PRODUCT MANUAL

Lynx™ Shielded Sequence Module

ID7-M-SEQ

Training and Technology for Injection Molding

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

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ALERTS

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

📖 **DEFINITION** *A definition 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 Lynx™ shielded sequence module is a DIN-rail-mounted module that is wired to the molding machine in order to collect 24 V DC timing signals for use with the eDART® and CoPilot® systems, including injection forward, screw run, mold closed/clamped, first stage, and mold opening.

The use of an ID7-M-SEQ (or a DIN/LX-D) module is required to physically connect the eDART or CoPilot systems to the injection molding machine.

APPLICATIONS

PROCESS MONITORING AND CONTROL

The eDART and CoPilot systems require various inputs from injection molding machines in order to accurately calculate significant process values for monitoring and control.

The ID7-M-SEQ gathers the machine sequence state signals from the injection molding machine for the eDART or CoPilot system.

The eDART and CoPilot systems perform computations using the machine sequence state signals from the injection molding machine for various process parameters during a typical cycle. In order for these to be accurate, the eDART and CoPilot systems generate internal machine sequence signals. These sequences are not necessarily wired to the sequence module, but can be created from signals collected from the module.

For example, the plastic cooling machine sequence is not directly derived from the molding machine, instead it is calculated by the systems using the mold open signal—a machine-outputted sequence signal.

OPERATION

MACHINE SEQUENCE SIGNALS

The ID7-M-SEQ collects up to seven machine sequence signals from the following: injection forward, first stage, second stage, screw run, mold closed/clamped, mold opening, mold closing, machine in manual mode, machine in auto or semi-auto mode, shuttle position, and DC common.

The eDART requires, at minimum, the injection forward, screw run, and mold closed/clamped signals from the injection molding machine/ID7-M-SEQ. It is critical that the selected signals are correct for the eDART system to properly calculate summary values.

The CoPilot requires, at minimum, the injection forward, screw run, and mold closed/clamped signals from the injection molding machine/ID7-M-SEQ. It is critical that the selected signals are correct for the CoPilot system to properly calculate summary values.

1. Injection Forward

Injection forward is the first portion of the molding cycle, during which the ram is being pushed forward; it begins when the injection unit starts to push plastic into the mold and ends when it stops applying pressure (when hold begins).

The eDART and CoPilot system use the injection forward signal as the start of the cycle. Without the injection forward signal, the system assumes the machine has stopped.

The eDART and CoPilot systems compute injection integrals while the injection forward signal is on, ignores peaks in cavity pressures after injection forward is off (a selectable setting), computes hold time, hold pressure, and various other items (detailed below). Injection forward is used by controls such as V→P transfer, shuttle, basic three-stage, and valve gate to cause the system to take certain actions.

2. First Stage

First stage is the portion of the molding cycle during which the machine is injecting; it begins when injection starts, and ends when transfer beings.

3. Second Stage

Second stage is the portion of the molding cycle during which the machine transfers from injection to hold pressure; it begins when transfer starts, and ends when hold ends/recovery begins.

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4. Screw Run

Screw run is the portion of the molding cycle during which the machine begins to rotate the screw to build the next shot; it beings when recovery begins and ends when recovery ends (the next shot has been built).

5. Mold Closed/Clamped

The mold closed/clamped signal indicates when the mold is closed during a cycle. If the signal is on only when the mold is clamped, assign it as "mold closed/clamped". If the signal is on when the mold is closing, assign it as "mold closing".

6. Mold Opening

The mold opening signal indicates when the mold is opening during a cycle. If the signal is on when the mold is opening, assign it as "mold opening".

7. Manual

The "manual" signal is assigned to indicate the machine's current operational mode—machine in manual (mode). The signal must be on only when the machine is in manual mode, and must turn off when it is in auto or semi-auto mode. This enables the operator to verify that the other sequence signals are correctly wired and assigned by cycling the different functions while in manual mode to verify that the corresponding sequence signal module light is activated.

