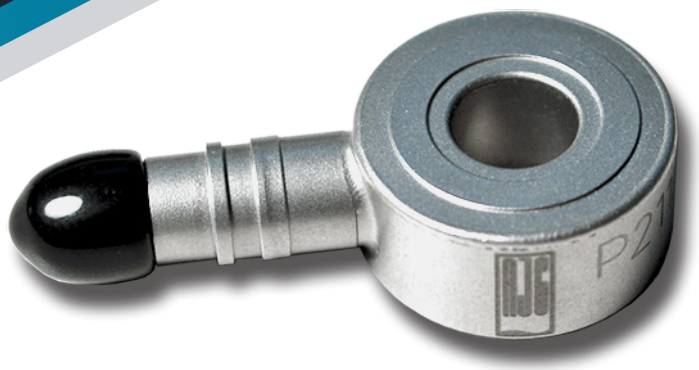
RJG MOLD SMART

PRODUCT MANUAL

Piezoelectric Load Washer Sensor

211M18



Training and Technology for Injection Molding

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RELATED PRODUCTS

INTRODUCTION

Read, understand, and comply with all following instructions. This guide must be kept available for reference at all times.

DISCLAIMER

Inasmuch as RJG, Inc. has no control over the use to which others may put this material, it does not guarantee that the same results as those described herein will be obtained. Nor does RJG, Inc. guarantee the effectiveness or safety of any possible or suggested design for articles of manufacture as illustrated herein by any photographs, technical drawings, and the like. Each user of the material or design or both should make his own tests to determine the suitability of the material or any material for the design as well as the suitability of the material, process, and/or design for his own particular use. Statements concerning possible or suggested uses of the material or designs described herein are not to be construed as constituting a license under any RJG, Inc. patent covering such use or as recommendations for use of such material or designs in the infringement of any patent.

PRIVACY

ALERTS

The following three alert types are used as needed to further clarify or highlight information presented in the manual:

DEFINITION *A definition or clarification of a term or terms used in the text.*

NOTES *A note provides additional information about a discussion topic.*

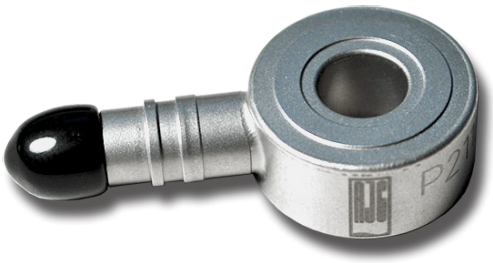
CAUTION *A caution is used to make the operator aware of conditions that can cause damage to equipment and/or injury to personnel.*

NOTES

PRODUCT DESCRIPTION

The 211M18 load washer sensor from RJG, Inc. is a digital piezoelectric sensor that measures cavity pressure on ejector sleeves. The core pin extends through the load washer so that only pressure from the ejector sleeve is monitored.

The piezoelectric load washer sensor is designed for use with the RJG eDART® or CoPilot® process control and monitoring systems. The 211M18 boasts a 5,000 lb. (22,24 kN) capacity and a sensitivity rating of 4,047 pC/kN.



APPLICATIONS

EJECTOR SLEEVES AND CORES

Load washers enable the use of cavity pressure sensors in ejector sleeve and core applications. The load washer sensor is suitable for injection molding applications in which the following conditions are met:

- Applied pressure is high enough to prevent poor sensor resolution, but low enough to prevent sensor damage.
- Sensor will be kept below 400 °F (204 °C) in the mold; sensor electronics will be kept below 140 °F (60 °C).
- The ejector sleeve will contact at least 80% of the sensor loading surface.

SINGLE-CHANNEL

The 211M18 can be utilized in single-channel applications in conjunction with the Lynx™ Mold-Mount Piezoelectric Sensor Adapter LP/LX1-M and the eDART system.

MULTI-CHANNEL

The 211M18 can be utilized in multi-channel applications which enable either four or eight sensors to be connected outside the mold with a single cable. The Lynx Four-Channel Piezoelectric Sensor Connector and Adapter—PZ-4 and PZ/LX4F-S-ID—allow up to four sensor connections, while the Lynx Eight-Channel Piezoelectric Sensor Connector and Adapter—PZ-8 and PZ/LX8F-S-ID—allow up to eight sensor connections to the eDART system.

OPERATION

LOAD WASHER SENSORS

The piezoelectric load washer sensor is placed in the ejector retainer plate behind the ejector sleeve. The ejector sleeve core pin extends through the sensor and sleeve. When the mold clamps and plastic is injected, pressure is transferred from the ejector sleeve onto the load washer. The load washer measures the force, and calculates the pressure based on the scale.

The accuracy of the sensor is dependent upon the scale. The sensor is programmed for 125 or 500 lb. as full scale, depending upon sensor ordered. The eDART computes a scale factor based on the full scale value while pressure is being applied.

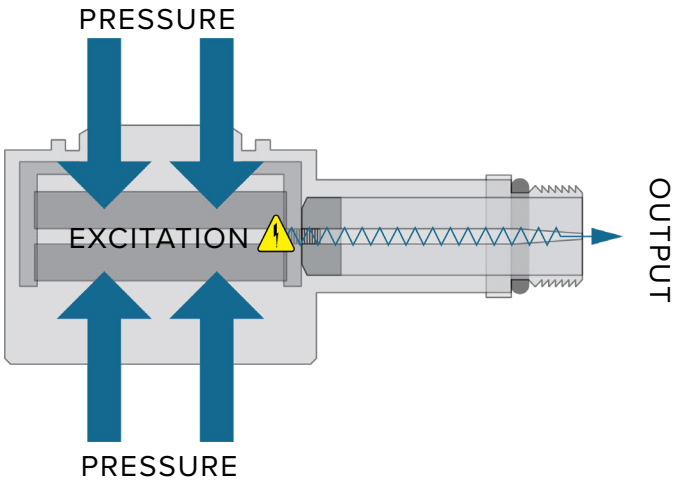
PIEZOELECTRIC SENSORS

Piezoelectric sensors use quartz crystals to measure the deformation, or change in resistance of the force over the sensor. The measurement is carried through the sensor cable to a sensor adapter mounted on the outside of the mold.

Piezoelectric quartz crystals contain balanced negative and positive electrical charges which are not symmetrically arranged. When force is applied to the piezoelectric crystal, the positive and negative atoms are deformed, pushing some of the atoms closer or further apart and causing electrical charges to occur.

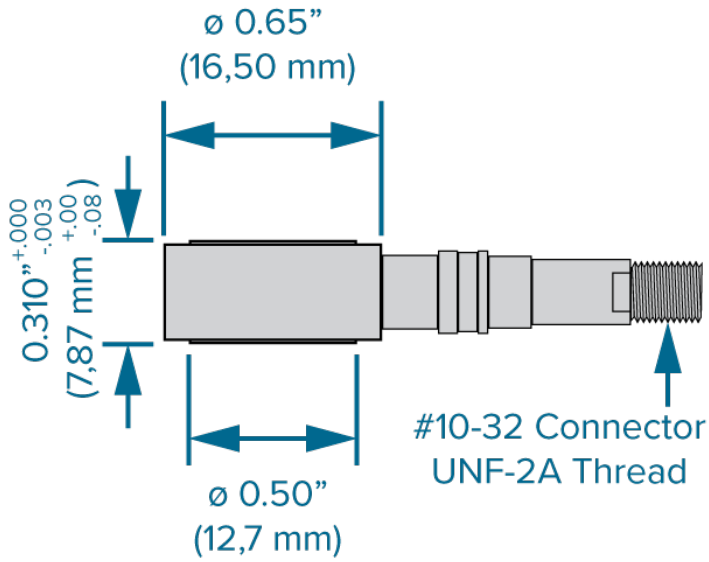
The sensor adapter is connected to the RJG, Inc. eDART or CoPilot system, which records and displays the sensor's measurement for operator aid in process monitoring and control.

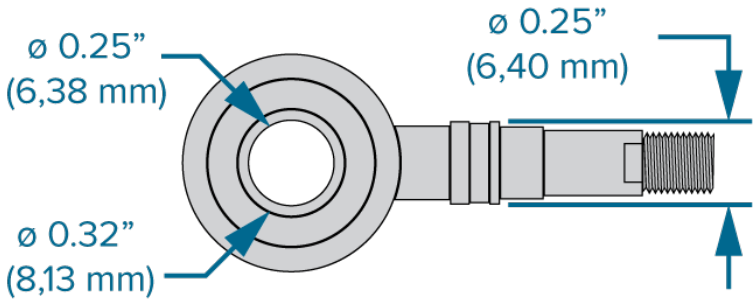
PIEZOELECTRIC SENSOR OPERATING PRINCIPLE



DIMENSIONS

SENSOR





CABLE LENGTHS

Length must be longer than needed to facilitate safe installation and removal of connector from tool to prevent tension on the lead wire; generally, 2–3” (50–75 mm) of slack is sufficient. Use good sense to determine the appropriate cable length required for each application. Length specified at time of order.

