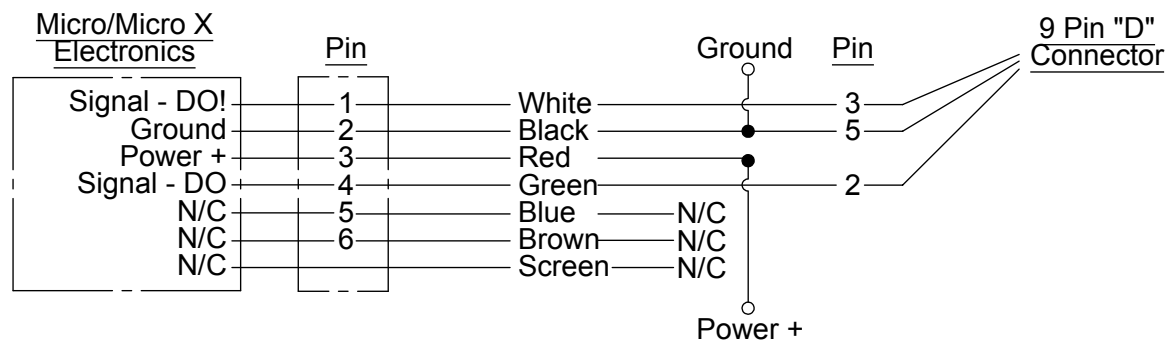| Micro/Micro X Electronics	Pin		Ground	Pin	9 Pin "D" Connector
Signal - Rx	1	White		3	
Ground	2	Black		5	
Power +	3	Red			
Signal - Tx	4	Green		2	
N/C	5	Blue	N/C		
N/C	6	Brown	N/C		
N/C		Screen	N/C		

Power +

MCBH-6-FS Bulkhead Face View

1
2   6
3   5
4
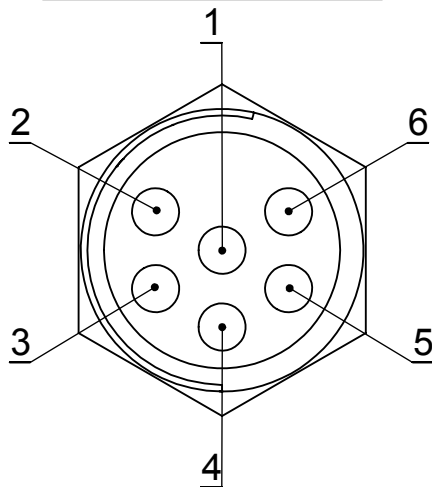
NOTE:
MICRO INSTRUMENTS ARE CONFIGURED AT THE FACTORY FOR RS-232 OR RS-485. CONSULT THE MICRO OR MICRO-X USER MANUAL FOR INSTRUCTIONS ON MAKING CHANGES TO YOUR INSTRUMENT'S COMMUNICATION PROTOCOL.

RS-485 COMMUNICATIONS

Micro/Micro X Electronics	Pin		Ground	Pin	9 Pin "D" Connector
Signal - DO!	1	White		3	
Ground	2	Black		5	
Power +	3	Red			
Signal - DO	4	Green		2	
N/C	5	Blue	N/C		
N/C	6	Brown	N/C		
N/C		Screen	N/C		

Power +

TITLE: Micro & Micro X Electrical Interface Communications and Power

DRAWN	DRAWING NO.:	REV	AML NO.
I.L.	MC1-GA-03259-B		N/A

DATE	MATERIAL:
MAY 25/11	N/A

TOLERANCES:	UNLESS OTHERWISE SPECIFIED:		
ANGLES: ± 1˚	ORIGINAL SCALE:1:4		
FRACTIONS: ± 1/32			
HOLE SIZES: ± 0.005(0.13)	DIM'S ARE IN INCHES (MM)	SLD FILE NO.:	SHEET NO.
0.00: ± 0.015(0.38)			
0.000: ± 0.005(0.13)	SURFACE FINISH: 63	MCBH-6_8-FS	Sheet3 of 3

3rd ANGLE PROJECTION   SIZE B