8. Shuttle Position

The shuttle position signal (for use with shuttle molding tables only) indicates to the eDART in which position the table is currently—Shuttle Position A, B, C, etc.

eDART AND COPILOT SYSTEM SEQUENCE SIGNALS

The eDART and CoPilot systems can calculate the following sequences from the aforementioned, hard-wired machine sequence signals. These sequences will vary based on the available hard-wired signals provided from the machine.

9. Fill

The fill signal is generated by the eDART and CoPilot systems from machine signals; fill will go on as the screw passes through the position to which it recovered just before decompress and will go off when the second-to-last velocity profile begins.

If the fill signal is not available on the machine, the system generates it, turning it on at the zero point of shot volume and off at a selected fill threshold in the sequencer.

If the fill button is greyed out (version 9 software/Sequence Lights tool), the eDART cannot generate fill.

10.   Pack

The pack signal is generated by the eDART and CoPilot systems from hard-wired machine signals; the pack signal will go on at the end of fill, and is turned off by the eDART, which uses the transfer pressure set in cavity pressure control. If cavity pressure control is not in use, pack will only exist if the fill signal is considered to be a fill and pack combined signal.

If the pack button is greyed out (version 9 software/Sequence Lights tool), the eDART cannot generate pack.

11.   Hold

The hold signal is generated by the eDART and CoPilot systems from hard-wired machine signals; the system turns on the hold signal at the end of pack or, if there is no pack, at the end of fill. It then turns it off at the end of injection forward.

If the hold button is greyed out (version 9 software/Sequence Lights tool), the eDART cannot generate hold.

12.   Plastic Cooling

The plastic cooling signal is generated by the eDART and CoPilot systems from hard-wired machine signals; the system turns the plastic cooling signal on at the end of fill and turns it off on one of the following (listed in order of priority):

• mold open goes on

• mold closed/clamped goes off (if there is no mold open)

• screw run goes off (neither mold open nor mold closed/clamped exist)

If the Plastic Cooling button is greyed out (version 9 software/Sequence Lights tool), the eDART cannot generate plastic cooling.

DIMENSIONS

2.97"
(75,4 mm)

1.97"
(50,15 mm)