C-LW003C10-F ORDERING LENGTH

C-LW003C10-A ORDERING LENGTH

COMPATIBLE CABLES

Single-Channel	C-LW003C10-F
Multi-Channel	C-LW003C10-A

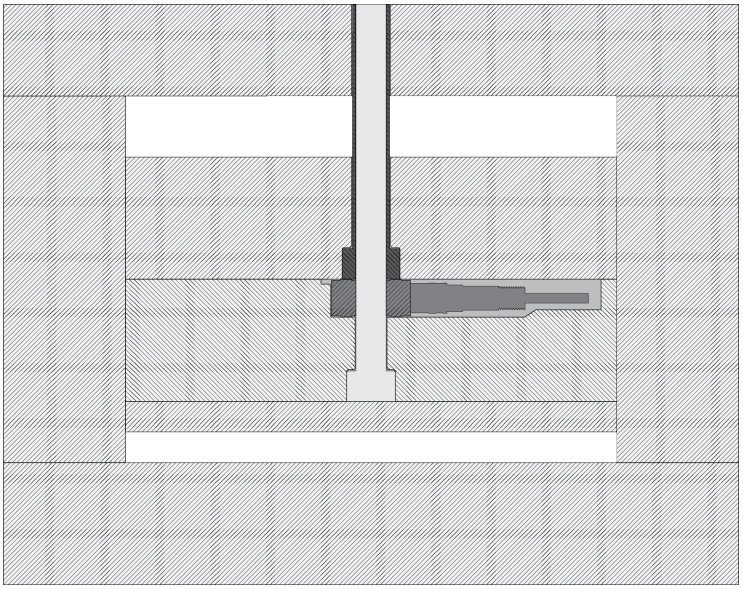
NOTES

INSTALLATION

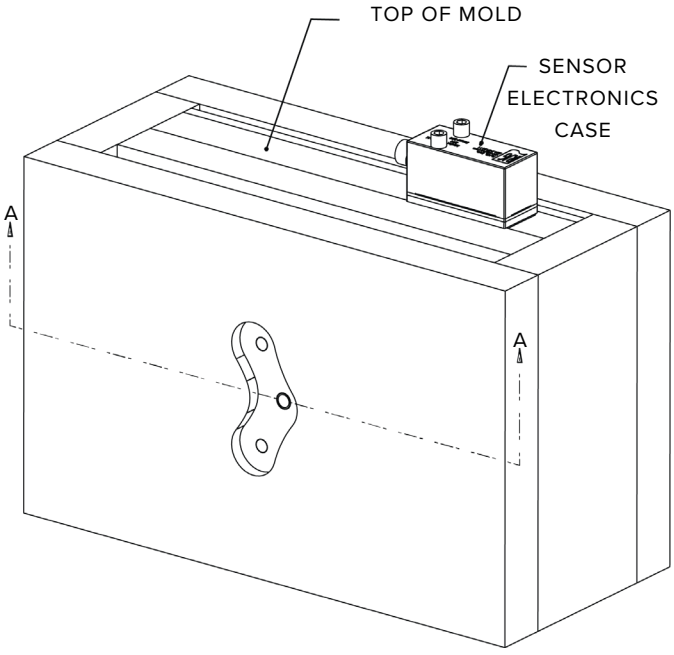
INSTALLATION OVERVIEW

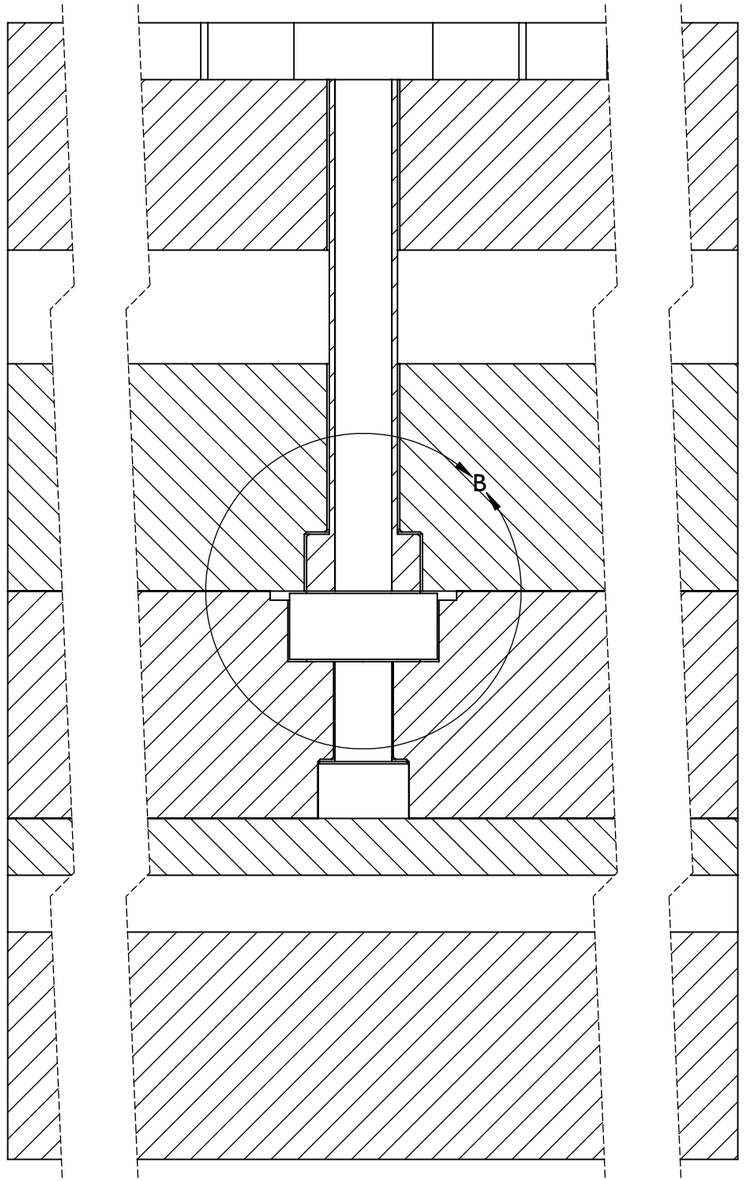
A channel is machined into the mold for the sensor cable and sensor head. The sensor head is placed under the ejector sleeve in the mold ejector retainer plate. An ejector sleeve core pin extends through the sensor head and ejector sleeve into the mold cavity. The sensor cable is attached to a sensor adapter mounted outside of the mold.

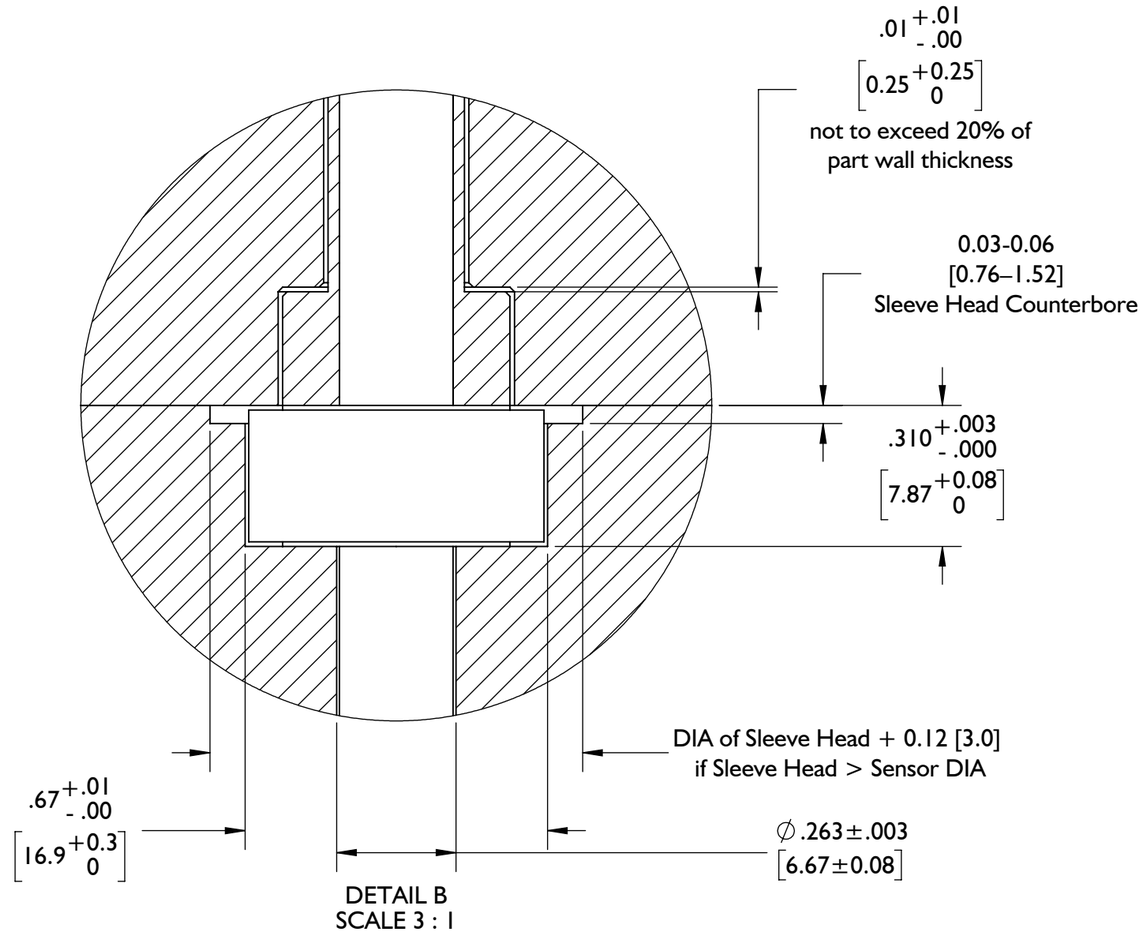
Because the load washer sensor relies on the ejector sleeve to transfer pressure from the cavity to the sensor surface, the head of the ejector sleeve must contact at least 80% of the loading surface. If this is not attainable, a spacer may be created to facilitate the correct loading. Read and follow all instructions to install the load washer sensor; refer to “Alternate Installation Overview” on page 9 for spacer installation instructions.



SECTION A:A




B

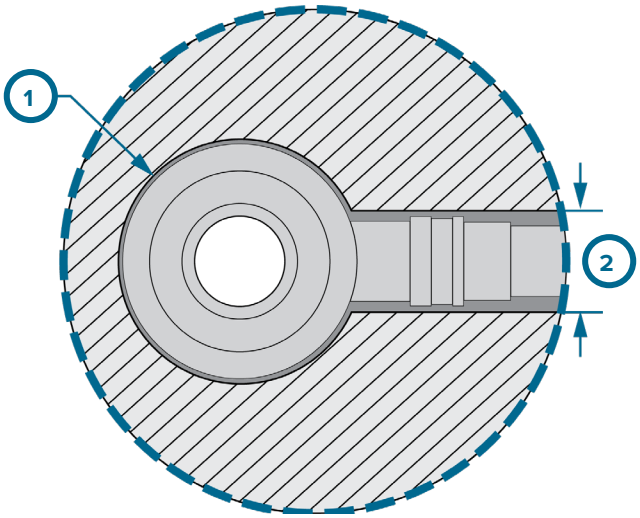

.01 +.01 -.00
[0.25 +0.25 0]
not to exceed 20% of part wall thickness
0.03-0.06
[0.76–1.52]
Sleeve Head Counterbore
.310 +.003 -.000
[7.87 +0.08 0]
DIA of Sleeve Head + 0.12 [3.0]
if Sleeve Head > Sensor DIA
.67 +.01 -.00
[16.9 +0.3 0]
∅.263±.003
[6.67±0.08]
DETAIL B
SCALE 3 : 1

INSTALLATION SPECIFICATIONS (*continued*)

SENSOR POCKET

The sensor pocket is machined into the ejector retainer plate.

