

General

About Safety Guidelines and Warranties/Metric Conversions	General-2
Terms and Conditions of Sale	General-2
Maintenance of Industrial Control Equipment	General-5

Quick Selection Guide	1
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Introduction to On-Machine™ Solutions	2
On-Machine Overview, Choosing a System, Sample Machine Layouts, Application Considerations	

Connection Systems	3
Cordsets, Patchcords, Y-Cables, Distributions Boxes, Receptacles, Terminal Chambers	

PanelConnect Systems	4
Input and Output Modules, Wiring Systems Cabling, Fusing Accessories	

Safety Connection Systems	5
Distribution Boxes and Splitters Wired for Safety, Shorting Plugs, Mating Receptacles	

Network Media	6
DeviceNet KwikLink™ Flat Media, Round Media, and Accessories; IP67 ControlNet™ Media	

On-Machine Distributed I/O	7
ArmorBlock™ , ArmorBlock MaXum™ , ArmorPoint™	

Catalog Number Index	8
-----------------------------	----------

Sales Offices	9
----------------------	----------

AB Drives

Application Considerations

Selection of Equipment—Because of the variety of uses for the products described in this catalog, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts and layouts shown in this catalog are intended solely for purposes of example. Because there are many variables and requirements associated with any particular installation, Rockwell Automation/Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation/Allen-Bradley Publication SGI-1.1, "Safety Guidelines for the Application, Installation and Maintenance of Solid State Control" (available from your local Rockwell Automation/Allen-Bradley office) describes some important differences between solid-state equipment and electromechanical devices which should be taken into consideration when applying products such as those described in this catalog.

Service and Installation Conditions—Unless otherwise noted, the products described in this catalog are designed to meet "usual service and installation conditions" as defined in NEMA (National Electrical Manufacturers Association) Standards Publication—Part ICS 1-108. Open style devices must be provided with environmental protection by proper mounting in enclosures designed for specific application conditions.

See pages 2–18 through 2–19 of this catalog for information on enclosures and an explanation of the degrees of protection provided by the different types, based on NEMA Standards Publication 250 and IEC Publication 529, as applicable.

Performance Data—Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of accelerated testing at elevated stress levels, and the user should correlate it to actual application requirements. Actual performance is subject to Rockwell Automation/Allen-Bradley WARRANTY and LIMIT OF LIABILITY (see Rockwell Automation/Allen-Bradley Terms and Conditions of Sale).

General Terms and Conditions of Sale

These general terms and conditions of sale only apply to direct sales by the manufacturer or its affiliates. Sales by appointed distributors and other independent authorized resellers will be subject to terms and conditions of sale as may be separately established by each such distributor or reseller. Sales outside of North America, as well as sales of other Rockwell Automation products and services, also may be subject to separate or supplemental terms and conditions of sale. For further information, please consult Rockwell Automation/Allen-Bradley sales office.

General. These general terms and conditions of sale (along with any directly associated written Seller specification or quotation) exclusively will govern the sale or licensing by Seller of all goods and services (including without limitation, hardware, firmware and software products, training, programming, maintenance, engineering, parts and repair services—collectively, the "Products") furnished hereunder. No addition or modification to these terms and conditions will be binding on Seller unless agreed to in writing signed by an authorized representative at Seller's headquarters. Seller objects to other terms and conditions that may be proposed by the customer not otherwise consistent with these or other terms and conditions set forth in Seller's written specification, quotation or order acknowledgment.

Payment Terms. Net thirty (30) days from date of invoice with ongoing approved credit as determined by Seller. Seller reserves the right to suspend any further performance under this agreement or otherwise in the event payment is not made when due. No payment by offset is permitted unless approved by Seller.

Delivery Terms. Delivery terms are Ex Works with respect to shipping costs, risk of loss and title transfer, except that title to all intellectual property rights associated with the Products (e.g., software and firmware) remains with Seller (or its suppliers and licensors), and such Products are made available or licensed only for use by the customer pursuant to this agreement or other Seller license agreement. Acknowledged shipping dates are approximate only and based on prompt receipt of all necessary information from the customer.