1.22"
(31,05 mm)
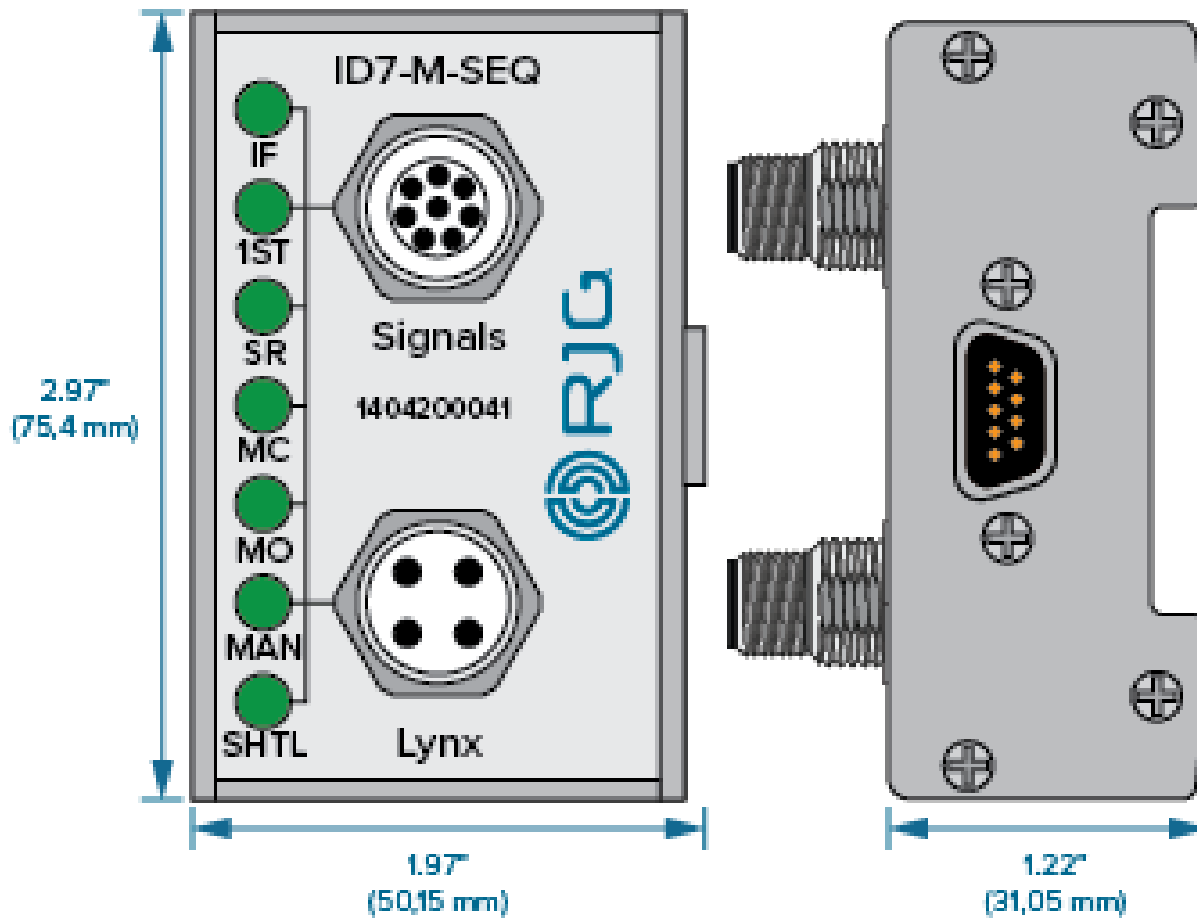
CABLE LENGTHS

The C-ID7-M-3M is 9.8 ft. (3 m) long.

CABLE LENGTH

# NOTES

INSTALLATION OVERVIEW

The shielded machine interface modules are mounted to a solid surface, such as the machine frame, inside the molding machine on a DIN rail.

ID7-M-SEQ

The shielded machine sequence module cable C-ID7-M-3M is wired directly to the machine (usually to an output card) on one end and connected to the ID7-M-SEQ on the other using the eight-pin connector.

eDART AND COPILOT SYSTEMS CONNECTION

A Lynx cable CE-LX5 is connected to the Lynx port on the ID7-M-SEQ and a Lynx port on the eDART or CoPilot system to provide it with the machine's sequence signals for process monitoring and control calculations, along with the other installed machine interface module signals.