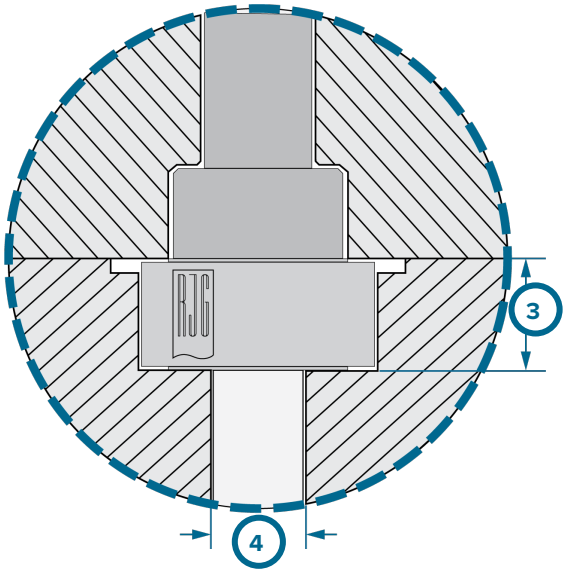
- The pocket must be concentric 0.67" +0.01/-0.000 (16,9 mm +0,30/-0,00 [1 at right]).
- Machine the pocket width for the sensor stem 0.28" (7 mm [2 at right]) MIN.
- Sensor pocket and stem depth must be 0.310" +0.003/-0.00 (7,87 mm +0,08/-0,00 [3 at right]).
- Machine the core pin pocket 0.263" ±0.003 (6,67 mm ±0,07 [4 at right]).



EJECTOR SLEEVE POCKET

Machine the ejector sleeve pocket into the ejector plate. The ejector sleeve must have 0.01" +0.01/-0.00 (0,25 mm +0,25/-0,00 [5 i at right]) MIN clearance.

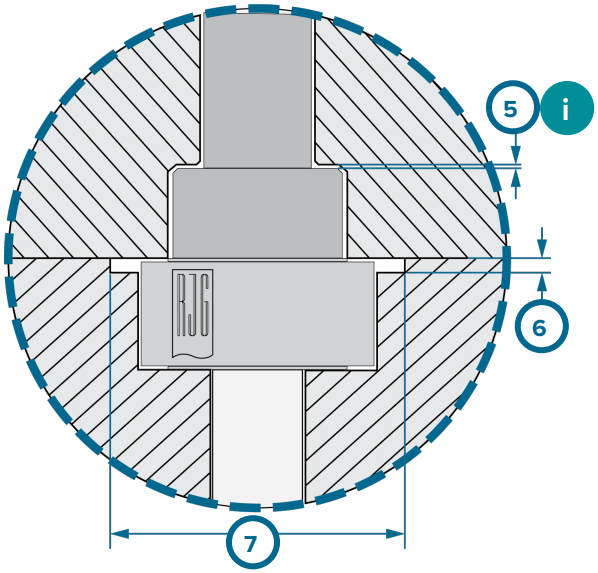
ⓘ **NOTES** *The ejector sleeve head clearance must not exceed 20% of the part wall thickness.*



EJECTOR SLEEVE COUNTER-BORE (OPTIONAL)

If the ejector sleeve head is larger than the sensor head, the ejector sleeve pocket must be counter-bored at a depth of 0.03–0.06" (0,76–1,52 mm [6 at right]).

Machine the countersink into the ejector plate the diameter of the ejector sleeve plus 0.12" (3,0 mm [7 at right]).



1	ø 0.67" +0.01/-0.00 (16,9 mm +0,30/-0,00)
2	0.28" (7 mm) MIN
3	0.310" +0.003/-0.00 (7,87 mm +0,08/-0,00)
4	0.263" ±0.003 (6,67 mm ±0,07)
5	0.01" +0.01/-0.00 (0,25 mm +0,20/-0,00) MIN i
6	0.03–0.06" (0,76–1,52 mm)
7	Sleeve Head Ø + 0.12" (3 mm) if Sleeve Head Ø > Sensor Ø

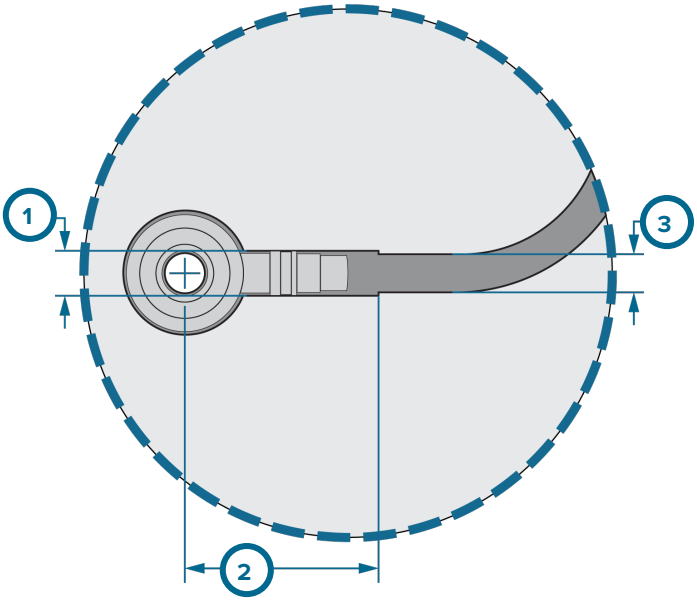
INSTALLATION SPECIFICATIONS (*continued*)

CABLE CHANNEL

Machine a cable channel width of 0.28” (7 mm [1 **AT RIGHT**]) MIN and depth of 0.310” (7,87 mm) to accommodate the sensor stem for 1.89” (48 mm [2 at right]) from center of sensor head: **this is also the minimum bend length.**

CAUTION *Do not bend the sensor cable closer than the minimum bend length; failure to comply will result in damage to equipment.*

Machine a cable channel width and depth from the end of the sensor stem pocket out of the mold of 0.25” (6 mm [2 at right]).

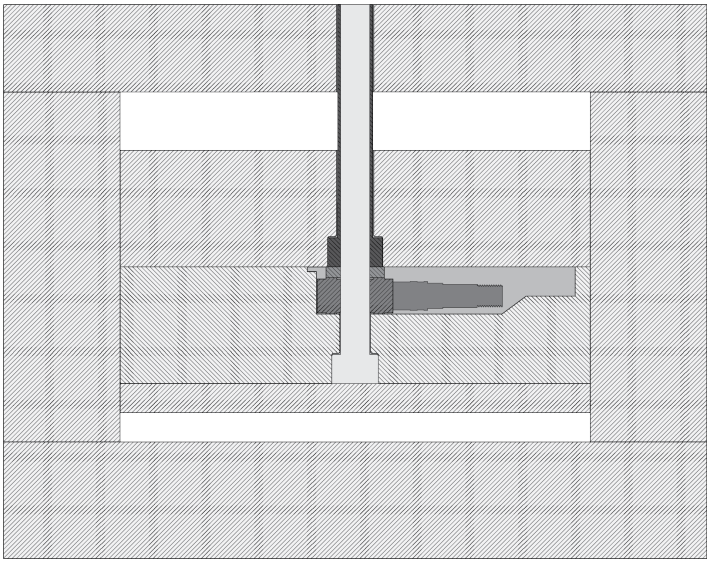


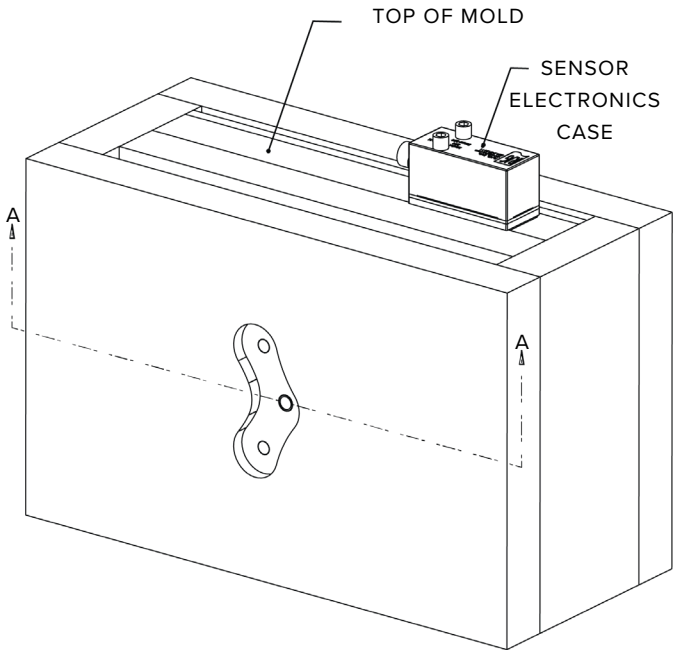
1	0.28” (7 mm) wide by 0.310” (7,87 mm) deep
2	1.89” (48 mm)
3	0.25” (6 mm)

