BALDOR
MOTORS AND DRIVES

LinStep+ Single–Axis Microstepping Indexer/Driver

Installation & Operating Manual

7/01

MN1853

Table of Contents

Section 1
General Information 1-1
CE Compliance 1-1
Limited Warranty 1-1
Product Notice 1-2
Safety Notice 1-2
Section 2
Product Overview 2-1
Section 3
Receiving and Installation 3-1
Receiving & Inspection 3-1
Location Considerations 3-1
Power Dissipation 3-1
Mechanical Installation 3-1
Electrical Installation 3-2
System Grounding 3-2
Power Disconnect 3-3
Protection Devices 3-3
Power Connections 3-4
RS232/Keypad Installation 3-6
RS–232 PC Connections 3-7
RS485 PC Connections 3-9
Discrete I/O Connections 3-11
Limits Connections 3-11
Encoder Connections 3-12
Motor Connections 3-13
LXOpto 44 and 88 3-14
DB25 Pin to Screw Terminal Converter 3-15
PNP Converter 3-15
Start-Up Procedure 3-16
Power Off Checks 3-16
Power On Checks 3-16

Section 4
Keypad Operation 4-1
Overview 4-1
Run Menu 4-3
JOG Menu 4-3
Edit Menu 4-4
PROG 4-4
Setup 4-8
POS 4-9
List 4-9
HELP Menu 4-10
COPY Menu 4-10
PROG 4-10
TO PAD 4-10
FROM 4-11
DEL Menu 4-11
Section 5
Setup 5-1
Overview 5-1
Configure Motor 5-2
Configure Encoder 5-4
Configure Your Application 5-6
Configure the I/O 5-8
Configure the Optional LXOPTO 44/88 5-12
Configure the Output States 5-12
Configure End of Travel Switch Polarity 5-13
Configure JOG Parameters 5-13
Configure HOME Parameters 5-14
Configure Power–up Program 5-16
Configure Serial Communications 5-17
Configure Miscellaneous Setup Parameters 5-18
Section 6
Keypad Programming 6-1
Commands 6-1
Helpful Hints 6-24
Variables 6-25
Arithmetic Operands and Equations 6-29
Boolean Operators 6-29
Logical Operators 6-30
Increment/Decrement Variables 6-30
Expressions 6-30
Other Programming Samples 6-30

Section 7
Troubleshooting 7-1

Section 8
Specifications & Product Data 8-1
Identification 8-1
General Specifications 8-2
Dimensions 8-3

Section 9
CE Guidelines 9-1
CE Declaration of Conformity 9-1
EMC – Conformity and CE – Marking 9-1
EMC Installation Instructions 9-3

Appendix A A-1
Programming Template A-1
Remote Keypad Mounting Template A-4

Section 1
General Information

Baldor makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of fitness for any particular purpose. The information in this document is subject to change without notice. Baldor assumes no responsibility for any errors that may appear in this document.

Microsoft and MS–DOS are registered trademarks, and Windows is a trademark of Microsoft Corporation.

UL and cUL are registered trademarks of Underwriters Laboratories.

CE Compliance

A custom unit may be required, contact Baldor. Compliance to Directive 89/336/EEC is the responsibility of the system integrator. A control, motor and all system components must have proper shielding, grounding, and filtering as described in MN1383. Please refer to MN1383 for installation techniques for CE compliance. For additional information, refer to Sections 3 and 9 of this manual.

Limited Warranty

For a period of two (2) years from the date of original purchase, BALDOR will repair or replace without charge controls and accessories which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. BALDOR shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, BALDOR's total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to BALDOR with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses.

Goods may be returned only with written notification including a BALDOR Return Authorization Number and any return shipments must be prepaid.

Product Notice Intended use:

These drives are intended for use in stationary ground based applications in industrial power installations according to the standards EN60204 and VDE0160. They are designed for machine applications that require 2 phase stepper motors.

These drives are not intended for use in applications such as:

- Home appliances
- Mobile vehicles
- Ships
- Airplanes

Unless otherwise specified, this drive is intended for installation in a suitable enclosure. The enclosure must protect the control from exposure to excessive or corrosive moisture, dust and dirt or abnormal ambient temperatures. The exact operating specifications are found in Section 8 of this manual.

The installation, connection and control of drives is a skilled operation, disassembly or repair must not be attempted.

In the event that a control fails to operate correctly, contact the place of purchase for return instructions.

Safety Notice: This equipment contains high voltages. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

- System documentation must be available at all times.
- Keep non-qualified personnel at a safe distance from this equipment.
- Only qualified personnel familiar with the safe installation, operation and maintenance of this device should attempt start-up or operating procedures.
- Always remove power before making or removing any connections to this control.

PRECAUTIONS: Classifications of cautionary statements.

⚠ **WARNING:** **Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.**

⚠ **Caution:** **Indicates a potentially hazardous situation which, if not avoided, could result in damage to property.**

Continued on next page.

PRECAUTIONS:

⚠ **WARNING:** **Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected and there is no high voltage present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury.**

⚠ **WARNING:** **Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.**

⚠ **WARNING:** **Be sure all wiring complies with the National Electrical Code and all regional and local codes or CE Compliance. Improper wiring may cause a hazardous condition.**

⚠ **WARNING:** **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury.**

⚠ **WARNING:** **Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Electrical shock can cause serious or fatal injury.**

⚠ **WARNING:** **Improper operation may cause violent motion of the motor and driven equipment. Be certain that unexpected movement will not cause injury to personnel or damage to equipment.**

⚠ **WARNING:** **Motor circuit may have high voltage present whenever AC power is applied, even when motor is not moving. Electrical shock can cause serious or fatal injury.**

⚠ **WARNING:** **If a motor is driven mechanically, it may generate hazardous voltages that are conducted to its power input terminals. The enclosure must be grounded to prevent a possible shock hazard.**

⚠ **WARNING:** **A DB Resistor may generate enough heat to ignite combustible materials. To avoid fire hazard, keep all combustible materials and flammable vapors away from brake resistors.**

⚠ **WARNING:** **The user must provide an external hard-wired emergency stop circuit to disable the control in the event of an emergency.**

⚠ **Caution:** **To prevent equipment damage, be certain that the input power has correctly sized protective devices installed as well as a power disconnect.**

⚠ **Caution:** **Avoid locating the control immediately above or beside heat generating equipment, or directly below water or steam pipes.**

⚠ **Caution:** **Suitable for use on a circuit capable of delivering not more than the RMS symmetrical short circuit amperes listed here at rated voltage.**

Horsepower	RMS Symmetrical Amperes
1–50	5,000

Continued on next page.

