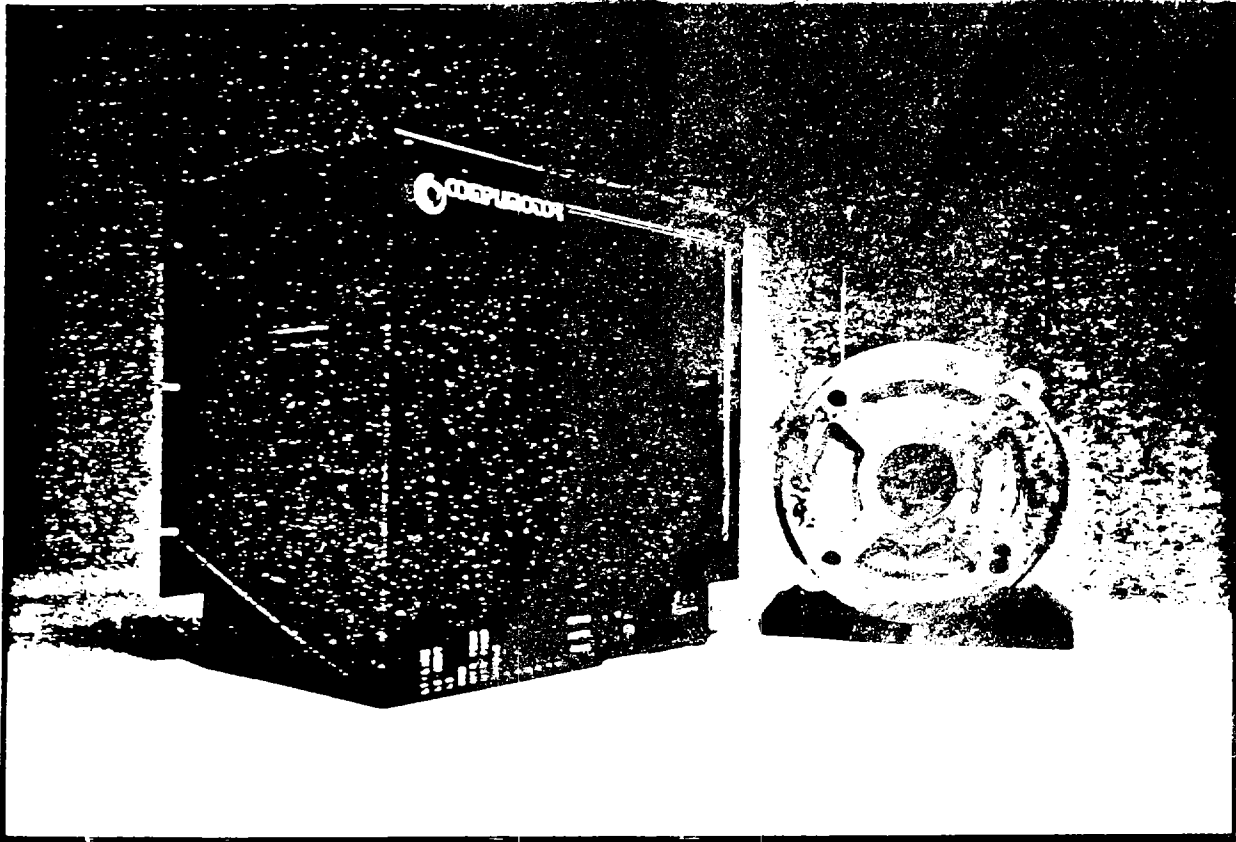


Compumotor

Bulletin OM-8200-1

Operator's Manual



I Series Motor/Drive

Parker Hannifin Corporation



I-Series Y-Revision Operator's Manual

COMPUMOTOR CORPORATION

I-Series Operator's Manual

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INTRODUCTION1. Description

The I-Series is a complete AC Servo positioning system. Ready to run, the I-Series system consists of an AC servomotor, brushless resolver feedback, and a microprocessor based closed loop drive amplifier. Digital electronics simplify operation and maintenance and improve performance.

The I-Series drive accepts digital STEP and DIRECTION inputs to control position and velocity. The onboard microprocessor monitors both the pulse inputs and the resolver feedback, then determines the proper voltage levels to apply to the motor. The system offers speeds to 3000 RPM, and torques to 175 lb.-in. (2800 oz.-in.) continuous and 350 lb.-in. (5500 oz.-in.) peak.

Closed-loop performance is simplified by microprocessor control and a sophisticated servo algorithm. All servo performance parameters are stored in non-volatile EEPROM memory, eliminating analog potentiometer adjustments required in conventional systems. I-Series Motor/Drives are supplied as packaged systems, factory compensated for typical load and performance requirements.