Warranty.

- A. **Hardware:** Seller warrants for a period of one (1) year from the date of invoice from Seller or its appointed distributor, as the case may be, that hardware Products furnished hereunder will be of merchantable quality, free from defects in material, workmanship and design. Repaired or replacement Products provided under warranty are similarly warranted for a period of six (6) months from the date of shipment to Customer or the remainder of the original warranty term, whichever is longer.
- B. **Software and Firmware:** Unless otherwise provided in a Seller or third party license agreement, Seller warrants for a period of one (1) year from the date of invoice from Seller or its appointed distributor, as the case may be, that standard software or firmware Products furnished hereunder, when used with Seller-specified hardware, will perform in accordance with published specifications prepared, approved, and issued by Seller's headquarters. Seller makes no representation or warranty, express or implied, that the operation of the software or firmware Products will be uninterrupted or error free, or that the functions contained therein will meet or satisfy the Customer's intended use or requirements. Software and firmware corrections are warranted for a period of three (3) months from the date of shipment to Customer or the remainder of the original warranty term, whichever is longer.
- C. **Factory Repair and Field Exchange:** Seller warrants for a period of six (6) months from the date of invoice from Seller or its appointed distributor, as the case may be, that billable or nonwarranty factory repaired or field exchanged hardware Products furnished hereunder will be free from defects in material and workmanship. Products furnished on an exchange basis may be new or reconditioned.
- D. **Service:** Seller warrants that Products comprised of services, including engineering and custom application programming services, whether provided on a fixed cost or time and material basis, will be performed in accordance with generally accepted industry practices to the extent such services are subject to written acceptance criteria agreed to in advance by Seller. All other warranties relative to provided services are disclaimed.

F. Remedies: Satisfaction of the above warranties will be limited, at Seller's option, to the replacement, repair, reperformance or modification of, or issuance of a credit for the purchase price of the Products involved, and where applicable, only after the return of such Products with Seller's consent. Replacement Products may be new or reconditioned. Any warranty service (consisting of time, travel and expenses related to such services) performed other than at Seller's factory, will be at Customer's expense.

G. General: Warranty satisfaction is available only if (a) Seller is promptly notified in writing and (b) Seller's examination discloses, to its satisfaction, that any alleged defect has not been caused by misuse; neglect; improper installation, operation, maintenance, repair, alteration or modification; accident; or unusual deterioration or degradation of the Products or parts thereof due to physical environment or electrical or electromagnetic noise environment.

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Licensed Software and Firmware—Products comprised of software or firmware may be subject to additional terms and conditions set forth in separate Seller's license agreements that will control to the extent necessary to resolve any conflict with the terms and conditions stated herein. Such Products will not be delivered or made available until the customer also agrees to the terms and conditions of such separate license agreements.

Packing & Marking—Customer-specified packing or marking may be subject to additional charges not otherwise included in the price of the Products.

Weights and Dimensions—Published weights and dimensions are estimates or approximate only and are not warranted.

Quotations—Written quotations are valid for 30 days from issue unless otherwise stated. Verbal quotations expire the same day they are made. All typographical and clerical errors are subject to correction.

Prices—Prices and other information shown in any Seller publication (including product catalogs and brochures) are subject to change without notice and confirmation by specific quotation. Such publications are not offers to sell and are maintained only as a source of general information. The customer will pay or reimburse Seller for all sales, use, excise or similar taxes. Products comprised of time and material services will be provided in accordance with Seller's published service rates (including applicable overtime and travel expenses) in effect as of the date such services are provided, unless otherwise confirmed by Seller's written quotation or order acknowledgment. Billable service time includes travel time to and from the job site and all time Seller's representatives are available for work and waiting (whether on or off the job site) to perform the services.

Changes. Customer-requested order changes, including those affecting the identity, scope and delivery of the Products, must be documented in writing and are subject to Seller's prior approval and adjustments in price, scheduling and other affected terms and conditions. In any event, Seller reserves the right to reject any change that it deems unsafe, technically inadvisable or inconsistent with established engineering or quality guidelines and standards, or incompatible with Seller's design or manufacturing capabilities.