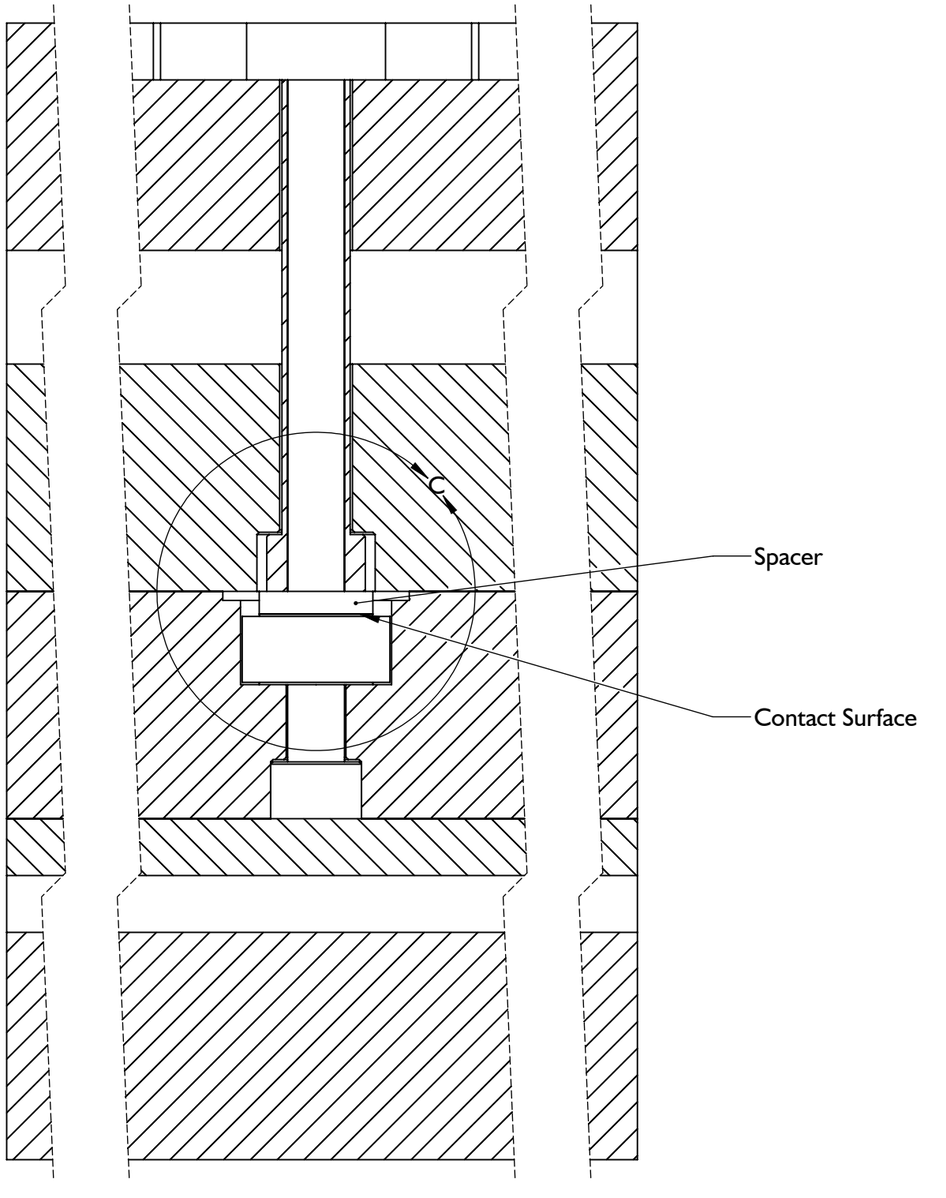
ALTERNATE INSTALLATION OVERVIEW

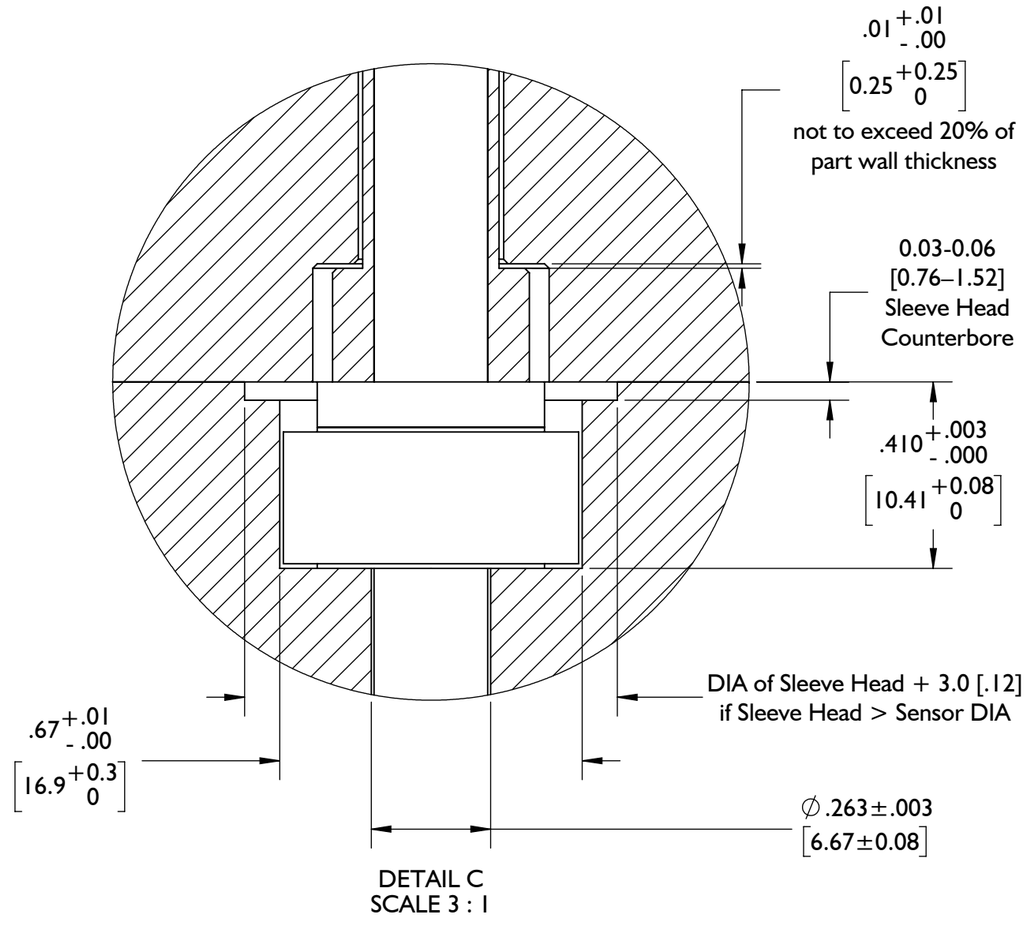
If the head of the ejector sleeve does not contact at least 80% of the loading surface, a spacer must be created to facilitate the correct loading.

A channel is machined into the mold for the sensor cable and sensor head. The sensor head is placed under the spacer and ejector sleeve in the mold ejector retainer plate. An ejector sleeve core pin extends through the sensor head, spacer, and ejector sleeve into the mold cavity. The sensor cable is attached to a sensor adapter mounted outside of the mold.









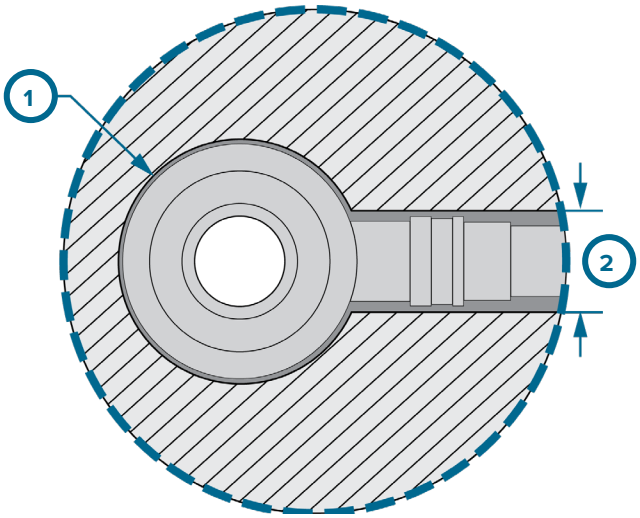
DETAIL C
SCALE 3 : 1

ALTERNATE INSTALLATION SPECIFICATIONS (*continued*)

SENSOR AND SPACER POCKET

The sensor pocket is machined into the ejector retainer plate.

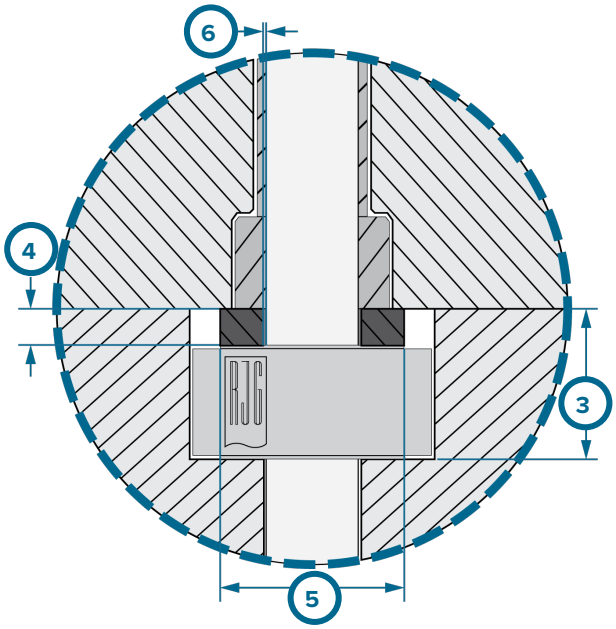
- The pocket must be concentric 0.67” +0.01/-0.000 (16,9 mm +0,30/-0,00 [1 at right]).
- Machine the pocket width for the sensor stem 0.28” (7 mm [2 at right]) MIN.
- Sensor, spacer, and stem pocket depth must be 0.410” +0.01/-0.00 (10,41 mm +0,25/-0,00 [3 at right]).



SPACER

Spacers are customer-supplied and must be made to match the diameter of the core pin.

- The spacer height is 0.100” ±0.003 (2,54 mm ±0,08 [4 at right]).
- Spacer outer DIA is concentric 0.500” ±0.003 (12,70 mm ±0,08 [5 at right]).
- Provide a pin diameter clearance inside the spacer of 0.005” (0,127 mm [6 at right]) per side.

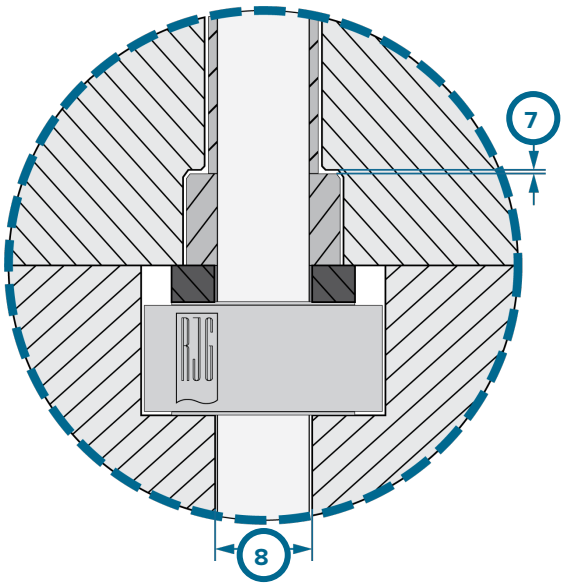


EJECTOR SLEEVE AND CORE PIN POCKETS

Machine the ejector sleeve pocket into the ejector plate. The ejector sleeve must have 0.01” +0.01/-0.00 (0,25 mm +0,25/-0,00 [7 i at right]) MIN clearance.