C-ID7-M-3M CABLE TO MACHINE

CE-LX5 CABLE TO *eDART* OR COPILOT SYSTEM
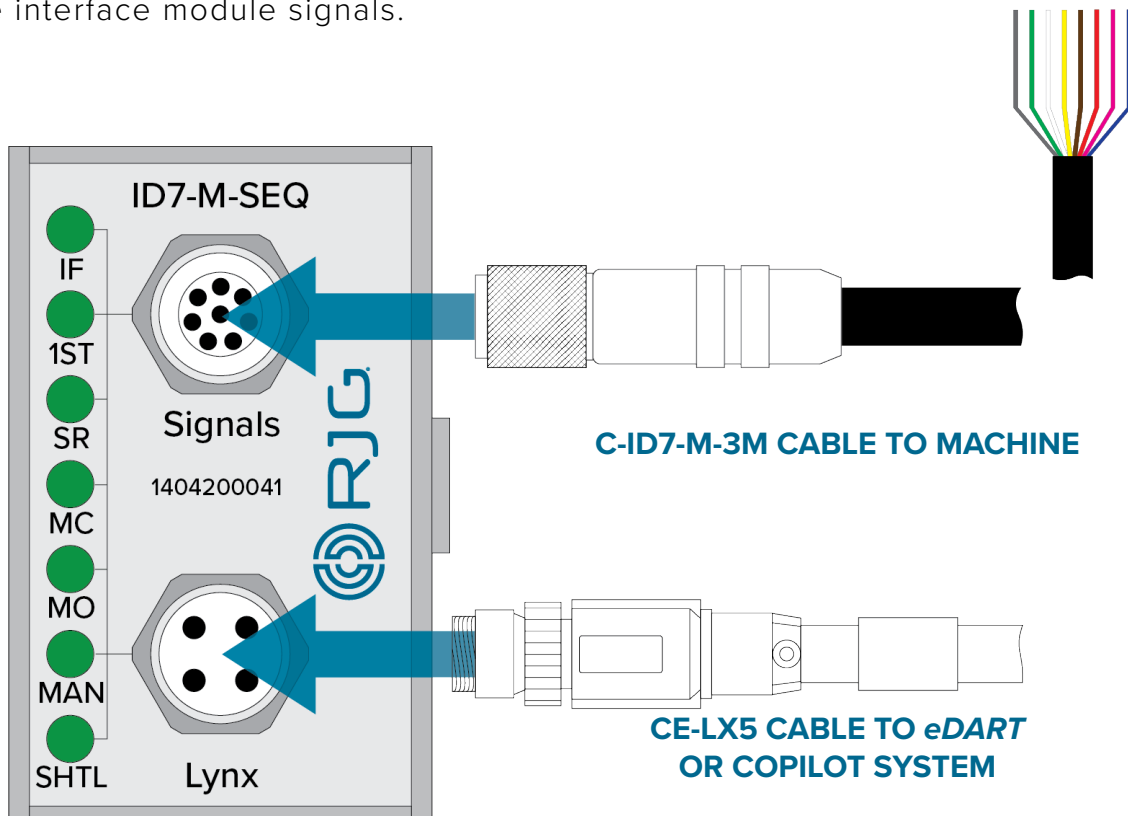
INSTALLATION SPECIFICATIONS

The instructions that follow are a general guide; actual steps necessary to install this product will vary based on injection molding machine manufacturer, model, and options.

REQUIREMENTS

At minimum, the following signals must be wired to the module:

- injection forward,

- screw run, and

- mold closed/clamped.

If the machine sequence signals are wired and assigned correctly, the eDART or CoPilot systems' sequencer function easily calculates accurate machine signals. If the signals do not exist, the system can calculate some machine sequence signals, but may require the user to input settings.

If the signals are misnamed, or do not go on and off as specified, the system-generated machine sequence signals will likely be incorrect, as will the data calculated from them. Refer to the CoPilot® Hardware Installation and Setup Guide, "Machine Sequence Signals" on page 2, and "Wiring" on page 9 for more information on sequence signal requirements and acceptable substitutions (if applicable).

MOUNTING

↗ **CAUTION** *Before beginning ID7-M-SEQ installation, disconnect and lockout/tag-out any and all power to the molding machine. Failure to comply will result in personal injury or death, and damage or destruction of equipment.*

Mount the ID7-M-SEQ module to a solid surface—such as the molding machine frame—using the supplied 1.38" (35 mm) DIN rail. A clearance height of 6" (152,4 mm) from the face of the module is recommended.

ⓘ **NOTES** *Modules and connecting cables must be located away from any static sources, such as feeder tubes and material hoppers.*

INSTALLATION SPECIFICATIONS (*continued*)

WIRING

The following table details machine sequence signals wiring and functions.