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General Terms and Conditions of Sale

Returns. All returns of Products will be subject to prior Seller approval. Nonwarranty returns of unused and salable Products for credit will be subject to Seller's return policies in effect at the time, including applicable restocking charges and other conditions of return. Products returned under warranty must be properly packed and shipped to Seller-specified locations. Shipping containers must be clearly marked per Seller's instruction and shipped freight prepaid by the customer.

Order Cancellation. An order may be canceled by the customer prior to shipment only by written notice and upon payment to Seller of reasonable cancellation and restocking charges, including reimbursement for direct costs, plus allowances for disruption. Cancellation charges associated with orders for custom Products or Products specifically manufactured to the customer's specification may equal the actual selling price of the Products. Seller has the right to cancel an order for cause at any time by written notice, and Seller will be entitled to cancellation and restocking charges as identified above. No termination by the customer for cause will be effective unless and until Seller has failed to correct such alleged cause within forty-five (45) days after receipt of the customer's written notice specifying such cause.

Force Majeure. Seller will not be liable for any loss, damage or delay arising out of its failure to perform hereunder due to causes beyond its reasonable control, including without limitation, acts of God or the customer, acts of civil or military authority,

fires, strikes, floods, epidemics, quarantine restrictions, war, riots, delays in transportation, or transportation embargoes. In the event of any such delay, Seller's performance date(s) will be extended for that length of time as may be reasonably necessary to compensate for the delay.

Government Clauses and Contracts. No government contract regulations or clauses will apply to the Products or this agreement or act to bind Seller unless specifically agreed to by Seller in writing at Seller's headquarters. Products sold or licensed hereunder are not intended to be used, nor should they be used, in any nuclear-related application either as a "Basic Component" under 10 CFR 21 (United States NRC) or otherwise under similar nuclear laws and regulations of this or any other country.

Export Control. Products and associated materials supplied or licensed under this agreement may be subject to various export laws and regulations. It is the responsibility of the exporter to comply with all such laws and regulations.

Disputes. The parties will attempt in good faith promptly to resolve any dispute arising out of this agreement by negotiations between representatives who have authority to settle the controversy. If unsuccessful, the parties further will attempt in good faith to settle the dispute by nonbinding third-party mediation, with fees and expenses of such mediation apportioned equally to each side. Any dispute not so resolved by negotiation or mediation may then be submitted to a

court of competent jurisdiction in accordance with the terms of this agreement. These procedures are the exclusive procedures for the resolution of all such disputes between the parties.

Governing Law. This agreement and all disputes arising thereunder will be governed by and interpreted in accordance with the internal laws of the state, province or other governmental jurisdiction in which Seller's principal place of business resides, but specifically excluding the provisions of the 1980 UN Convention on Contracts for the International Sales of Goods.

Assignment. This agreement may not be assigned by either party without the written consent of the other, however, consent will not be required for internal transfers and assignments as between Seller and its parent corporations, subsidiaries or affiliates as part of a consolidation, merger or other form of corporate reorganization.

Language. The parties acknowledge that they have required that this agreement be drawn up in English. Les parties reconnaissent avoir exigé la rédaction en anglais du Contrat. In the event of a conflict between the English and other language versions of this agreement, the English version will prevail.

Forever Warranty

Refer to Rockwell Automation/
Allen-Bradley *Proximity Sensors*, *Forever Warranty* publication number
871-SB001B-EN-P which can be found
on www.theautomationbookstore.com

ATTENTION: Servicing energized Industrial Control Equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present. Refer to **National Fire Protection Association Standard No. NFPA70E, Part II and (as applicable) OSHA rules for Control of Hazardous Energy Sources (Lockout/Tagout) and OSHA Electrical Safety Related Work Practices** for safety related work practices, including procedural requirements for lockout-tagout, and appropriate work practices, personnel qualifications and training requirements where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.