⚠ **Caution:** **To prevent keypad damage, be sure keypad mounting screws do not extend more than 0.2 (5) into keypad assembly.**

⚠ **Caution:** **Avoid locating the control in the vicinity of corrosive substances or vapors, metal particles and dust.**

⚠ **Caution:** **Baldor recommends not using "Grounded Leg Delta" transformer power leads that may create ground loops and degrade system performance. Instead, we recommend using a four wire Wye.**

⚠ **Caution:** **Logic signals are interruptible signals; these signals are removed when power is removed from the drive.**

⚠ **Caution:** **The safe integration of the driver into a machine system is the responsibility of the machine designer. Be sure to comply with the local safety requirements at the place where the machine is to be used. In Europe this is the Machinery Directive, the ElectroMagnetic Compatibility Directive and the Low Voltage Directive. In the United States this is the National Electrical code and local codes.**

⚠ **Caution:** **Drivers must be installed inside an electrical cabinet that provides environmental control and protection. Installation information for the drive is provided in this manual. Motors and controlling devices that connect to the driver should have specifications compatible to the drive.**

⚠ **Caution:** **Do not tin (solder) exposed wires. Solder contracts over time and may cause loose connections.**

⚠ **Caution:** **Electrical components can be damaged by static electricity. Use ESD (electro-static discharge) procedures when handling this control.**

⚠ **Caution:** **Do not connect or disconnect motor wires from the control while power is on. If motor leads are disconnected while the control is powered up, damage to the control may result.**

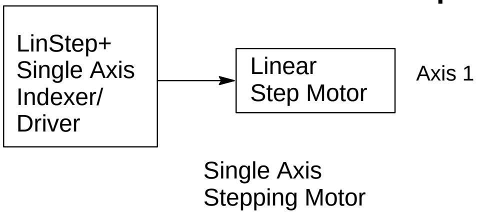
Section 2
Product Overview

Overview

The design of LinStep and LinStep+ microstepping motor drivers (also called a driver or control) and the internal cooling tunnel are revolutionary. These drivers consume less panel space than other controls and keep internal electronics cool and clean for years of reliable performance and operation. LinStep+ single and dual–axis drivers are used with Baldor motion controls and other popular stepper controllers that provide step and direction (or CW/CCW step pulses) . They are ideally suited to control Baldor single and dual–axis linear stepping motors. Figure 2-1 shows how the LinStep+ driver is placed in a linear stepper motor system.

The open loop linear stepper motor provides the most economical linear motor positioning solution. There are two types of linear stepper motors: a single–axis linear stepper motor and the compact dual–axis linear stepper motor. Linear stepper motors include the motor, positioning system and bearings in two components: a moving forcer and a stationary platen.

Figure 2-1 Motion Control with LinStep+



Linear stepper motors move in discrete incremental moves called steps. The size of each step is determined by the spacing of the teeth in the platen and how the coils are energized. Baldor 2–phase motors travel 0.010 inches (0.254mm) in a single full step yielding 100 steps per inch. Baldor 4–phase motors travel 0.005 inches (0.127mm) in a step. When the coils are energized in a predetermined pattern, the forcer will move down the platen. Reversing the pattern will reverse the direction of travel. The microstep frequency determines the velocity of the forcer. Linear stepper motors produce their maximum force at zero speed. As speed increases the ability to switch winding current decreases due to motor inductance. This results in lower forces at higher speeds.

Contact your local Baldor distributor or sales representative for assistance with sizing and compatibility. Custom motors or motors not manufactured by Baldor may be used. Please contact your local Baldor distributor or sales representative for assistance.

Motors

Baldor LinStep+ Drivers are compatible with many Linear Stepper motors from Baldor and other manufacturers. Compatible Baldor motors include: (refer to BR1800 for additional motor information).

- LMSS Series Single Axis
- LMDS Series Dual Axis

Section 3
Receiving and Installation

Receiving & Inspection

Baldor Drivers are thoroughly tested at the factory and carefully packaged for shipment. When you receive your driver, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your driver.
2. Remove the driver from the shipping container and remove all packing materials. The container and packing materials may be retained for future shipment.
3. Verify that the part number you received is the same as the part number listed on your purchase order.
4. Inspect for external physical damage that may have been sustained during shipment and report any damage immediately to the commercial carrier that delivered your driver.
5. If the driver is to be stored for several weeks before use, be sure that it is stored in a location that conforms to published storage humidity and temperature specifications stated in this manual.

Location Considerations

The location of the driver is important. Installation should be in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. Exposure to these can reduce the operating life and degrade performance of the driver.

Several other factors should be carefully evaluated when selecting a location for installation:

1. For effective cooling and maintenance, the driver should be mounted on a smooth, non-flammable vertical surface.
2. At least 3 inches (75mm) top and bottom clearance must be provided for air flow. Between drivers (each side), allow at least 0.1 inch (2.5mm).
3. **Altitude derating**. Up to 3300 feet (1000 meters) no derating required. Derate the continuous and peak output current by 1.1% for each 330 (100) above 3300 feet. Maximum altitude is 8300 (2540m).
4. **Temperature derating**. From 0°C to 40°C ambient no derating required. Above 40°C, derate the continuous and peak output current by 2.5% per °C above 40°C. Maximum ambient is 50°C.

Power Dissipation

Cooling requirements can be determined if you know the maximum (or continuous) current output from the microstepping driver, I_D. Calculate heat dissipation, W_{Diss} as follows:

$W_{Diss} = 5 + 3.4I_D + 0.15I_D^2$

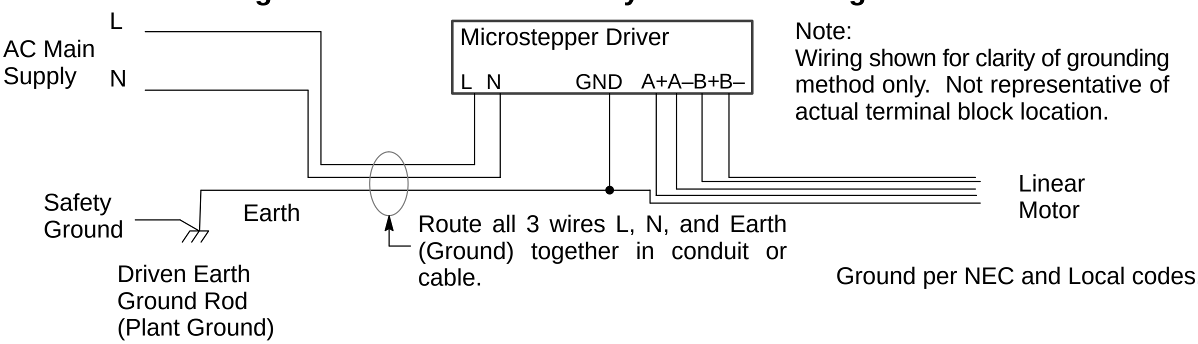
Mechanical Installation

Mount the driver to the mounting surface. The driver must be securely fastened to the mounting surface by the driver mounting holes. The location of the mounting holes is shown in Section 8 of this manual. Use #8 (M4) cap screws.

Electrical Installation All interconnection wires between the driver, AC power source, motor, host driver and any operator interface stations should be in metal conduits. Use listed closed loop connectors that are of appropriate size for wire gauge being used. Connectors are to be installed using crimp tool specified by the manufacturer of the connector. Only class 1 wiring should be used.

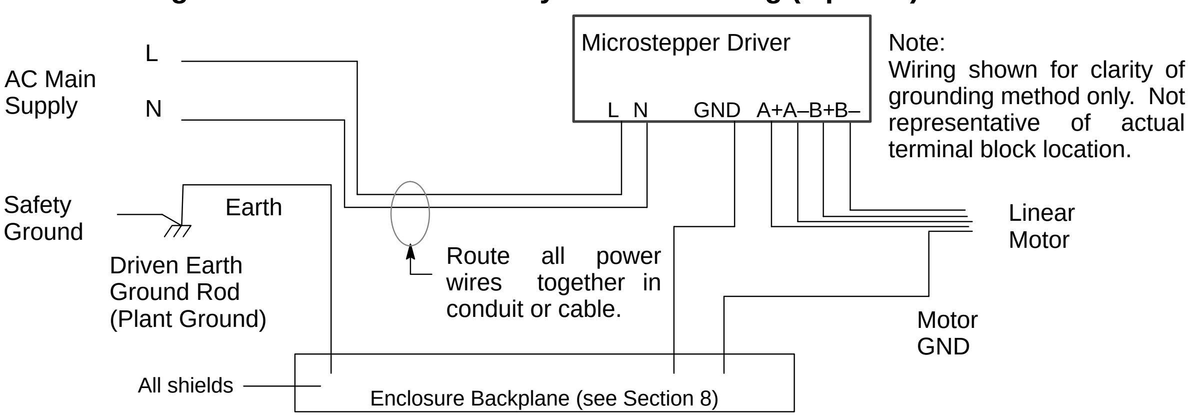
System Grounding Baldor drivers are designed to be powered from standard single phase lines that are electrically symmetrical with respect to ground. System grounding is an important step in the overall installation to prevent problems. The recommended grounding method is shown in Figure 3-1 for UL compliant systems (Figure 3-2 for CE compliant systems).