SIGNAL	WIRING	ON	OFF	PURPOSE	REMARKS
Injection Forward	IF	Injection Starts	End of Hold	Primary signal for fill, pack, and hold times calculation; also peak injection pressure and effective viscosity calculations.	A form of this signal is required. If no injection forward signal is present, the cycle graph will not refresh; will not calculate integral values.
First Stage	1ST	Start of Fill	Transfer to Hold	Calculates fill time in DII processes; calculates injection forward if signal is not available.	Fill time can be created by manually setting the Fill Volume at Cursor function with only the injection forward signal.
Second Stage	any unused	Switch to Hold (Pressure)	End of Hold	Calculates hold time; calculates injection forward if signal is not available.	Calculates more accurate hold time, hold pressure, and average hold pressure.
Screw Run	SR	Screw Motor Starts	Screw Motor Stops	Calculates screw run on time; detects stroke direction; zeroes plastic volume at cycle.	This signal is required.
Mold Closed/ Clamped	MC	Mold Clamped to High Tonnage	Mold Begins to Open	Primary signal for cycle time calculation; zeroing of sensors, cycle reset for piezoelectric equipment.	This signal is required.
Mold Opening	MO	Mold Begins to Open	Mold Fully Open	Cycle reset for piezoelectric equipment.	Pinched part detection when used in conjunction with a part diverter.
Mold Closing	any unused	Mold Begins to Close	Mold Clamps	Calculates cycle time when mold closed/clamped is not available; zeroing of sensors, cycle reset for piezoelectric equipment.	Zeroing of sensors when mold closed/clamped signal is not available.
Manual Mode	MAN	Machine in Manual Mode	Machine in Auto or Semi-Auto Mode	Enables the average cycle time calculation to discard time the machine spends in manual mode.	May allow valve gates to open to purge through manifold in this mode.
Shuttle Position	SHTL	Start of Cycle at Position 2	Start of Cycle at Position 1	Detects rotary table position in shuttle molding applications.	The *eDART* shuttle control software uses this signal to identify which position is active for use with template control, alarm outputs, and summary value calculation.

INSTALLATION SPECIFICATIONS (*continued*)

ⓘ **NOTES** *The following required signals may be obtained from a machine output card.*

Confirm the machine's sequence output card can supply a reliable 24 V signal. Input for all signals 24 V ON; 0 V OFF. Maximum Input Voltage 36 V; Minimum Trigger-On Voltage 18 V. Wire the machine sequence signals to the module cable C-ID7-M-3M.

ⓘ **NOTES** *Note the signals which are wired to the machine for future software setup and use.*

The C-ID7-M-3M cable has colored-coded wires to simplify installation. Refer to the table below for the correct wire/signal combinations for installation.

SIGNAL	WIRING		COLOR
Injection Forward	IF	🔵	Blue
First Stage	1ST	🔵🔴	Blue or Pink
Second Stage	any unused		any unused
Screw Run	SR	🔴	Red
Mold Clamped	MC	🟤	Brown
Mold Opening	MO	🟡	Yellow
Mold Closing	any unused		any unused
Manual Mode	MAN	⚪	White
Shuttle Position	SHTL	🟢	Green
Common		⚫	Grey

CONNECTIONS

Connect the C-ID7-M-3M cable to the ID7-M-SEQ module. Connect the ID7-M-SEQ to the JLX-1 junction using the CE-LX5-2M Lynx cable.

The shielded sequence module requires little to no maintenance provided that all installation instructions are followed.

CLEANING

REGULAR CLEANING

Cables must be installed in areas 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®

TESTING

1. eDART system

Test the ID7-M-SEQ inputs after assignment using the Sequence Lights/Sequence Inputs tool in eDART version 9.xx software, or in Machine Setup/Test Inputs in eDART version 10.xx software, or utilize the integrated LED on the ID7-M-SEQ to verify that the corresponding light goes on/off for the machine sequence.

2. CoPilot System

Test the ID7-M-SEQ inputs after assignment during Machine Setup>Assign Inputs page in CoPilot system software, or utilize the integrated LED on the ID7-M-SEQ to verify that the corresponding light goes on/off for the machine sequence.

EDART VERSION 9.XX SOFTWARE

The Sequence Lights tool displays what stage of the process is taking place showing the on/off status of machine sequences. If a "light" is on, then the signal is on; if a "light is off, the signal is off. The Sequence Lights tool displays machine sequences that are not necessarily wired to the sequence module. To view the status of the hard-wired sequence signals, select the Sequence Inputs inputs button on the Sequence Lights tool.