Periodic Inspection—Industrial control equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions and adjusted as indicated by experience. An initial inspection within 3 to 4 months after installation is suggested. See National Electrical Manufacturers Association (NEMA) Standard No. ICS 1.3, *Preventive Maintenance of Industrial Control and Systems Equipment*, for general guidelines for setting-up a periodic maintenance program. Some specific guidelines for Rockwell Automation/Allen-Bradley products are listed below.

Contamination—If inspection reveals that dust, dirt, moisture or other contamination has reached the control equipment, the **cause must be eliminated**. This could indicate an incorrectly selected or ineffective enclosure, unsealed enclosure openings (conduit or other) or incorrect operating procedures. Replace any improperly selected enclosure with one that is suitable for the environmental conditions—refer to NEMA Standard No. 250, *Enclosures for Electrical Equipment* for enclosure type descriptions and test criteria. Replace any damaged or embrittled elastomer seals and repair or replace any other damaged or malfunctioning parts (e.g., hinges, fasteners, etc.). Dirty, wet or contaminated control devices must be replaced unless they can be cleaned effectively by vacuuming or wiping. Compressed air is **not** recommended for cleaning because it may displace dirt, dust, or debris into other parts or equipment, or damage delicate parts.

Cooling Devices—Inspect blowers and fans used for forced air cooling. Replace any that have bent, chipped, or missing blades, or if the shaft does not turn freely. Apply power momentarily to check operation. If unit does not operate, check and replace wiring, fuse, or blower or fan motor as appropriate. Clean or change air filters as recommended in the product manual. Also, clean fins of heat exchangers so convection cooling is not impaired.

Hazardous Location Enclosures—

ATTENTION: Explosion hazard. Always disconnect power before opening enclosures in hazardous locations. Close and secure such enclosures before reapplying power.

NEMA Types 7 and 9 enclosures require careful handling so machined flanges do not get damaged. For removable covers, remove the cover and set aside with machined surface up. For hinged covers, open the cover fully and restrain in the full open position if necessary. Clean and examine the flanges on both the body and cover before reassembly. If there are scratches, nicks, grooves or rust on the mating surfaces, replace the body or cover as necessary. Examine all bolts and replace any that have damaged threads. Also check mating threads for damage and replace enclosure if necessary. Covers and bodies of some enclosures are manufactured as matched sets (not interchangeable). The manufacturer should be consulted before replacing a cover or body unless it is specified by the manufacturer as interchangeable.

Operating Mechanisms—Check for proper functioning and freedom from sticking or binding. Replace any broken, deformed or badly worn parts or assemblies according to individual product renewal parts lists. Check for and retighten securely any loose fasteners. Lubricate if specified in individual product instructions.

Note: Rockwell Automation/ Allen-Bradley magnetic starters, contactors and relays are designed to operate without lubrication—**do not** lubricate these devices because oil or grease on the pole faces (mating surfaces) of the operating magnet may cause the device to stick in the “ON” mode. Some parts of other devices are factory lubricated—if lubrication during use or maintenance of these devices is needed, it will be specified in their individual instructions. If in doubt, consult your nearest Rockwell Automation Sales Office for information (see page 9-1).

Contacts—Check contacts for excessive wear and dirt accumulations. Vacuum or wipe contacts with a soft cloth if necessary to remove dirt. Contacts are not harmed by discoloration and slight pitting. Contacts should never be filed, as dressing only shortens contact life. Contact spray cleaners should **not be used** as their residues on magnet pole faces or in operating mechanisms may cause sticking, and on contacts can interfere with electrical continuity. Contacts should only be replaced after silver has become badly worn. Always replace contacts in complete sets to avoid misalignment and uneven contact pressure.

Vacuum Contactors—Contacts of vacuum contactors are not visible, so contact wear must be checked indirectly. Vacuum bottles should be replaced when:

1. The estimated number of operations equals one million, or
2. The contact life line indicator shows need for replacement, or
3. The vacuum bottle integrity tests show need for replacement.

Replace all vacuum bottles in the contactor at the same time to avoid misalignment and uneven contact wear. If the vacuum bottles do not require replacement, check and adjust overtravel to the value listed on the maintenance instructions.