Figure 3-1 Recommended System Grounding for UL



Note: Use shielded cable for driver signal wires. Route driver signal wires in conduit. These wires must be kept separate from power and motor wires.

Figure 3-2 Recommended System Grounding (1 phase) for CE



Note: Use shielded cable for driver signal wires. Route driver signal wires in conduit. These wires must be kept separate from power and motor wires.

System Grounding Continued

Ungrounded Distribution System

With an ungrounded power distribution system it is possible to have a continuous current path to ground through the MOV devices. To avoid equipment damage, an isolation transformer with a grounded secondary is recommended.

Input Power Conditioning

Certain power line conditions must be avoided. An AC line reactor or an isolation transformer may be required for some power conditions.

- If the feeder or branch circuit that provides power to the driver has permanently connected power factor correction capacitors, an input AC line reactor or an isolation transformer must be connected between the power factor correction capacitors and the driver.
- If the feeder or branch circuit that provides power to the driver has power factor correction capacitors that are switched on line and off line, the capacitors must not be switched while the driver is connected to the AC power line. If the capacitors are switched on line while the driver is still connected to the AC power line, additional protection is required. TVSS (Transient Voltage Surge Suppressor) of the proper rating must be installed between the AC line reactor or an isolation transformer and the AC input to the driver.

Power Disconnect

A power disconnect should be installed between the input power service and the driver for a fail–safe method to disconnect power. The driver will remain in a powered-up condition until all input power is removed from the driver and the internal bus voltage is depleted.

Protection Devices

The driver must have a suitable input power protection device installed. Input and output wire size is based on the use of copper conductor wire rated at 75 °C. Table 3-1 describes the wire size to be used for power connections and the ratings of the protection devices. Use the recommended circuit breaker or fuse types as follows:

Circuit Breaker: 1 phase, thermal magnetic.
Equal to GE type THQ or TEB for 115 or 230 VAC

Time Delay Fuses: Buss LPN on 115 VAC or
Buss FRN on 230 VAC or equivalent.

Recommended fuse sizes are based on the following:

UL 508C suggests a fuse size of four times the continuous output current of the driver.
Dual element, time delay fuses should be used to avoid nuisance trips due to inrush current when power is first applied.

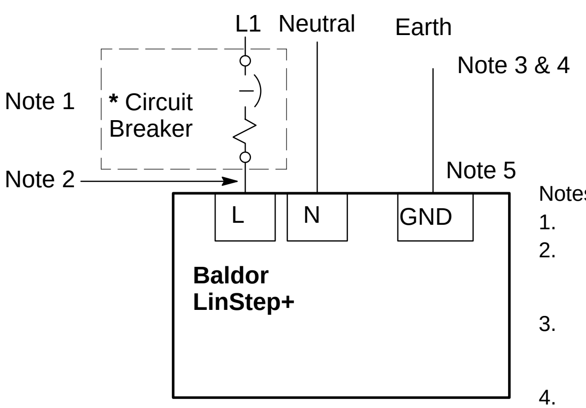
Table 3-1 Wire Size and Protection Devices

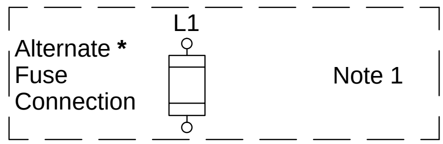
Catalog Number	Incoming Power					
	Nominal Input Voltage	Continuous Output Amps (RMS)	Input Breaker (A)	Input Fuse Time Delay (A)	Wire Gauge	
					AWG (USA)	mm^2 (Europe)
LX1P1A07F9	115V (1ϕ)	7.9A	30	30	14	2.5
LX1P2A06	115V (1ϕ)	6.0A	20	20	14	2.5
LX1P1A03	230V (1ϕ)	3.9A	20	20	14	2.5

Note: All wire sizes are based on 75°C copper wire. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 25°C ambient, maximum continuous driver output current and no harmonic current.

Power Connections Power connections are shown in Figures 3-3 and 3-4.

Figure 3-3 115VAC Single Phase AC Power Connections



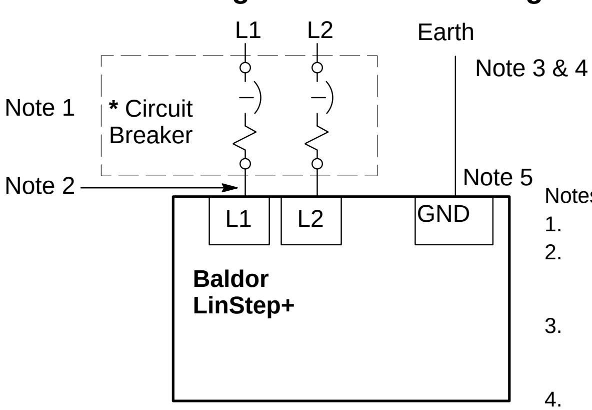


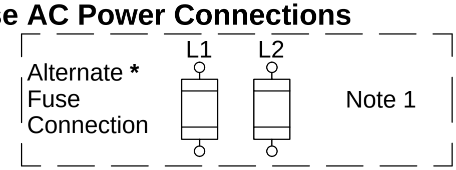
* Components not provided with driver.

Notes:

1. See "Protection Devices" described in this section.
2. Metal conduit or shielded cable should be used. Connect conduits so the use of a Reactor or RC Device does not interrupt EMI/RFI shielding.
3. Use same gauge wire for Earth ground as is used for L and N. (VDE (Germany) requires $10mm^2$ minimum, 6AWG). For CE Compliance, connect Earth to the backplane of the enclosure.
4. Reference EMC wiring in Section 8.
5. GND is located on the motor terminal strip.

Figure 3-4 230VAC Single Phase AC Power Connections





* Components not provided with driver.

Notes:

1. See "Protection Devices" described in this section.
2. Metal conduit or shielded cable should be used. Connect conduits so the use of a Reactor or RC Device does not interrupt EMI/RFI shielding.
3. Use same gauge wire for Earth ground as is used for L and N. (VDE (Germany) requires $10mm^2$ minimum, 6AWG). For CE Compliance, connect Earth to the backplane of the enclosure.
4. Reference EMC wiring in Section 8.
5. GND is located on the motor terminal strip.