Similarly, the Sequence Inputs tool displays the hard-wired signals statuses. With the machine in manual mode, cycle the machine while watching to verify that the corresponding "light" goes on/off for the machine sequence.

EDART VERSION 10.XX SOFTWARE

The Machine Setup/Test Inputs function displays the hard-wired signal statuses. With the machine in manual mode, cycle the machine while watching to verify that the corresponding "light" goes on/off for the machine sequence.

COPILOT SYSTEM SOFTWARE

The Help>Diagnostic>Sequence State function displays the hard-wired signal statuses. With the machine in manual mode, cycle the machine while watching to verify that the corresponding "light" goes on/off for the machine sequence.

WARRANTY

RJG, INC. STANDARD WARRANTY

RJG, Inc. is confident in the quality and robustness of the shielded machine interface modules, and so are offering a one-year warranty. RJG's products are guaranteed against defects in material and workmanship for one year from the original date of purchase. The warranty is void if it is determined that the adapter was subjected to abuse or neglect beyond the normal wear and tear of field use, or in the event the adapter box has been opened by the customer.

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.

COMMON ERRORS

SIGNAL ERRORS

1. **Signal(s) do not appear on module test lights**

In the eDART system software, any signals that never appear "on" must be named "Not Used", even if wired to the module. In eDART system version 9.xx software Sensor Locations tool, assign the Sensor Location as "Not Used". In eDART system version 10.xx software Machine Setup/ Inputs, the ID7-M-SEQ will automatically assign itself in the Sequence Signal (ID7) box; select the "i" to open the Locations selector, then select "Not Used" for a signal(s). This is not necessary with the CoPilot system.

2. **Signal(s) are unknown**

If a signal does go on and off but is unknown, then name it "Unknown" and review it later (with the cycle graph or sequence lights functions).

Signals that have been assigned and have lights that go on and off at the wrong time must be corrected. In eDART system version 9.xx software Sensor Locations tool, select the correct signal name. If none of the signal names listed correlate to the signal, then select "Not Used" (or "Unknown" to review it later). For the CoPilot system, assign signals from the dashboard using the machine inputs card.

3. **Injection forward signal**

On some machines the injection forward signal may not perform as specified; the eDART system sequencer can adjust for some of these abnormalities. For example, if the screw run signal is available it will reject additional injection forward on

signals until after the screw stops.

With other problems, such as a half-second variation of the start of injection signal from shot to shot, or signal "bounce" at the beginning that causes the eDART system to read the injection forward was on for a quarter of a second.

In eDART system software version 9.xx, use the "Sequence Settings" "Injection" page:

- If the start of the signal is unreliable, select the "Ignore Injection Forward Sequence Module Input at Start". The eDART will use screw motion (or injection pressure, if no screw) to determine the start.

- If the end of injection is not stable, or does not go off at the end of injection, select the "Ignore Injection Forward Sequence Module Input at End". The eDART will use the falling pressure (corner or threshold) to determine where injection ends.

- If no Screw Run signal is available, then the "Ignore Injection Forward OFF➔ON" setting may need to be adjusted if the injection forward signal comes on twice. Set the "ignore" time long enough so that the eDART system does not detect the second event.

Each of these settings are saved with the machine; the settings only have to be applied once on a machine and are saved with the setup.

ACCEPTABLE SIGNAL SUBSTITUTIONS

1. No injection forward signal

If the injection forward signal is not available the eDART system uses several techniques determine when injection forward is on. In lieu of an injection forward signal, the following may be used as a substitute (in descending order of quality):

- Wired and assigned first stage or second stage sequence input signals

- Screw motion forward/falling edge of injection pressure (detected by eDART system)

- Screw motion forward/screw motion backward for a time (detected by eDART system)

- Injection pressure thresholds (detected by eDART)

- Mold clamped plus a set time to turn on and a set injection forward on time (detected by eDART system)

For CoPilot systems, refer to the **CoPilot® Hardware Installation and Setup Guide**.