I-Series systems are readily installed and operated by personnel with little or no training in servo controls. In most applications, no adjustments will be required. A simple pushbutton adjustment is provided to alter factory set servo constants for special loads. In addition, an RS-232 interface is provided to access all servo parameters for the few cases where critical adjustment is required.

The power amplifier section of I-Series drives utilizes a proprietary MOSFET hybrid power module for high frequency (20 kHz) pulse width modulation (PWM) current control. This innovative design improves efficiency, regulation and low speed smoothness, and results in virtually inaudible operation.

In summary, the I-Series system features include:

- * AC servomotor
- * Brushless resolver feedback
- * Speeds to 3000 RPM
- * Torques to 350 lb.-in. (5500 oz.-in.)
- * 4096 steps per revolution standard
- * 16,384 steps per revolution optional (35 rps max. speed)
- * Microprocessor control; no drift, no analog pots to adjust
- * Fan cooled drive enclosure
- * Inaudible 20 kHz PWM switching frequency
- * Accepts digital STEP and DIRECTION inputs
- * Servo parameters factory set and stored in non-volatile EEPROM memory
- * High noise immunity due to optical isolation and brushless resolver technology
- * Simple pushbutton adjustment of servo compensation
- * LED Fault Indicators

2. Pre Installation

Please read this entire manual carefully before attempting to install or operate the I-Series system. If any questions should arise which are not covered to your satisfaction in this manual, please call Compumotor for assistance.

INSPECTION

Your I-Series should be inspected upon receipt for obvious damage to its shipping container. Report any such damage to the shipping company as soon as possible, as Compumotor cannot be held responsible for damage incurred in shipment. The I-Series should then be carefully unpacked and inspected for the following items to be present and in good condition.

1. I-Drive unit
2. Motor
3. Motor cable (round MS connector one end, 7 leads with ring terminals installed on other end).
4. Resolver cable (round MS connector one end, 9 Pin D connector other end)
5. This manual

WARRANTY

Your I-Drive is warranted against manufacturing defects for one year from the date of purchase. Should you have questions about operating the I-Drive, your Compumotor representatives and distributors stand ready to support your individual needs. Call Compumotor Corporation at the number listed below to get the name, address and phone number of the Compumotor representative nearest you.

Should return of your Motor Controller be required to effect repairs or upgrades, do the following:

1. Get the serial number and the model number of the defective unit, and a purchase order number to cover repair costs in the event the unit is determined to be out of warranty by Compumotor upon inspection.
2. Call Compumotor for a Return Material Authorization Number (RMA) at 800-358-9068 except in California. In California, call collect at 707-778-1244.
3. Ship the unit to:
Compumotor Corporation
1179 N. McDowell Blvd.
Petaluma, CA 94952
Attn: RMA# xxxxxxxx

INSTALLATION AND HOOKUP**1. General**

Safety is of primary importance when installing a motion control system. This section outlines installation guidelines with the safety of the operator and the equipment in mind. The installer of this equipment should become familiar with this section and with local and national codes which pertain to installation of electrical equipment before attempting the installation.

2. System Installation Recommendations

Special attention should be given to the environment in which the equipment will be operated, the layout and mounting, and the wiring and grounding practices used, to ensure trouble free operation. These recommendations are intended to aid the user in easily and safely integrating Compumotor equipment in his manufacturing facility.

Industrial environments often contain conditions which may adversely affect solid state equipment. Electrical noise, atmospheric contamination, or excess heat may be generated by other equipment in use.

A. Electrical Noise

When an I-Series system will be operated in an environment where there is an excess amount of electrical noise, special care must be taken to eliminate sources of possible noise interference. Potential sources of electrical noise include inductive devices such as solenoids, relays, motors, and motor starters when operated by a hard contact.

Noise suppression may be necessary when these types of devices are connected to the same AC power source or are in close proximity to electronic equipment. The illustration below shows some recommended suppression devices for most small loads. For best results these should be installed as close as possible to the inductive load.