Figure 3-5 Connection Locations (115VAC, 1 Axis)

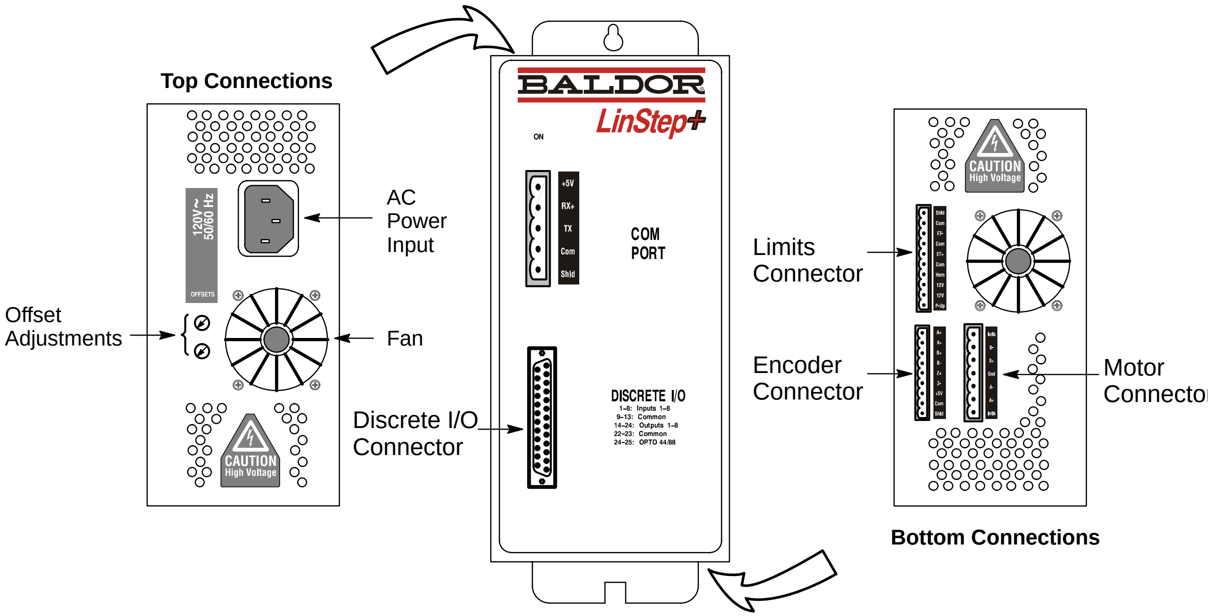
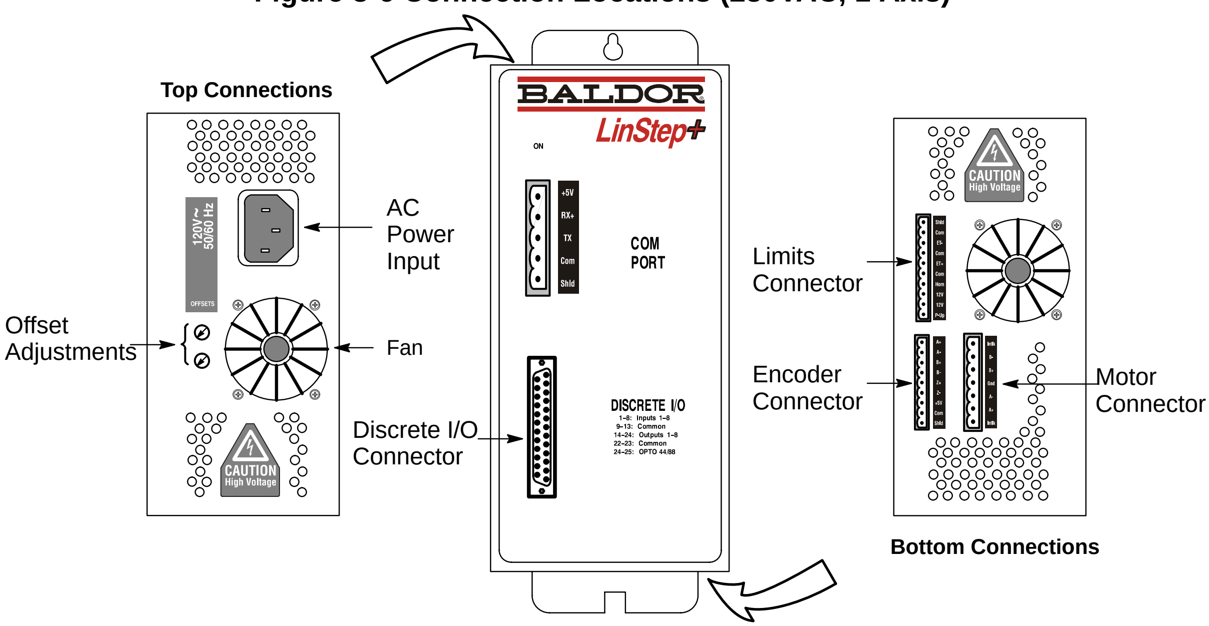


Figure 3-6 Connection Locations (230VAC, 1 Axis)



RS232/Keypad Installation Procedure: (optional keypad – LXKP)

Optional Remote Keypad Installation

The keypad may be remotely mounted and sealed to NEMA 4 specification by using the gasket and 6 ft (1.8m) cable included. The keypad assembly is complete with the screws and gasket required to mount it to an enclosure. The gasket has adhesive on one side that must be placed toward the enclosure.

Tools Required:

- Center punch.
- $^{3}/_{16}$″ drill bit (for clearance mounting holes).
- $^{1}/_{2}$″ (12.7) and 1-$^{1}/_{2}$″ (38.1) standard knockout punch.
- (4) 6-32 nuts and washers (or M3.5 hardware).
- Remote keypad mounting template. A tear out copy is provided at the end of this manual for your convenience.

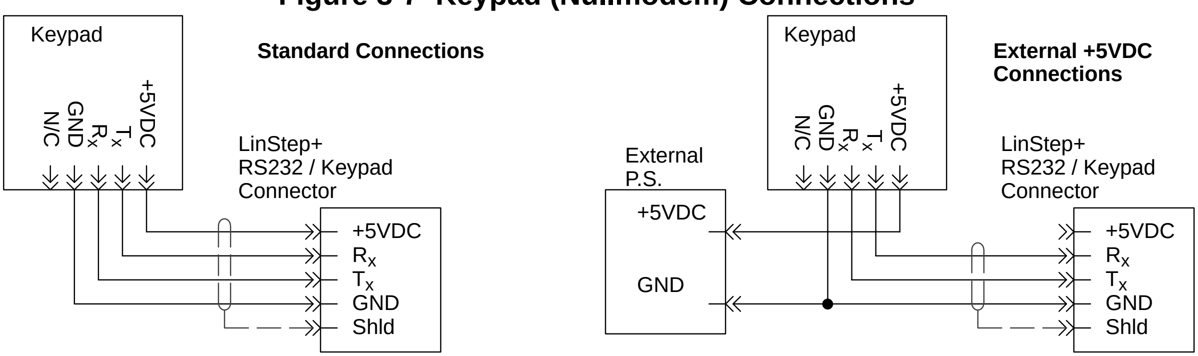
Mounting Instructions: (see remote keypad mounting template)

1. Locate a flat mounting surface. Material should be sufficient thickness (14 gauge minimum).
2. Place the template on the mounting surface or mark the holes as shown.
3. Accurately center punch the 4 mounting holes (labeled E for SAE or M for metric) and the three large Cut–Out holes.
4. Drill four $^{3}/_{16}$″ holes (at E or M).
5. Make the three large Cut–Out holes using the punch manufacturers instructions.
6. Debur knockout and mounting holes making sure the panel stays clean and flat.
7. Apply the adhesive backed gasket to the enclosure.
8. Assemble the keypad to the panel. Non–conductive screws and washers should be used to electrically isolate the keypad from the enclosure.