Terminals—Loose connections in power circuits can cause overheating that can lead to equipment malfunction or failure. Loose connections in control circuits can cause control malfunctions. Loose bonding or grounding connections can increase hazards of electrical shock and contribute to electromagnetic interference (EMI). Check the tightness of all terminals and bus bar connections and tighten **securely** any loose connections. Replace any parts or wiring damaged by overheating, and any broken wires or bonding straps.

Arc Hoods—Check for cracks, breaks, or deep erosion. Arc hoods and arc chutes should be replaced if damaged or deeply eroded.

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Maintenance of Industrial Control Equipment

Coils—If a coil exhibits evidence of overheating (cracked, melted or burned insulation), it must be replaced. In that event, check for and correct overvoltage or undervoltage conditions, which can cause coil failure. Be sure to clean any residues of melted coil insulation from other parts of the device or replace such parts.

Batteries—Replace batteries periodically as specified in product manual or if a battery shows signs of electrolyte leakage. Use tools to handle batteries that have leaked electrolyte; most electrolytes are corrosive and can cause burns. Dispose of the old battery in accordance with instructions supplied with the new battery or as specified in the manual for the product.

Pilot Lights—Replace any burned out lamps or damaged lenses.

Photoelectric Switches—The lenses of photoelectric switches require periodic cleaning with a soft dry cloth. Reflective devices used in conjunction with photoelectric switches also require periodic cleaning. Do not use solvents or cleaning agents on the lenses or reflectors. Replace any damaged lenses and reflectors.

Solid State Devices—

ATTENTION: Use of other than factory recommended test equipment for solid state controls may result in damage to the control or test equipment or unintended actuation of the controlled equipment. Refer to paragraph titled HIGH VOLTAGE TESTING.

Solid state devices require little more than a periodic visual inspection. Discolored, charred or burned components may indicate the need to replace the component or circuit board. Necessary replacements should be made only at the PC board or plug-in component level. Printed circuit boards should be inspected to determine whether they are properly seated in the edge board connectors. Board locking tabs should also be in place. Solid state devices must also be protected from contamination, and cooling provisions must be maintained — refer to paragraphs titled CONTAMINATION and COOLING DEVICES on previous page. Solvents should not be used on printed circuit boards.

High Voltage Testing—High voltage insulation resistance (IR) and dielectric withstanding voltage (DWV) tests should not be used to check solid state control equipment. When measuring IR or DWV of electrical equipment such as transformers or motors, a solid state device used for control or monitoring must be disconnected before performing the test. Even though no damage is readily apparent after an IR or DWV test, the solid state devices are degraded and repeated application of high voltage can lead to failure.

Locking and Interlocking

Devices—Check these devices for proper working condition and capability of performing their intended functions. Make any necessary replacements only with Rockwell Automation/Allen-Bradley renewal parts or kits. Adjust or repair only in accordance with Rockwell Automation/Allen-Bradley instructions.

Maintenance After a Fault

Condition—Opening of the short circuit protective device (such as fuses or circuit breakers) in a properly coordinated motor branch circuit is an indication of a fault condition in excess of operating overload. Such conditions can cause damage to control equipment. **Before restoring power**, the fault condition must be corrected and any necessary repairs or replacements must be made to restore the control equipment to good working order. Refer to NEMA Standards Publication No. ICS-2, Part ICS2-302 for procedures.

Replacements—Use only replacement parts and devices recommended by Rockwell Automation/Allen-Bradley to maintain the integrity of the equipment. Make sure the parts are properly matched to the model, series and revision level of the equipment.

Final Check Out—After maintenance or repair of industrial controls, always test the control system for proper functioning under controlled conditions that avoid hazards in the event of a control malfunction.

For additional information, refer to NEMA ICS 1.3, PREVENTIVE MAINTENANCE OF INDUSTRIAL CONTROL AND SYSTEMS EQUIPMENT, published by the National Electrical Manufacturers Association, and NFPA70B, ELECTRICAL EQUIPMENT MAINTENANCE, published by the National Fire Protection Association.