ⓘ **NOTES** *The ejector sleeve head clearance must not exceed 20% of the part wall thickness.*

Machine the core pin pocket 0.263” ±0.003 (6,67 mm ±0,07 [8 at right]).



1	ø 0.67” +0.01/-0.00 (16,9 mm +0,30/-0,00)
2	0.28” (7 mm) MIN
3	0.410” +0.003/-0.00 (10,41 mm +0,08/-0,00)
4	0.100” ±0.003 (2,54 mm ±0,08)
5	0.500” ±0.003 (12,7 mm ±0,08)
6	0.005” (0,127 mm) Per Side
7	0.01” +0.01/-0.00 (0,25 mm +0,25/-0,00) MIN i
8	0.263” ±0.003 (6,67 mm ±0,07)

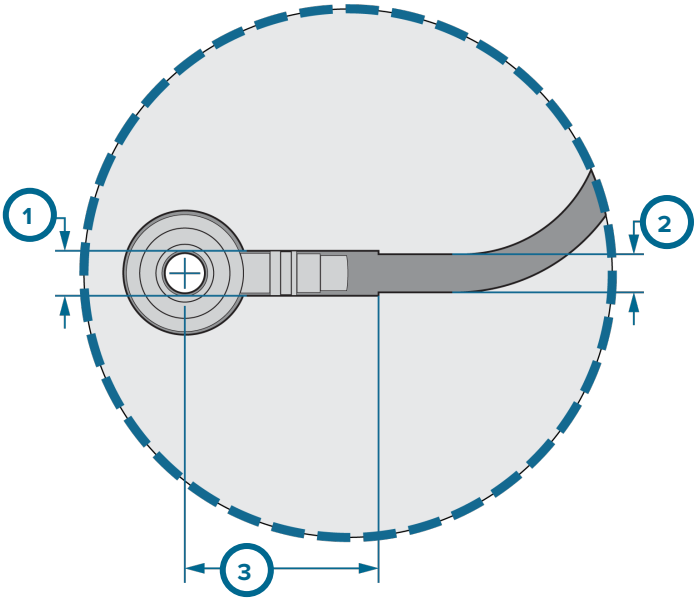
ALTERNATE INSTALLATION SPECIFICATIONS (*continued*)

CABLE CHANNEL

Machine a cable channel width of 0.28” (7 mm [3 **AT RIGHT**]) MIN and depth of 0.310” (7,87 mm) to accommodate the sensor stem for 1.89” (48 mm [1 at right]) from center of sensor head: **this is also the minimum bend length.**

CAUTION *Do not bend the sensor cable closer than the minimum bend length; failure to comply will result in damage to equipment.*

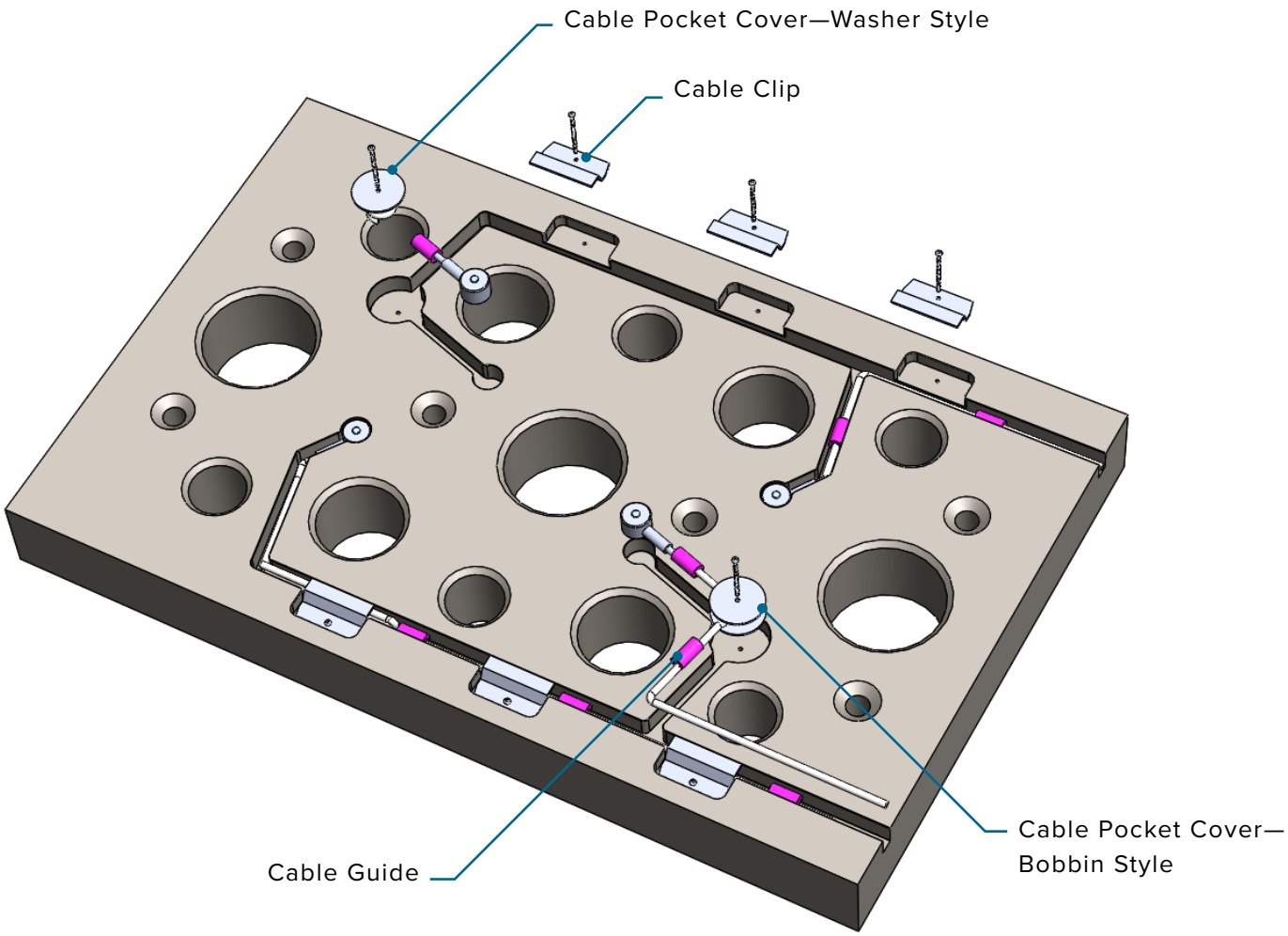
Machine a cable channel width and depth from the end of the sensor stem pocket out of the mold of 0.25” (6 mm [2 at right]).



1	1.89” (48 mm)
2	0.25” (6 mm)
3	0.28” (7 mm) wide by 0.25” (6 mm) deep

SENSOR CABLE RETENTION

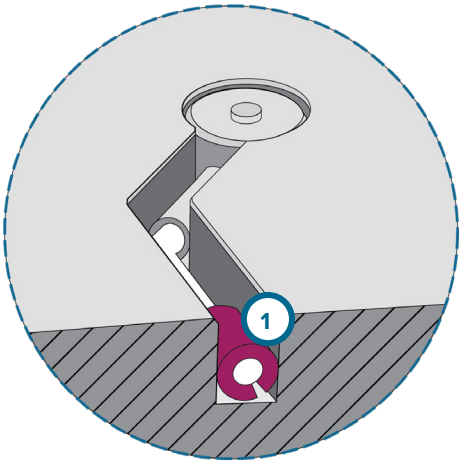
Sensor cable retention strategies must be considered during the mold design phase. Cables are often not the exact size needed, or do not easily remain in the cable channels during assembly and must be retained using one or more of the following methods.



INSTALLATION SPECIFICATIONS (*continued*)

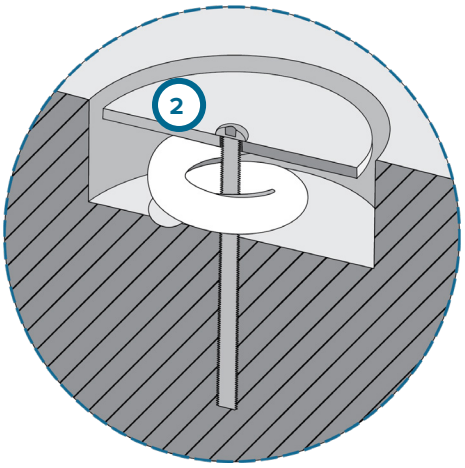
1. Cable Guides

Use self-locking cable guides (**1 AT RIGHT**) in cable channels to retain the sensor cable. Cable guides are silicone rubber tubes with a slot in them to accommodate the sensor cable; the cable guides fit snugly within the cable channel dimensions provided.



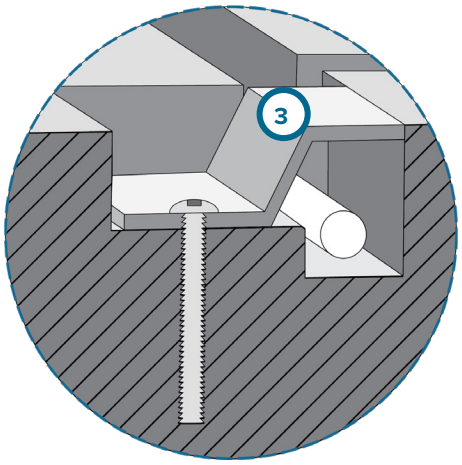
2. Cable Pocket Covers

If excess cable pockets are present, it may be useful to provide a cover (**2 AT RIGHT**) for the cable pocket with which to retain extra cable. Though RJG does not currently provide a solution specifically for this application, plastic or metal discs with a centrally-located hole, retained by a single bolt through the center, can be used to easily retain cable within the pocket. Alternatively, a bobbin-style device can be used similarly to retain cable within a pocket.



3. Cable Clips

Cables may also be retained in channels using cable clips (**3 AT RIGHT**) ; RJG does not currently provide this solution. Clips can be formed from sheet or plate metal and retained by machine screws. The clips can supplement or replace the use of silicone rubber cable guides, enabling an easier assembly of the tool.