⚠ **Caution: To prevent keypad damage, be sure keypad mounting screws do not extend more than 0.2 (5) into keypad assembly.**

9. Connect the keypad cable to the keypad connector of the main circuit board, Figure 3-7.

Figure 3-7 Keypad (Nullmodem) Connections



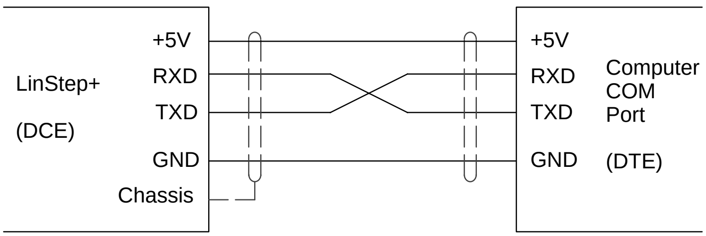
Note: A 6ft (1.8m) cable is provided with the keypad. If a longer cable is to be used, an external +5VDC @ 500mA power supply is required.

RS–232 PC Connections

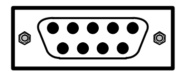
A null modem connection must be made between the LinStep+ and the computer COM port. This will ensure that the transmit and receive lines are properly connected. Either a 9 pin or a 25 pin connector can be used at the computer, Figure 3-8. Maximum recommended length for RS232 cable is 6 ft. (1.8 meter).

Figure 3-8 9 & 25 Pin RS-232 Cable Connections for UL Installations

RS232/Keypad Connector

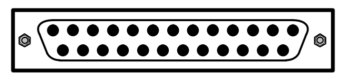


9 Pin Connector



Pin	Signal
2	RXD
3	TXD
5	GND

25 Pin Connector



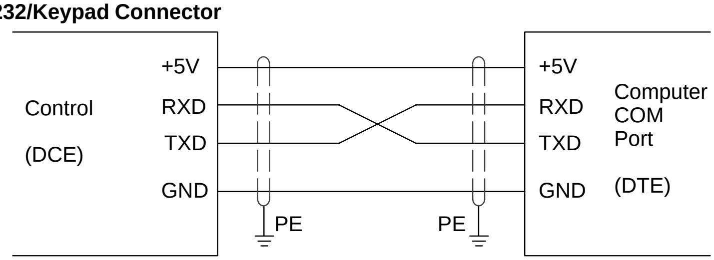
Pin	Signal
2	RXD
3	TXD
7	GND

If required, RTS, CTS, DSR and DTR may also be connected for a full null modem connection.

Jumper	9 Pin	25 Pin
RTS to CTS	7 to 8	4 to 5
DSR to DTR	4 to 6	6 to 20

Figure 3-9 9 & 25 Pin RS-232 Cable Connections for CE Installations

RS232/Keypad Connector



Note: For CE installations, connect the overall shield at each end of the cable to PE. The voltage potential between the PE points at each end of the cable must be Zero Volts.

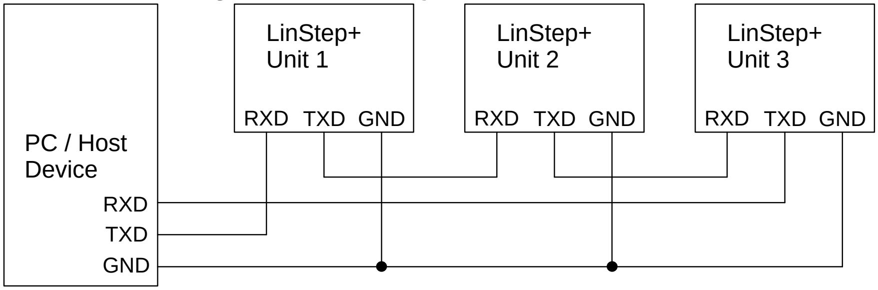
Daisy Chain Connections

LinStep+ can support daisy chaining. The unit address (range 1–99) can be set with the keypad, through Application Developer, or with a terminal program using the Unit Number (UN) command, or the entire chain may be addressed at once using the Auto–Address (AA) command. Connect as shown in Figure 3-10.

Rules for Daisy Chain Operation

1. All LinStep's in a daisy chain must have their device address assigned in ascending order away from the host device. This allows the Load All (LA – EX) commands to work properly. Addresses do not have to be sequential, but must be in ascending order.
   Example: 1, 2, 4, 6, 8 is valid addressing. 6, 3, 10, 8, 2 is not valid.
2. Do not duplicate unit addresses.
3. RS–232C "Echo" should be turned on for each unit in the daisy chain. Disabling RS–232C Echo will prevent daisy chain operation.
4. All RS–232C connections must be correctly made.
5. "Device Addressing" RS–232C commands (for a specific LinStep+ device) must have the correct address specified in the command.
6. Status commands require the correct address.

Figure 3-10 Daisy Chain Connection



RS485 PC Connections

Standard RS485 connections are shown in Figure 3-11 and 3-12. Maximum cable length is 3280 ft (1000M).

Figure 3-11 9 Pin RS-485 Cable Connections For UL Installations

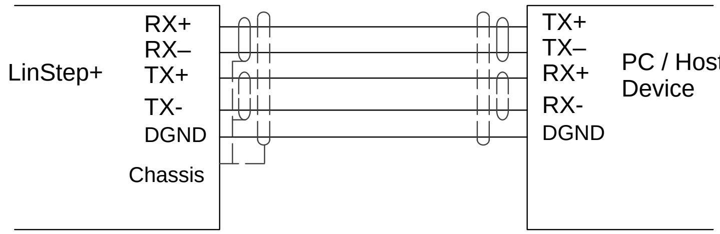
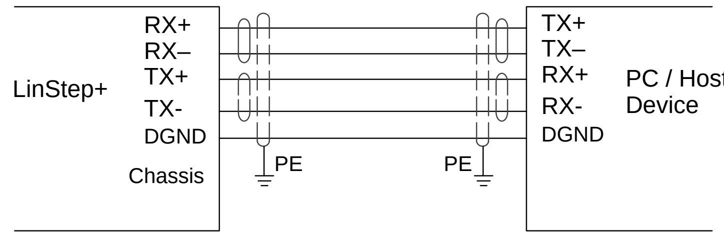


Figure 3-12 9 Pin RS-485 Cable Connections For CE Installations



Note: For CE installations, connect the overall shield at each end of the cable to PE. The voltage potential between the PE points at each end of the cable must be Zero Volts.

RS485 Multi-Drop Connections

What does termination or a termination resistor do?

Termination resistance is used to match the impedance of the load to the impedance of the transmission line (cable) being used. Unmatched impedance causes the transmitted signal to not be fully absorbed by the load. This causes a portion of the signal to be reflected back into the transmission line (noise). If the *Source* impedance, *Transmission Line* impedance, and *Load* impedance are all equal, these reflections (noise) are eliminated.

Termination does increase load current and sometimes changes the bias requirements and increases the complexity of the system.

What is a termination resistor?

A resistor is added in parallel with the receiver input to match the impedance of the cable being used. Typically, the resistor value that is used is 100 ohm or 120 ohm. Resistors with 90 ohms or less should never be used.

Where are these resistors placed?

Terminators or Termination resistors are placed in parallel with the receiver at both ends of a transmission line. This means that you should **never** have more than two terminators in the system (unless repeaters are being used).

How many resistors should my system have?

Terminators or Termination resistors are placed in parallel with the receiver at both ends of a transmission line. This means that you should **never** have more than two terminators in the system (unless repeaters are being used).