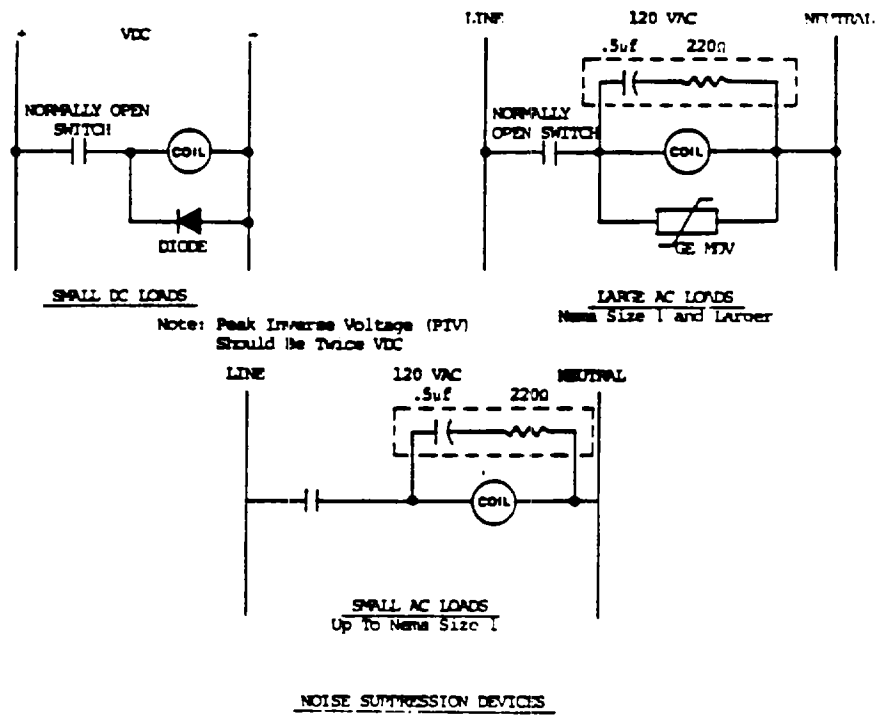


Figure 1. Recommended Supression For Small Inductive Loads

B. Enclosure Considerations

The I-Drive should generally be installed in an enclosure to protect it against atmospheric contaminants such as oil, moisture, and dirt. The National Electrical Manufacturers Association has established standards which define the degree of protection provided by electrical enclosures. The enclosure should conform to NEMA Type 12 standards if the intended environment is industrial in nature and contains airborne contaminants. Proper layout of components is required to ensure sufficient cooling of equipment within the enclosure.

C. Grounding Information

Proper grounding of electrical equipment is essential to assure the safety of personnel. The affects of electrical noise due to electromagnetic interference (EMI) can also be reduced by grounding. All Compumotor equipment should be properly grounded. A good source of information on grounding requirements is the National Electrical Code published by the National Fire Protection Association of Boston, Massachussets. Grounding should also conform to applicable local codes and ordinances.

In general, all components and enclosures must be connected to earth ground through a grounding electrode conductor to provide a low-impedence path for ground fault or noise induced currents. All earth ground connections must be continuous and permanent.

Components and mounting surfaces should be prepared prior to installation so that good electrical contact is made between mounting surfaces of equipment and enclosure. Paint should be removed from equipment surfaces where they will be bolted to a panel and star washers should be used to assure a solid bare metal contact. An 8 guage or larger copper wire should be used to connect each component from a mounting stud to a central ground bus. Permanent ground connections should be made to only one mounting bracket on each piece of equipment. If this method is used, there should be no connection to the ground terminal of the AC Power connector.

For temporary installations, or when the grounding method described above cannot be implemented, the GROUND terminal on the AC power connector must be connected to earth ground.