4. Cable Retention Putty

- Use cable retention putty to retain sensors where self-locking cable guides will not be effective, such as multiple sensor cable channels.

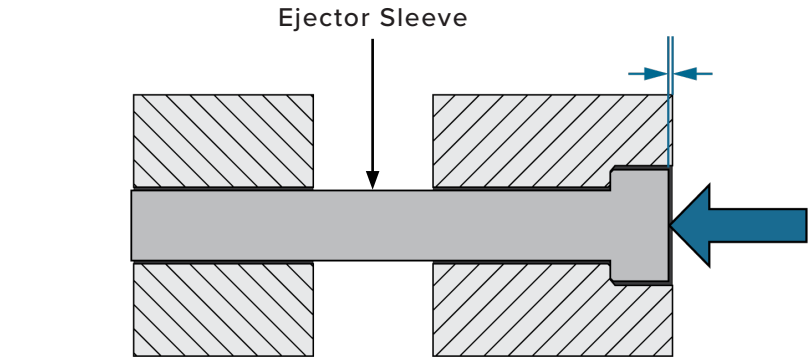
SENSOR INSTALLATION CHECK

Verify that the each sensor and ejector pin pocket is machined correctly.

PRE-ASSEMBLY CHECKS

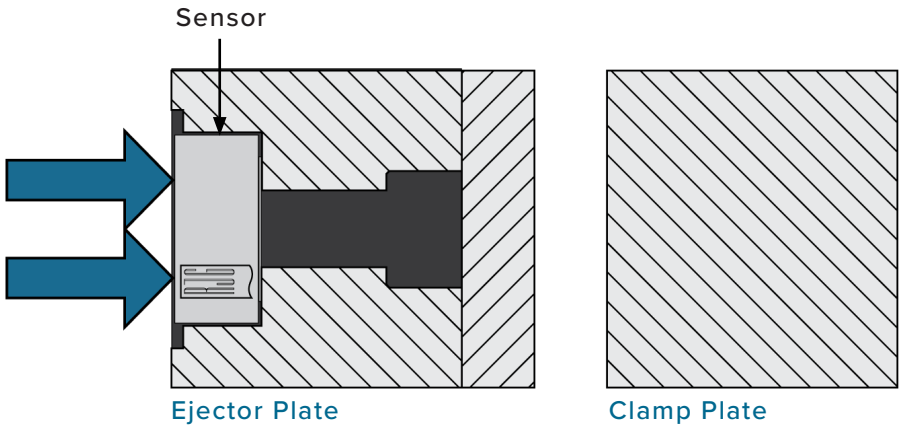
1. Indentation Test (with Ejector Pin)

With the ejector sleeve installed, push on the ejector sleeve; verify the clearance of 0.01" (0,25 mm (or ≤ 1/5 part thickness)) exists between the bottom of the ejector sleeve head and the ejector retainer plate surface.



2. Flush Test (with Sensor)

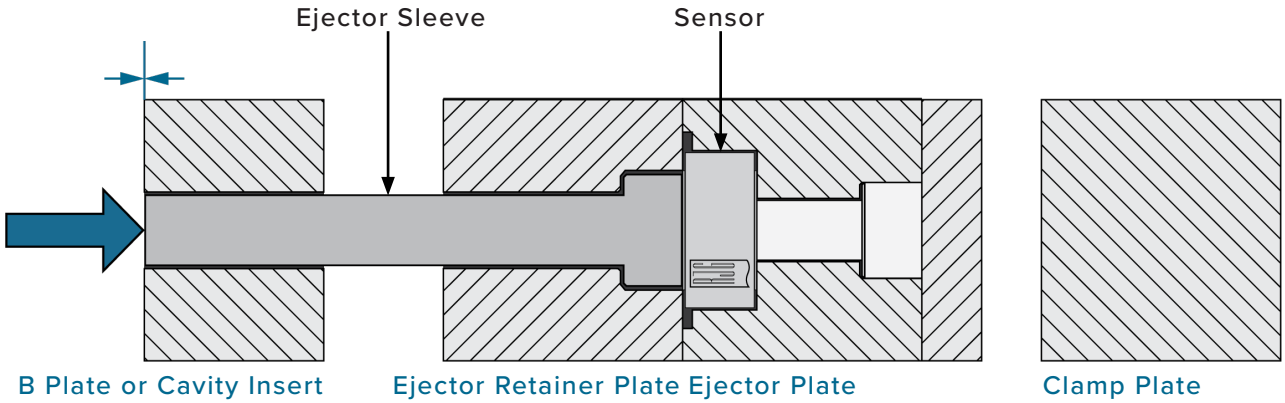
With the sensor installed in the ejector plate, verify that the sensor head is flush with the ejector retainer plate.



POST-ASSEMBLY CHECK

1. Flush Test (Full Stack)

With the sensor and ejector sleeve installed, and the ejector plate in the injection position, fixed towards clamp plate, the ejector sleeve should be flush with the ejector plate/cavity surface.



NOTES

MAINTENANCE

CLEANING & DRIFT

REGULAR CLEANING

Pull sensors from the mold and clean out the pockets and channels when a mold is pulled for preventative maintenance. Sensors must be installed in pockets free from oil, dirt, grime, and grease.

RJG, Inc. recommends the following cleaners:

- MicroCare MCC-CCC Contact Cleaner C
- MicroCare MCC-SPR SuprClean™
- Miller-Stephenson MS-730L Contact Re-Nu®

DRIFT

Piezoelectric sensors can drift negative (-) or positive (+). The acceptable drift specification for RJG piezoelectric sensors is 20 pC/minute. The easiest place to monitor this is the eDART "Sensor Locations" screen. Drift of ±20 pC in sixty seconds indicates abnormal drift. The cause of "Drift" is dirty/contaminated connections. This could be the connection at the sensor to cable or cable to adapter case.

Properly clean all connection points with an electronics grade contact cleaner. Allow the sensors and cables to air-dry before reconnecting them. Do not blow them out with a "shop" air line as this air usually contains oil and other contaminants.

If drift continues, clean the sensors out again with electronics grade cleaner then bake them in an oven to remove the contaminants (same method used at RJG). It is recommended to bake the sensors/cables at 100 °C for sixty minutes.

If continuing to experience drift after this, please contact RJG Sales for pricing and lead time on replacement items.

TESTING & CALIBRATION

SENSOR TESTING

1. Sensor PreCheck

The Sensor PreCheck provides diagnostics on typical sensor problems such as sensor drift, preload, and zero shift, and can also detect sensor installation errors caused by improper pocket dimensions, damaged wires, and damaged sensor heads. A test report with sensor configuration can be emailed or printed from the device. This device allows testing of up to thirty-two sensors at one time and can verify that a force was applied to the sensor.

2. eDART Software—Raw Data Viewer

The eDART Raw Data Viewer displays the status of the sensor, either Valid, No Reply, Stale, or Invalid.

- A Valid sensor has raw counts that change when force is applied to the sensor; this indicates a properly working sensor.
- A No Reply sensor is not communicating with the eDART; the sensor may be unplugged.
- A Stale sensor indicates a sensor that is unused.
- An Invalid sensor will indicate a Failure of either Over-range (Ovrng) or Under-range (Undrng). The Ovrng indicates the sensor's calibration has changed too far in a positive direction, outside of the upper specification. The Undrng indicates that the sensor's calibration has changed too far in a negative direction, and the sensor may report a number below zero when load is applied.

WARRANTY

RJG, INC. STANDARD THREE-YEAR WARRANTY

RJG, Inc. is confident in the quality and robustness of the 211M18 sensors, and so are offering a three-year warranty on all RJG sensors. RJG's cavity pressure sensors are guaranteed against defects in material and workmanship for three years from the original date of purchase. The warranty is void if it is determined that the sensor was subjected to abuse or neglect beyond the normal wear and tear of field use, or in the event the sensor has been opened by the customer. This new warranty policy is the most generous offered in the cavity pressure sensor industry, with one year being the most common.

PRODUCT DISCLAIMER

RJG, Inc. is not responsible for the improper installation of this equipment, or any other equipment RJG manufactures.

Proper RJG equipment installation does not interfere with original equipment safety features of the machine. Safety mechanisms on all machines should never be removed.

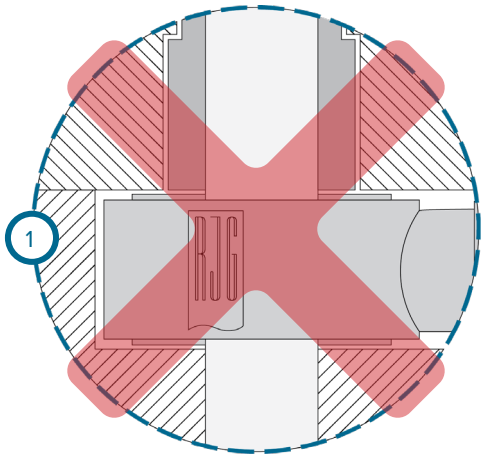
TROUBLESHOOTING

INSTALLATION ERRORS

LOADING SURFACE ISSUES

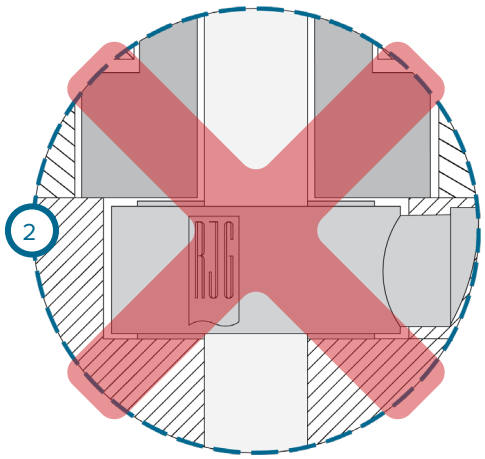
2. Loading Surface Contact Insufficient (1 at right).

- The ejector sleeve must cover at least 80% of the loading surface, or a spacer must be used to facilitate this requirement.