Figure 3-13 RS485 4 Wire Multi-Drop for UL Installations

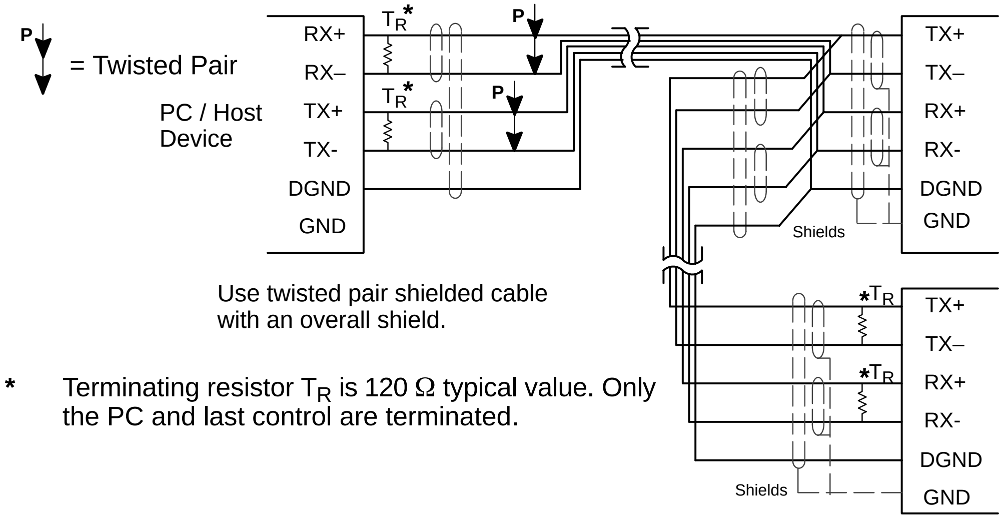
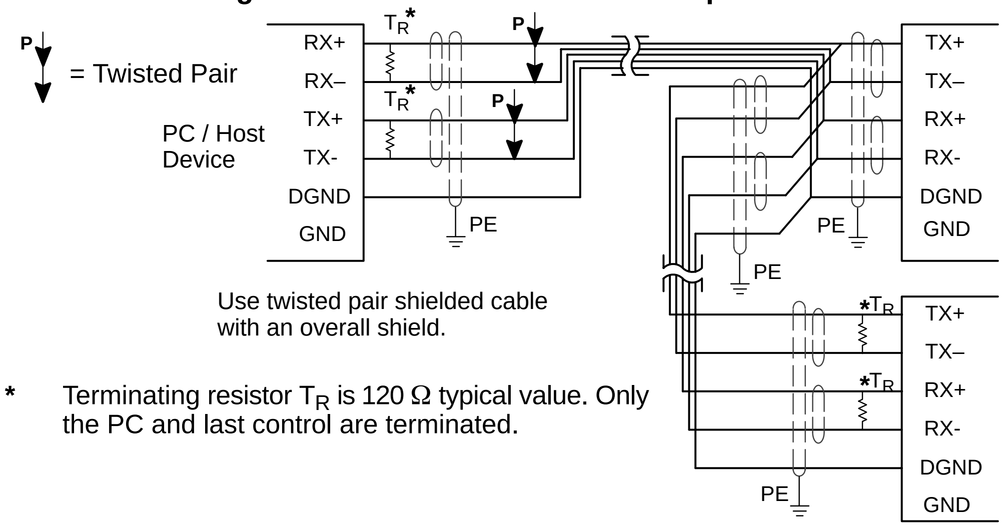


Figure 3-14 RS485 4 Wire Multi-Drop for CE Installations



Note: For CE installations, connect the overall shield at each end of the cable to PE. The voltage potential between the PE points at each end of the cable must be Zero Volts.

Discrete I/O Connections

The 25 pin “Discrete I/O” connector (Figure 3-5) contains the Input 1–8, Output 1–8 and OPTO 44/88 connections. (See Figures 3-15, 3-16 and the Section “OPTO 44/88” description.

Figure 3-15 Opto Isolated Input Connections (Inputs 1–8)

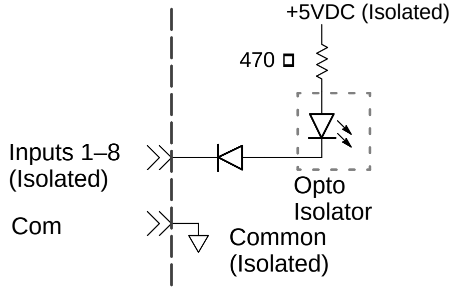
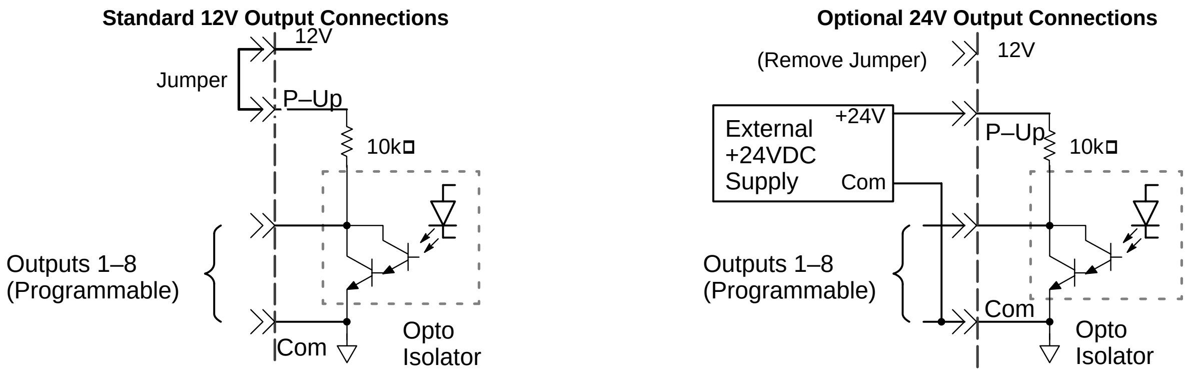


Figure 3-16 Programmable Output Connections

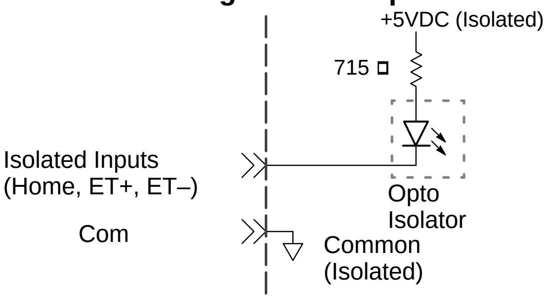


Factory installed jumper for 12VDC pull–up operation. Maximum current sink capability is 100mA per output and 350mA maximum from internal 12VDC supply.

Remove factory installed jumper from terminal P–Up. Connect an external 24VDC supply to terminals P–Up and Com. (Terminal P–Up must be positive).

Limits Connections

Figure 3-17 Opto Isolated Input Connections (Inputs 1–8)



Limits		
Limit	Drive	Color
+V	12V	Brown
0V	Com	Green
Output	ET±	White/Red

Encoder Connections

(Refer to MN1800 for wire color and lead information.)

Twisted pair shielded wire with an overall shield should be used. Figures 3-18 and 3-19 show the connections between the encoder and the encoder connector.