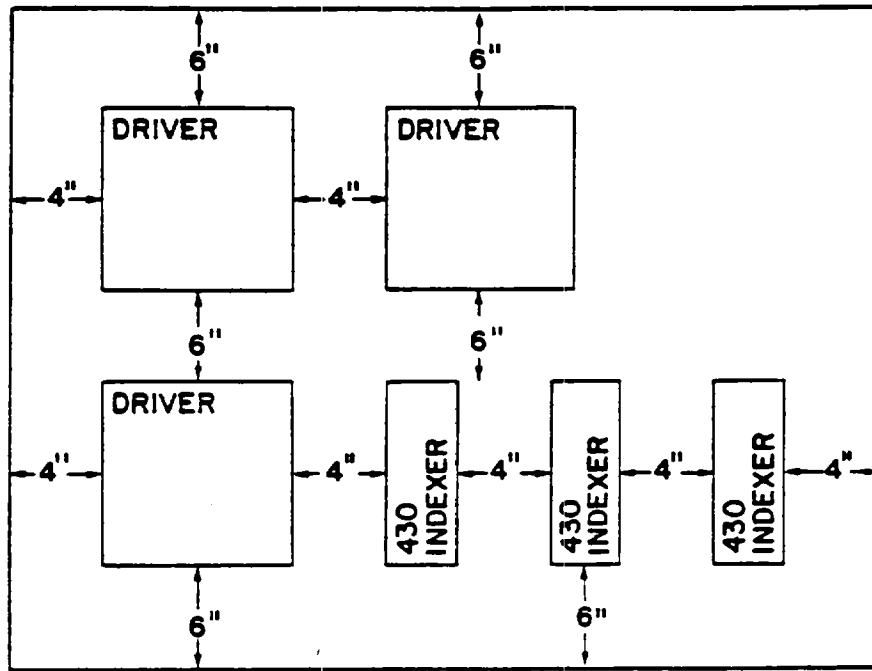
3. Mounting

A. Panel Layout

A good panel layout is essential for trouble free operation of the I-Drive. The I-Drive relies on fan cooling to maintain the temperature within its operating range. Panel mounting requires consideration of this to allow sufficient space for unrestricted airflow over the heatsink. Because the fan draws air upward over the heatsink, the air directly beneath the unit must not exceed the recommended maximum ambient temperature of 50 degrees C. The limiting factor is the heatsink temperature, which must be no greater than 65°C. The I-Drive has temperature sensors on each amplifier board which should prevent overheating. LED indicators on each board will indicate an overtemperature condition.

The following rules should be observed when mounting I-Series drives in an enclosure:

1. The vertical distance between the I-Drive and other equipment or the top and bottom of the enclosure should be no less than 6 inches.
2. The horizontal distance between the I-Drive and other equipment or the side walls of the enclosure should be no less than 4 inches.
3. Because motor/drive products produce more heat than indexers, drives should not be mounted directly below indexers if possible.
4. Large heat producing equipment should not be mounted directly beneath the I-Drive.



PANEL LAYOUT RECOMMENDATIONS

Figure 2. Recommended Panel Layout Guidelines

B. Panel Mounting

The I-Drive has "L" shaped mounting brackets, notched to accept screws on either end to facilitate mounting to flat panel surfaces. The unit should be securely mounted to prevent it from moving unexpectedly, as this could cause an unsafe condition to occur, and could lead to damage of the I-Drive.

CAUTION

The high voltage connections--both 110 VAC line power and motor drive power--have voltages present on them which are hazardous to personnel and could damage other electrical equipment. **Caution** should be used in the installation and operation of the I-Drive so that this danger is minimized.

C. Motor Mounting

When mounting a servo motor, several factors require important consideration to ensure long life and trouble free operation. This section provides useful information intended to help in the proper installation of the I- Series motor.

Shaft Misalignments -- Drive line component tolerances will always cause misalignments between the ends of coupled shafts. The misalignments that can occur include parallel, angular and end float. They can and will exist in any combination.

Parallel misalignment is the offset of two mating shaft centerlines although the centerlines remain parallel to each other. Angular misalignment is when two shaft centerlines intersect at some angle other than zero degrees. End float is a change in the relative distance between the ends of the two shafts.

Flexible couplings are used to accommodate these misalignments and to transmit the desired torque. The coupling manufacturer should be consulted to assure that the coupling is being used within its ratings; both for torque capacity and misalignment capabilities.

Coupling Types — Shaft couplings may be divided into three types; single-flex, double flex and rigid. Like a hinge, a single flex coupling accepts angular misalignment only. A double-flex coupling accepts both angular and parallel misalignments. Both types, depending on their design, may or may not accept end play. A rigid coupling cannot compensate for any misalignment.

Whenever two shafts are joined that are fixed in the radial and angular direction, a double-flex coupling should be used. A single-flex coupling should not be used because it does not permit any parallel misalignment and the only compensation for parallel misalignment will be by bending the shafts, which will cause excessive bearing loads and premature failure.

When a single-flex coupling is used, one and only one of the shafts must be free to move in the radial direction without constraint. A double -flex coupling should not be used in this situation because it will allow too much freedom and rotate eccentrically, which will cause large vibrations and immediate failure.

For situations other than those described here or if you have any questions regarding proper motor installation, please contact Compumotor for assistance.

4. Wiring

WARNING

Be certain that all AC power is disconnected before attempting to do any wiring. The wiring between the motor and I-Drive should be done with AC power disconnected as there are life threatening voltages on the motor when energized.

A. Motor Connections

The I-Drive is supplied with a preassembled motor cable with an MS type connector on the motor end, and 7 leads with ring terminals on the drive end. This cable should be attached to both the motor and the drive before the AC power is connected. The motor connections on the I-Series drive are made to a screw terminal block on the lower left front panel. The terminals are each marked with a color code corresponding to the appropriate wire color.