3. No Counter-bore for Oversized Ejector Sleeve (2 at right).

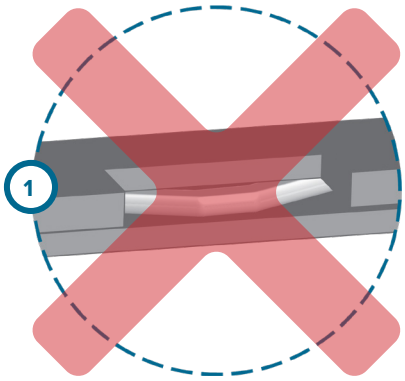
- An over-sized ejector sleeve must have a counter-bore into the ejector retainer plate.



CABLE AND CASE ISSUES

CABLES

4. Sensor cable is pinched during mold assembly (1 at right).

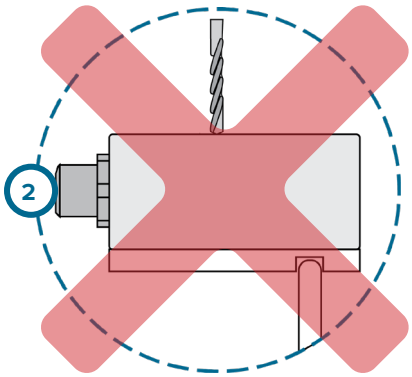


5. Sensor case is mounted on surface that exceeds temperature rating.

- Do not mount the Lynx case on surface that exceeds the recommended temperature rating. Contact RJG, Inc. Customer support for high-temperature applications.

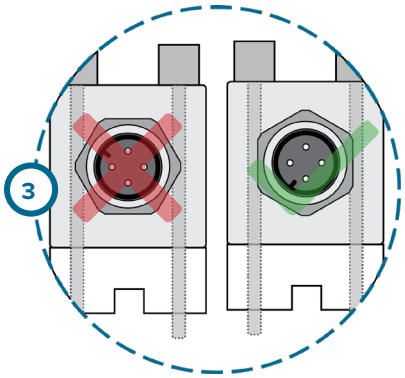
SENSOR ADAPTER CASES

6. Sensor adapter case is drilled to accommodate alternate mounting (2 at right).



- NEVER drill a sensor adapter case. Failure to comply will result in damage or destruction to equipment and void of warranty.

7. Orientation of Lynx connector on sensor adapter case is altered from OEM (3 at right).



The Lynx connector on the sensor adapter case is keyed. DO NOT attempt to change key orientation by loosening or tightening the Lynx connector on the sensor adapter case. Failure to comply will result in damage to equipment and void of warranty.

COMMON ERRORS

1. Slow sensor drift reading.

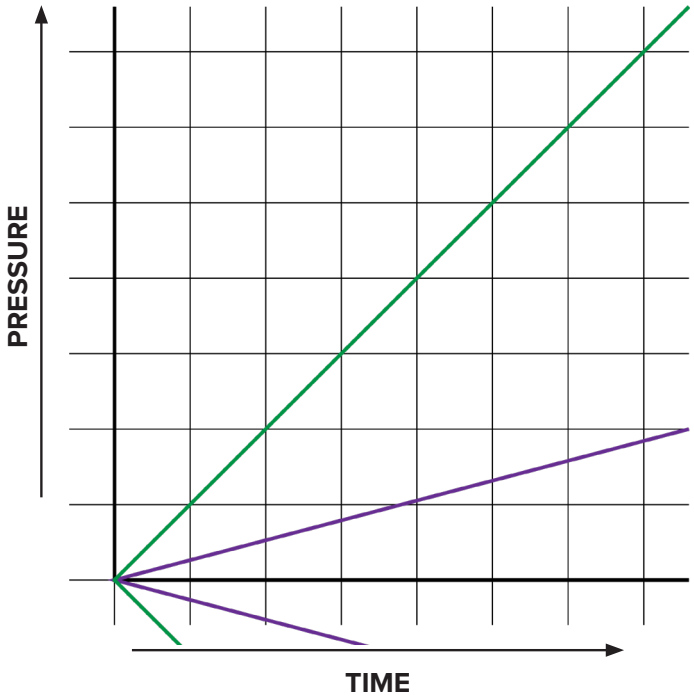
A sensor reading that slowly rises or falls (positive or negative) from the set zero value.

2. Fast sensor drift/invalid reading.

A sensor reading that quickly or rises or falls (positive or negative) from the set zero value, possibly so much that the reading becomes invalid.

3. No sensor to eDART/CoPilot communication.

The sensor reading cannot be obtained by the eDART or CoPilot.



Piezoelectric Sensor Drift Type Graph	
	Fast Drift/Invalid
	Slow Drift

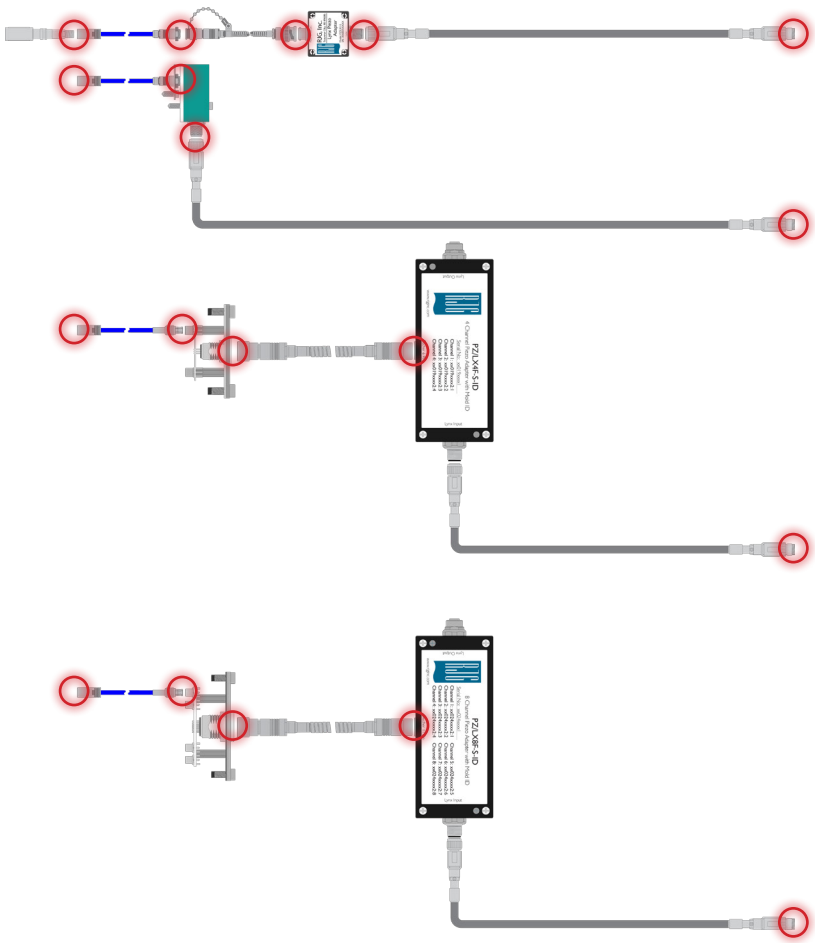
COMMON ERRORS (*continued*)

SLOW SENSOR DRIFT READING

If the sensor reading will not remain steady and drifts positive or negative, the sensor, cables, or adapter connectors may be contaminated. To identify the connector(s) with contamination, perform the following:

1. Disconnect sensor from 1645 or C-PZ/1645 cable and clean ends; if reading continues to drift, continue to next step.
2. Disconnect the 1645 or C-PZ/1645 from the sensor connector or adapter and clean ends; if the reading continues to drift, continue to next step.
3. If applicable, disconnect cable from the sensor connector and clean end and connector; if the reading continues to drift, continue to next step.
4. If applicable, disconnect cable from adapter and clean end and connector; if the reading continues to drift, continue to next step.

If the sensor reading continues to drift after the above troubleshooting steps are completed, either the sensor, cables, connector, or adapter must be replaced.

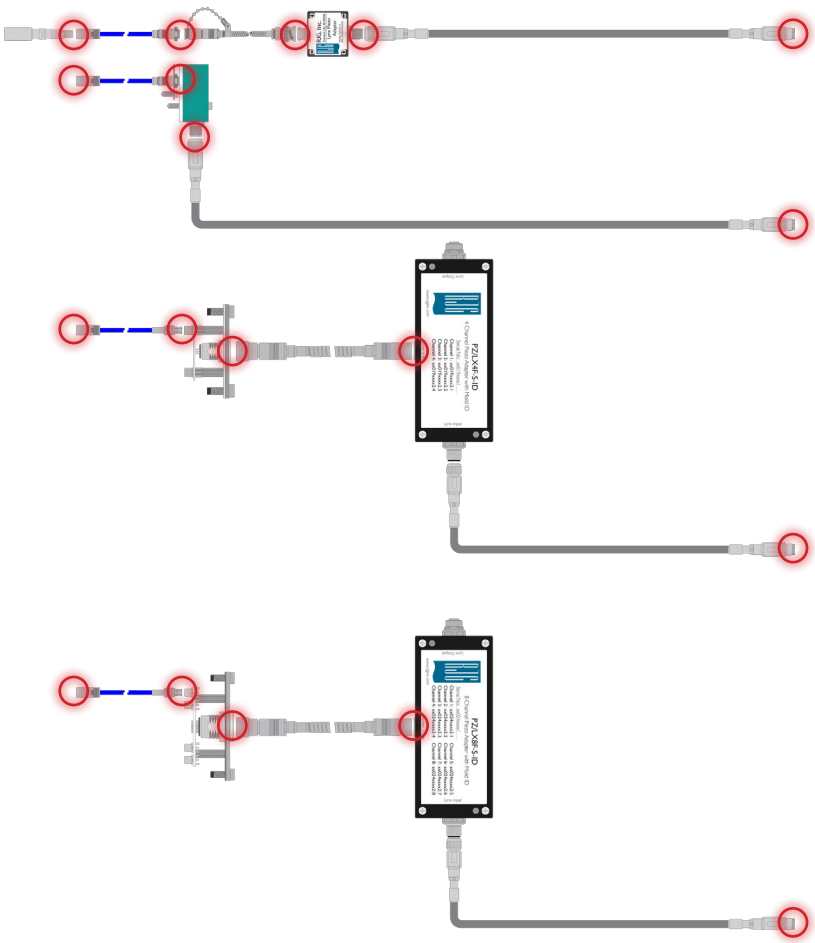


FAST SENSOR DRIFT/INVALID READING

If the sensor reading drifts quickly and becomes invalid, the sensor, cables, or adapter connectors may be heavily contaminated, or the adapter may have failed. To identify the connector(s) with contamination, perform the following:

1. Disconnect sensor from 1645 or C-PZ/1645 cable and clean ends; if reading continues to drift, continue to next step.
2. Disconnect the 1645 or C-PZ/1645 from connector or adapter and clean ends; if the reading continues to drift, continue to next step.
3. If applicable, disconnect cable from the sensor connector and clean end and connector; if the reading continues to drift, continue to next step.
4. If applicable, disconnect cable from the adapter and clean end and connector; if the reading continues to drift, continue to next step.