Figure 3-18 Differential Encoder Connections for UL Installations

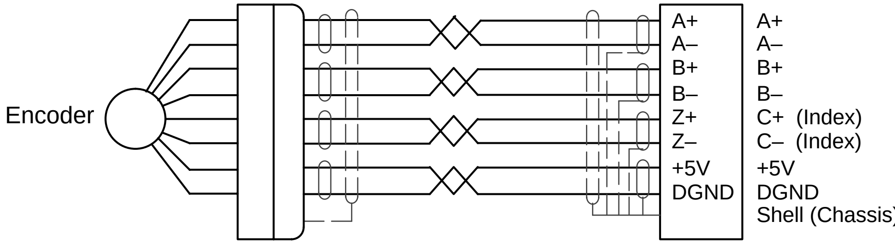
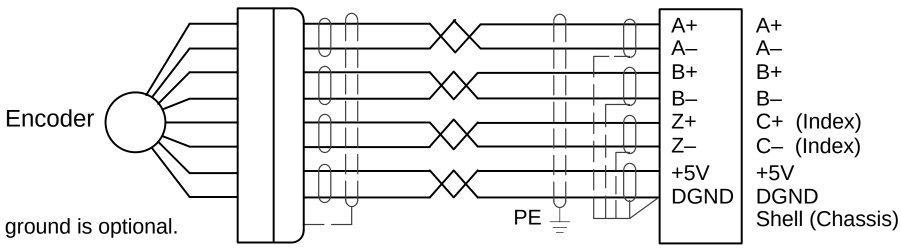


Figure 3-19 Differential Encoder Connections for CE Installations



Connection of shields to digital ground is optional.

Table 3-2 Encoder Color Code

Encoder			
Signal	**PVS100**	**Danaher (9–Pin D)**	
A+	White	Green	6
A–	Gray	Yellow	1
B+	Orange	Blue	8
B–	Red	Violet	3
Z+ (Index)	N/A	Red	9
Z– (Index)	N/A	Orange	5
+5VDC	Black	Brown	7
GND	Brown	Black	2
Inner shield	Blue	–	4
Outer shield	Violet	–	Shell

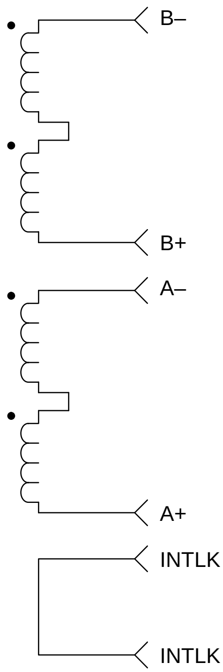
Motor Connections The A+, A–, B+ and B– phase outputs provide power to the motor windings. These connections are shown in Figures 3-5 and 3-6. The motor windings can be connected in series or parallel as shown in Figure 3-20. For Baldor motors, refer to MN1800 for lead information.

Interlock (INTLK)
The two INTLK pins must be jumpered together at the motor connector for the drive to apply power to the motor. If the interlock wire breaks, or the connector is removed, the current to the motor is immediately stopped, the drive faults (latched) and flashes the dual function LED labeled Over Volt./INTLK. Interlock wires longer than 5 inches can create noise generated shutdowns.

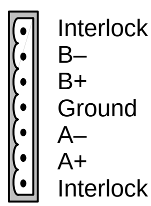
Ground (GND)
GND is internally connected to the Earth pin on the Power connector. This provides a convenient terminal for grounding the motor frame and a motor cable shield.

Figure 3-20 Stepper Motor Connections

Series Motor Connections



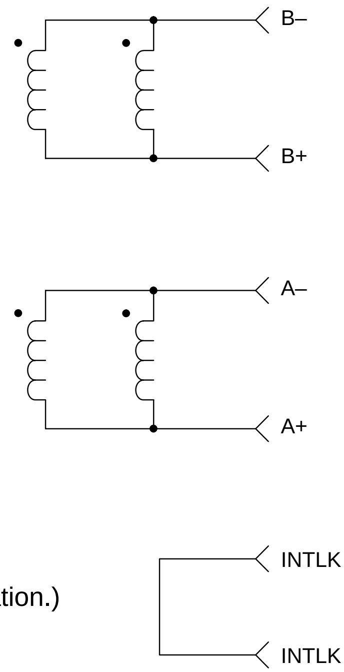
Motor Connector



Motor	
Color	Phase
White	A+
Red	A–
Green	B+
Orange	B–
Black	GND

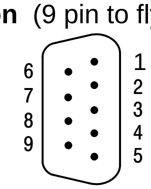
(Refer to MN1800 for wire color and lead information.)

Parallel Motor Connections



AY0165A00 Leadwire Connection (9 pin to flying leads)

Color	Pin#	Description
White	1	A1+ Winding
	2	N.C.
Green	3	B1+ Winding
	4	N.C.
Black	5	Ground
	6	N.C.
Red	7	A1– Winding
	8	N.C.
Orange	9	B1– Winding



Male (D Sub)

When a Male D Sub connector is used, use the pin numbers to connect the forcer.

When flying leads are used, use the color codes to connect the forcer.

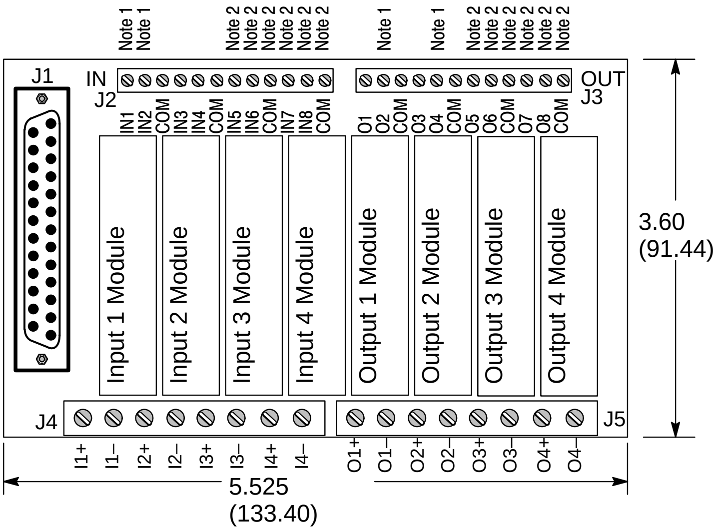
LXOpto 44 and 88

Break out box and accessories.

Two break out boxes are available; LXOpto44 accepts up to 8 conditioning modules and LXOpto88 accepts up to 16 conditioning modules. Figure 3-21 shows the layout and dimensions of each. Each allows the use of discrete inputs and outputs and provide the ability to perform signal conditioning.