The standard cable supplied with the I-Drive is 25 feet in length. If you need a longer length cable it may be purchased from Compumotor in lengths up to 100 feet. If you wish to make up your own cable, 14 gauge or larger wire should be used for lengths up to 100 feet. Lengths above 100 feet are not recommended.

Contact Compumotor for further details about configuring the I-Drive for situations other than those provided for at the factory.

B. Resolver Connections

A preassembled 25 foot cable is supplied for connecting the resolver to the I-Drive. This cable has an MS style connector on the motor/resolver end and a 9-pin D type connector on the drive end.

The MS type connector should be connected to the motor mounted resolver connector and securely tightened. The 9-pin D connector should be connected to the mating resolver connector on the I-Drive and secured with the two captive mounting screws.

C. Line Power Connections

AC power is connected to the screw terminal connector on the lower left front panel. The AC power connection wire should be at least 14 guage stranded wire. The wires should be connected to the screw terminals as follows:

120 VAC single-phase power,

<u>Terminal</u>	<u>I-Drive</u>	<u>Wire color</u>
L1	120 VAC LINE	Black (blue)
L2	120 VAC NEUT	White (brown)
L3	N.C.	
GND	AC GND	Green (green with yellow)

120 VAC three-phase power,

<u>Terminal</u>	<u>I-Drive</u>	<u>Function</u>
L1	120 VAC 1	120 VRMS, line 1
L2	120 VAC 2	120 VRMS, line 2
L3	120 VAC 3	120 VRMS, line 3
GND	AC GND	Earth ground (green or green with yellow)

Note: See section 2.C for grounding recommendations.

Be careful to ensure that the leads do not short to one another and there are no loose strands that are not captured by the terminal connection for each lead.

D. Indexer Connections

The Indexer connector on the I-Drive is a 25-pin D connector which is compatible with Indexer to Motor/Drive cables supplied with all Compumotor Indexers shipped after 02/22/85. Simply connect the cable from the indexer you are using to the Indexer connector on the I-Drive.

If you are using an indexer other than Compumotor, STEP+ and STEP- both must be connected to run the motor. DIRECTION+ and DIRECTION- need only be connected if the motor needs to be run bi-directionally. SHUTDOWN+ and SHUTDOWN- must be connected if the motor is to be shutdown remotely without powering down the drive. If a Compumotor indexer is used, a pre-fabricated indexer to I-Drive cable is provided with the indexer. Refer to the Specifications sections for STEP and DIRECTION electrical characteristics.

E. Auxilliary Connector Connections

The I-Drive has two signals available on the auxilliary connector, DRIVE ENABLE and FAULT.

The DRIVE ENABLE input allows external devices to enable or disable the I-Drive. This is typically where hardwired end of travel switches would be connected. A customer supplied voltage of 5 to 30 VDC must be connected across DRIVE ENABLE and DRIVE ENABLE RETURN to turn on the optical isolator. This input consists of a 500 ohm resistor in series with the opto diode and requires 7 to 60 mA current. The I-Drive is shipped with this input disabled, which allows operation with no user connections. An RS-232 command allows the user to enable this input. When enabled presence of current is required to enable the drive.

The FAULT output provides an indication of an overcurrent, overtemperature or shortcircuit condition in the amplifier section of the I-Drive. This output is identical in function to the DRIVE FAULT output on the indexer connector and the DRIVE FAULT LED indicator, except that it is not activated by shutdown commands for the drive on the indexer. This is an open collector device, with the collector tied to the FAULT terminal and the emitter tied to FAULT RETURN. It is capable of sinking up to 100 mA from a user supplied, 5 to 30 VDC source.

F. RS-232 Connector

The RS-232 connector is a standard 25-pin D connector and is electrically compatible with the IEEE specifications for RS-232C communications. The I-Drive has a three wire implementation of this interface and provides RECIEVE DATA (pin 2), TRANSMIT DATA (pin 3), and GROUND (pin 7) signals on the connector.

The communication format is fixed at 1200 baud, 8 data bits, 2 stop bits, and no parity.

5. Fuses

The I-Drive uses four fuses. Three for AC power (mounted internally), and one for internal circuit protection. Should the I-Drive fail to function at all, check each of the 120 VAC LINE fuses.

NOTE

Examining the AC power fuses will require partial disassembly of the I-Drive enclosure. A continuity tester will be required to verify fuse integrity. Remove AC power before disassembly of the I-Drive. Refer to Appendix E for more information.

The I-Drive includes an over-voltage crowbar circuit which will cause the AC line fuse(s) to fail if an over-voltage fault is detected. This circuit protects against misapplied input voltages, such as 220 VAC and internal circuit failures. Should any of these fuses fail, Contact your nearest Compumotor representative for assistance.