2. No mold closed/clamped signal

If no mold closed/clamped signal is available, but both mold opening and mold closing are available, then the sequencer will create the mold closed/clamped signal from those two. It will use the end of mold closing for mold closed/clamped on and the start of mold opening for mold closed/clamped off.

3. No machine-in-manual signal

If a machine-in-semi-auto mode or machine-in-auto mode signal is hard-wired and assigned, then the sequencer inverts it and creates an internal machine-in-manual mode signal.

4. No screw run signal available

If no screw run signal is available, refer to the eDART system version 9.xx software manual, eDART system version 10.xx software manual, or the **CoPilot® Hardware Installation and Setup Guide** for more information and instructions for screw run setup.

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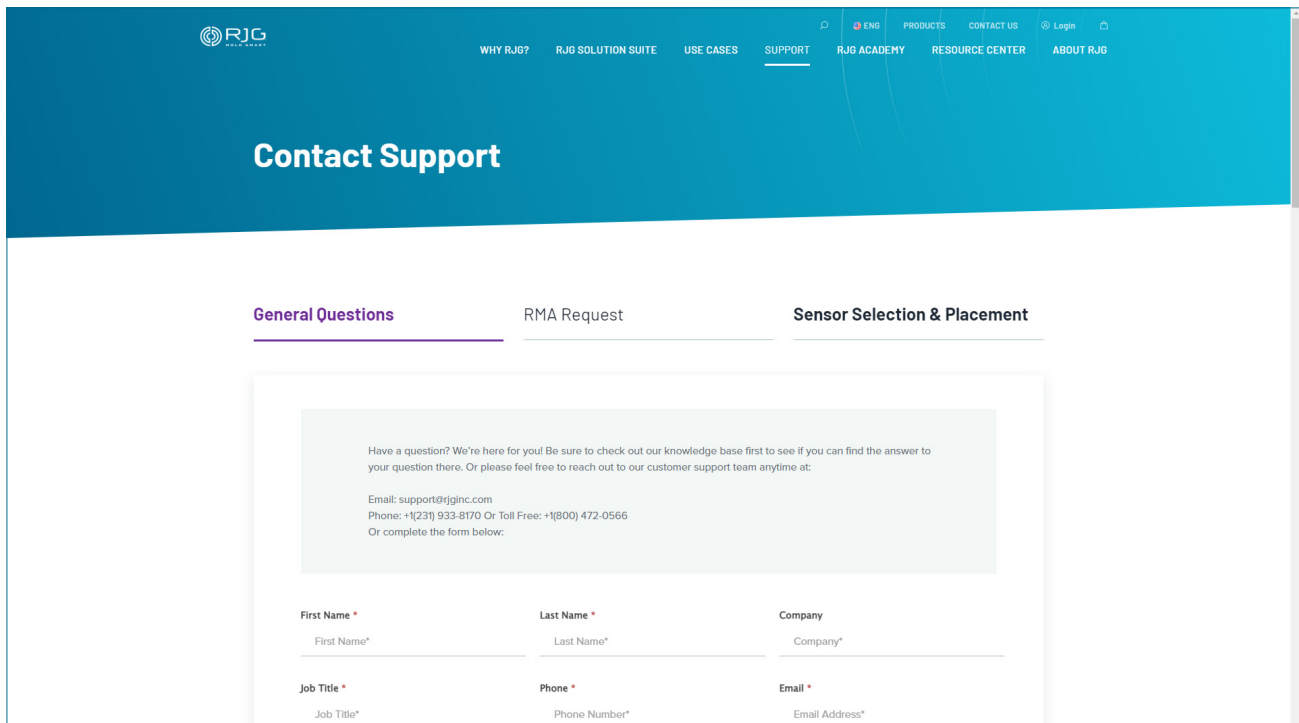
Contact RJG's Customer Support team by phone or email.