If the sensor reading continues to drift or remains invalid after the above troubleshooting steps are completed the adapter must be replaced.

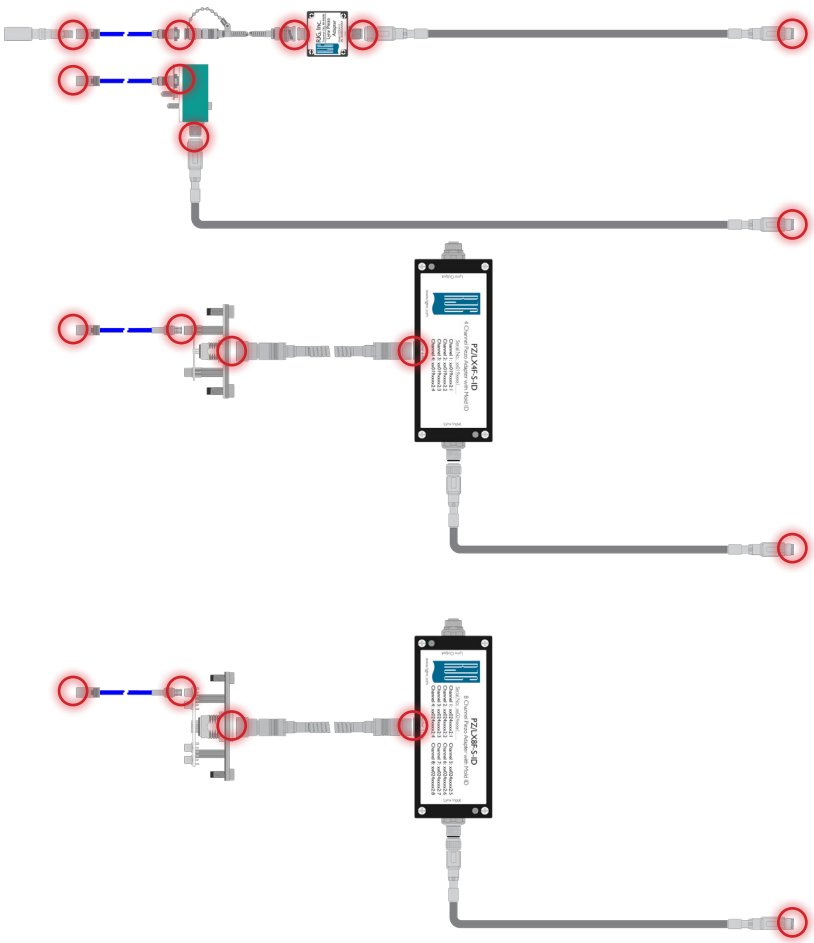


SENSOR DOES NOT COMMUNICATE WITH EDART

If the eDART is unable to establish communication with the sensor, the cables or adapter may have failed. To identify the failed component, perform the following;

1. Replace the 1645 or C-PZ/1645 sensor cable with working cable; test sensor operation. If communication remains non-existent, continue to next step.
2. Replace the sensor connector cable with working cable; test sensor operation. If communication remains non-existent, continue to next step.
3. If applicable, replace the sensor adapter cable with working cable; test sensor operation. If communication remains non-existent, continue to next step.
4. Replace the CE-LX5 Lynx cable with working cable; test the sensor operation.

If the eDART cannot establish communication after these steps, the connector has failed and must be replaced.



CUSTOMER SUPPORT

Contact RJG's Customer Support team by phone or email.

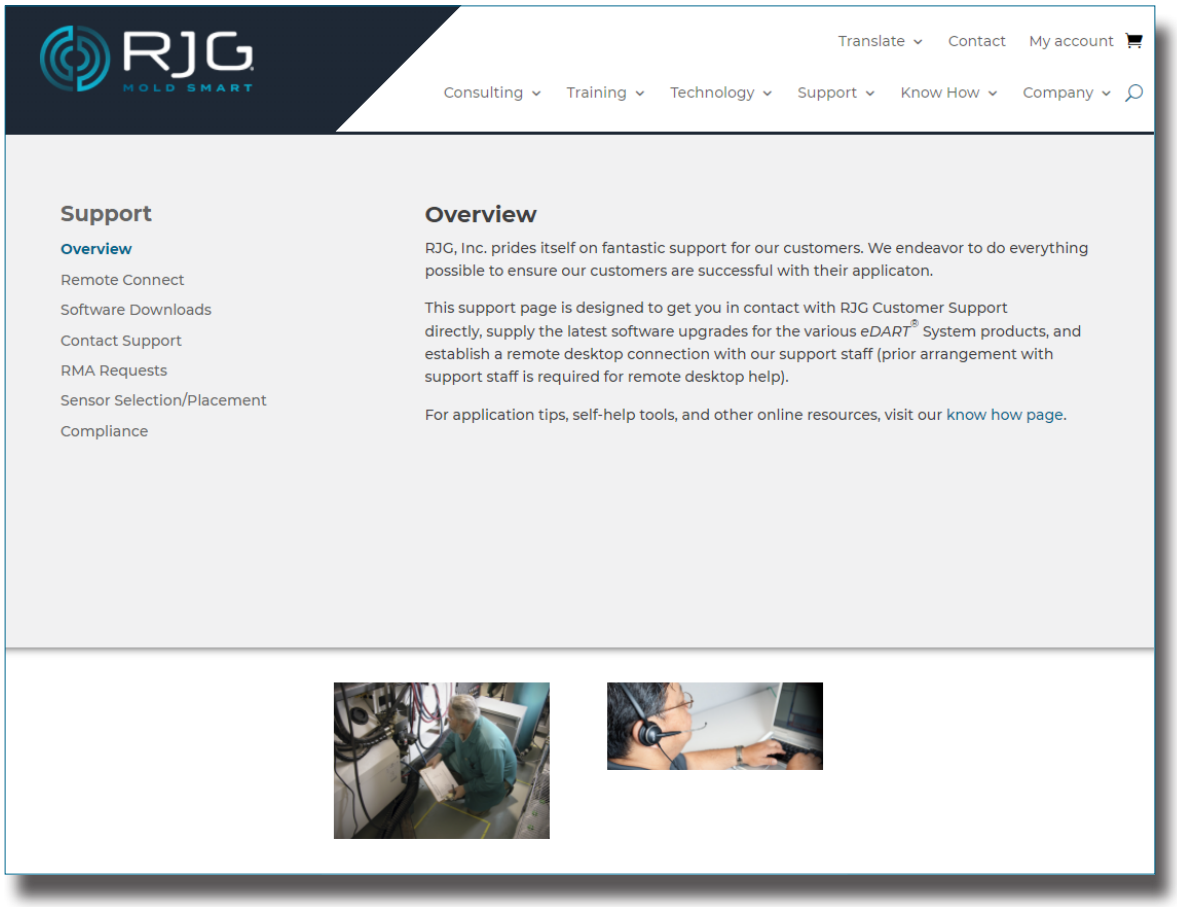
RJG, Inc. Customer Support

P: 800.472.0566 (Toll Free)

P: +1.231.933.8170

email: globalcustomersupport@rjginc.com

www.rjginc.com/support



NOTES

RELATED PRODUCTS

The 211M18 is compatible with other RJG, Inc. products for use with the eDART or CoPilot process control and monitoring systems.

COMPATIBLE PRODUCTS

SINGLE-CHANNEL LYNX LOAD WASHER SENSOR CABLE C-LW003C10-F

The C-LW003C10-F Piezoelectric Sensor Cable (1 at right) connects the Lynx Piezoelectric Load Washer Sensor to single-channel sensor adapters.

MULTI-CHANNEL LYNX LOAD WASHER SENSOR CABLE C-LW003C10-A

The C-LW003C10-A Piezoelectric Sensor Cable (2 at right) connects the Lynx Piezoelectric Load Washer Sensor to multi-channel sensor adapters.

LYNX CABLES CE-LX5

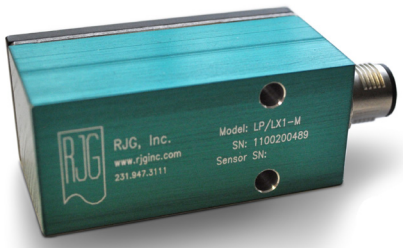
The Lynx sensor cable (3 at right) is a polypropylene-coated cable suited for the heat and stress found in injection molding environments. The cable is available in lengths 12–473” (0,3–12,0 m), and can be ordered with straight or 90° fittings. One CE-LX5 is required to interface the single-channel sensor adapters LP/LX1-M or PZ/LX1-S with the eDART or CoPilot system.

COMPATIBLE PRODUCTS (*continued*)

LYNX SINGLE-CHANNEL MOLD MOUNT SENSOR ADAPTER LP/LX1-M

The LP/LX1-M Lynx Single-Channel Mold Mount Sensor Adapter (1 at right) connects the Piezoelectric Load Washer Sensor to the eDART or CoPilot systems.

1



LYNX SINGLE-CHANNEL SURFACE MOUNT SENSOR ADAPTER PZ/LX1-S

The PZ/LX1-S Lynx Single Channel Surface Mount Sensor Adapter (2 at right) connects the Piezoelectric Load Washer Sensor to the eDART or CoPilot systems.

2

PZ-4 & PZ/LX4F-S

The PZ-4 Four Channel Piezoelectric Connector and PZ/LX4F-S Four Channel Piezoelectric Adapter (3 at right) connect up to four Piezoelectric Load Washer Sensors to the eDART or CoPilot systems.

3

PZ-8 & PZ/LX8F-S

The PZ-8 Eight Channel Piezoelectric Connector and PZ/LX4F-S Eight Channel Piezoelectric Adapter (4 at right) connect up to eight Piezoelectric Load Washer Sensors to the eDART or CoPilot systems.

4

NOTES

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