RJG, Inc. Customer Support

P: 800.472.0566 (Toll Free)

P: +1.231.933.8170

email: CustomerSupportGroup@rjginc.com

www.rjginc.com/support

NOTES

The shielded sequence module is compatible with other RJG, Inc. products for use with the eDART and CoPilot process control and monitoring system.

COMPATIBLE PRODUCTS

SHIELDED SEQUENCE MODULE CABLE C-ID7-M-3M

The shielded sequence module cable C-ID7-M-3M (**1** at right) cable features a metal sheathing and shielding suited for the heat and stress found in injection molding environments. Designed specifically for use with RJG, Inc.'s machine sequence module ID7-M-SEQ and the eDART or CoPilot System, the C-ID7-M-3M provides a connection from molding machines' sequence output card and the RJG, Inc. ID7-M-SEQ.

LYNX CABLES CE-LX5

The Lynx sensor cable (**2** at right) is a polypropylene-coated cable suited for the heat and stress found in injection molding environments. The cable is available in lengths 11.8–472.4" (0,3–12 m), and can be ordered with straight or 90° fittings. One CE-LX5 is required to interface the ID7-M-SEQ with the eDART or CoPilot system.

SIMILAR PRODUCTS

The following products, similar to the ID7-M-SEQ, are compatible for use with the eDART or CoPilot process control and monitoring systems.

LYNX COMMUNICATIONS ADAPTER DIN/LX-D

The Lynx communications adapter DIN/LX-D (**1** at right)is a shielded, DIN-rail-mounted module that interfaces other RJG, Inc. shielded machine interface modules with the eDART or CoPilot system when the ID7-M-SEQ is not used. This module is shielded to ensure high quality data even in rugged molding environments, and designed to be mounted on standard 35 mm DIN rails often found in machine panels.

LYNX SHIELDED DUAL-RELAY OUTPUT MODULE OR2-M

The Lynx shielded dual-relay output module OR2-M (**2** at right) is a shielded, DIN-rail-mounted module that interfaces the eDART or CoPilot system and sorting equipment or injection molding machines to implement part containment or control transfer. This module is shielded to ensure high quality data even in rugged molding environments, and designed to be mounted on standard 35 mm DIN rails often found in machine panels.

LYNX SHIELDED ANALOG INPUT MODULE IA1-M-V

The Lynx shielded analog input module IA1-M-V (**3** at right)is a shielded, DIN-rail-mounted module that interfaces the eDART or CoPilot system and injection molding machines in order to collect 0–10 V DC signals from analog measurement devices, providing information such as: injection pressure, plastic pressure, screw position, and temperature.

LOCATIONS / OFFICES

USA
RJG USA (HEADQUARTERS)
3111 Park Drive
Traverse City, MI 49686
P +01 231 947-3111
F +01 231 947-6403
sales@rjginc.com
www.rjginc.com

ITALY
NEXT INNOVATION SRL
Milano, Italy
P +39 335 178 4035
sales@it.rjginc.com
it.rjginc.com

MEXICO
RJG MEXICO
Chihuahua, Mexico
P +52 614 4242281
sales@es.rjginc.com
es.rjginc.com

SINGAPORE
RJG (S.E.A.) PTE LTD
Singapore, Republic of
Singapore
P +65 6846 1518
sales@swg.rjginc.com
en.rjginc.com

FRANCE
RJG FRANCE
Arnithod, France
P +33 384 442 992
sales@fr.rjginc.com
fr.rjginc.com

CHINA
RJG CHINA
Chengdu, China
P +86 28 6201 6816
sales@cn.rjginc.com
zh.rjginc.com

GERMANY
RJG GERMANY
Karlstein, Germany
P +49 (0) 6188 44696 11
sales@de.rjginc.com
de.rjginc.com

KOREA
CAEPRO
Seoul, Korea
P +82 02-2113-1870
sales@ko.rjginc.com
www.caepro.co.kr

IRELAND/UK
RJG TECHNOLOGIES, LTD.
Peterborough, England
P +44(0)1733-232211
info@rjginc.co.uk
www.rjginc.co.uk