Figure 3-21 OPTO Racks

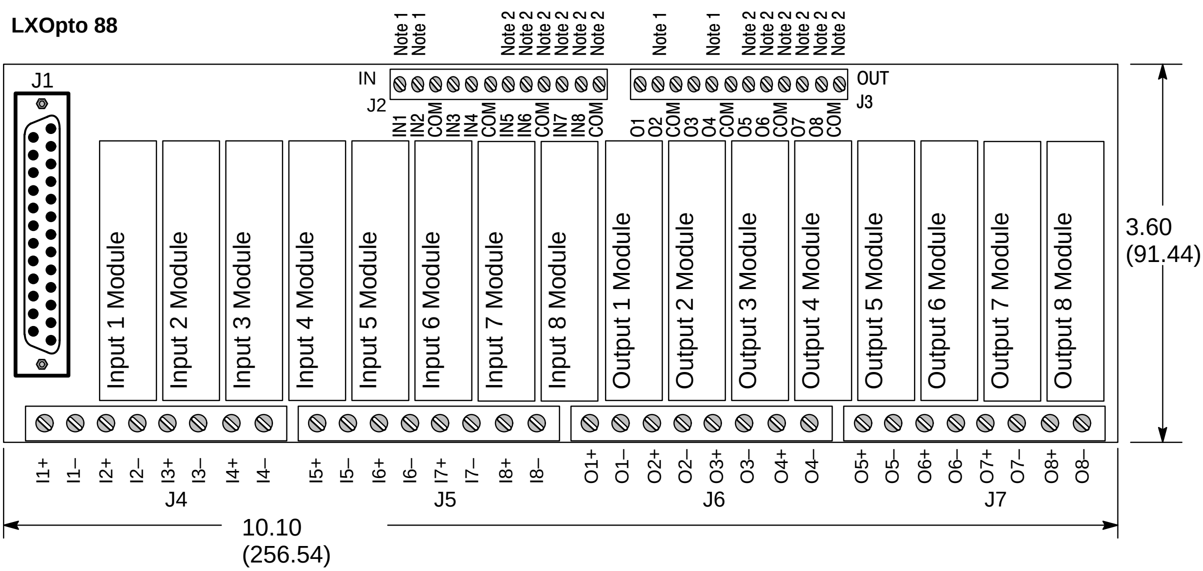
LXOpto 44



Notes

1. Do Not Use.
2. Always usable (no corresponding module).
3. Do not use IN1–4 or O1–4 if a corresponding LXOPTO module is being used. Using the same J2 or J3 signal with a module in place may result in equipment damage.
4. J1 connector connects to the DB25 “Discrete I/O” connector on LinStep+.

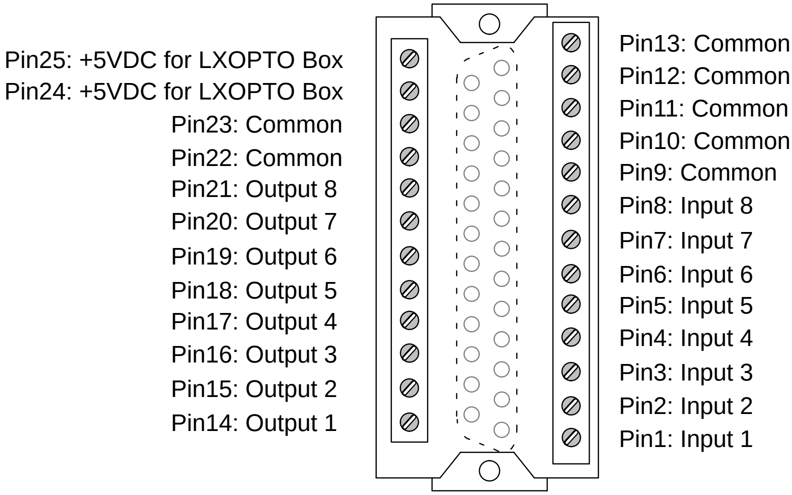
LXOpto 88



DB25 Pin to Screw Terminal Converter

The LXDB25 converter allows connection of individual wires to the DB25 pin connector. The terminal configuration is shown in Figure 3-22.

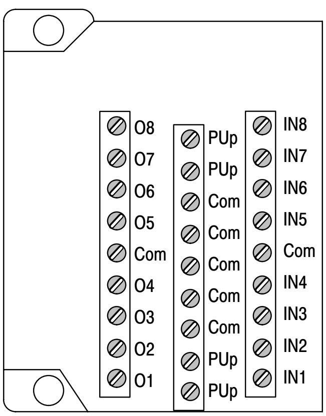
Figure 3-22 LXDB25 Converter

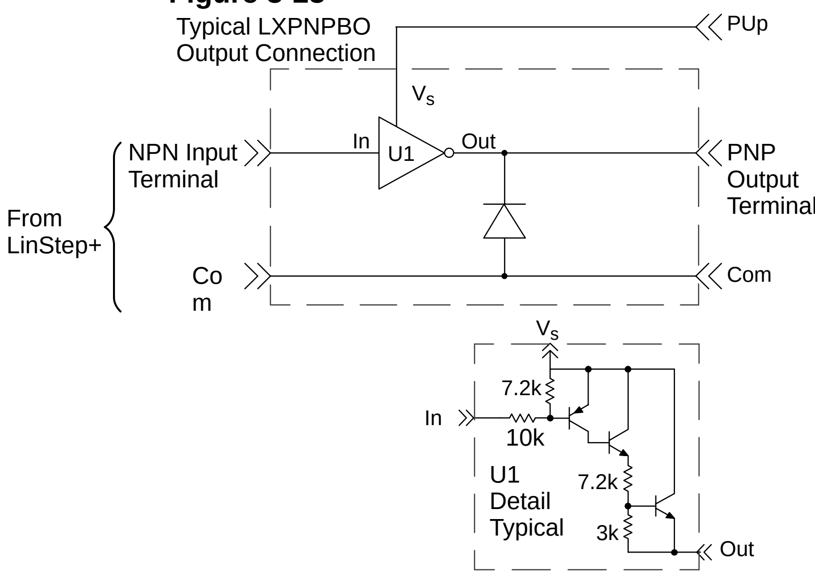


PNP Converter

The LXPNPBO converts NPN outputs from the LinStep+ to PNP compatible outputs, shown in Figure 3-23. Inputs IN1–8 connect directly to the LinStep+ NPN inputs. Outputs 1–8 are PNP outputs. PUp and COM are the 12VDC or 24VDC pull up and common power supply connections.

Figure 3-23





Start-Up Procedure

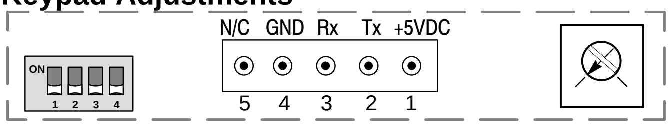
Power Off Checks

Before you apply power, it is very important to verify the following:

1. Verify the AC line voltage at the source matches the control rated voltage.
2. Inspect all power connections for accuracy, workmanship and tightness.
3. Verify that all wiring conforms to applicable codes.
4. Verify that the control and motor are properly grounded to earth ground.
5. Check all signal wiring for accuracy.
6. Set Keypad DIP switches as desired, Figure 3-24. (Power must be cycled after a DIP switch position change).

Figure 3-24 Keypad Adjustments

DIP Switch 1	2	Keypad Operation
Off	Off	Full Keypad Operation
Off	On	No access to Run, ESC, Edit, Copy, Del
On	Off	No access to Run, Edit, Copy, Del
On	On	No access to Edit, Copy, Del



Switches 3 and 4 are reserved.

Power On Checks

When power is first applied, the "ON" LED will be green. With the keypad connected, the LCD display will briefly display the initialization screens.

Note: The LCD display may require contrast adjustment for better viewing. If the display cannot be seen, adjust the potentiometer in Figure 3-24 for best viewing.

Action	Display	Comments
Apply Power.	`+0.0000` `00000000    00000000`	Power–up diagnostic display. No errors.
Select "Edit, Setup (F2), Motor (F1), Type (F1), Stepper (F1)"	`–↑STEPPER SETUP↓–` `00000000    00000000`	Stepper Set–up display.
Select "Current (F1)". enter the motor current value. (Factory setting =0")	`Axis One Motor Curnt` `___Amps`	Enter the correct setting for your motor. Press "ESC" when done.
Select "A–RES (F2)".	`–Axis One  Anti–Res–` `0`	Enter the unloaded Anti–Res value for your motor. Press "ESC" when done.
Select "INDUCT (F3)".	`–Axis One Inductance–` `–↑      HIGH      ↓–`	Select the HIGH or LOW setting for your motor. Press "ESC" when done until you return to the main display.

The motor should now be producing torque.

Action	Display	Comments
Select "RUN, JOG (F2)".	`JOG AXIS +0.0000` `<LO>    HIGH`	Select either Low or High to Jog the motor position. Confirm proper motor operation.

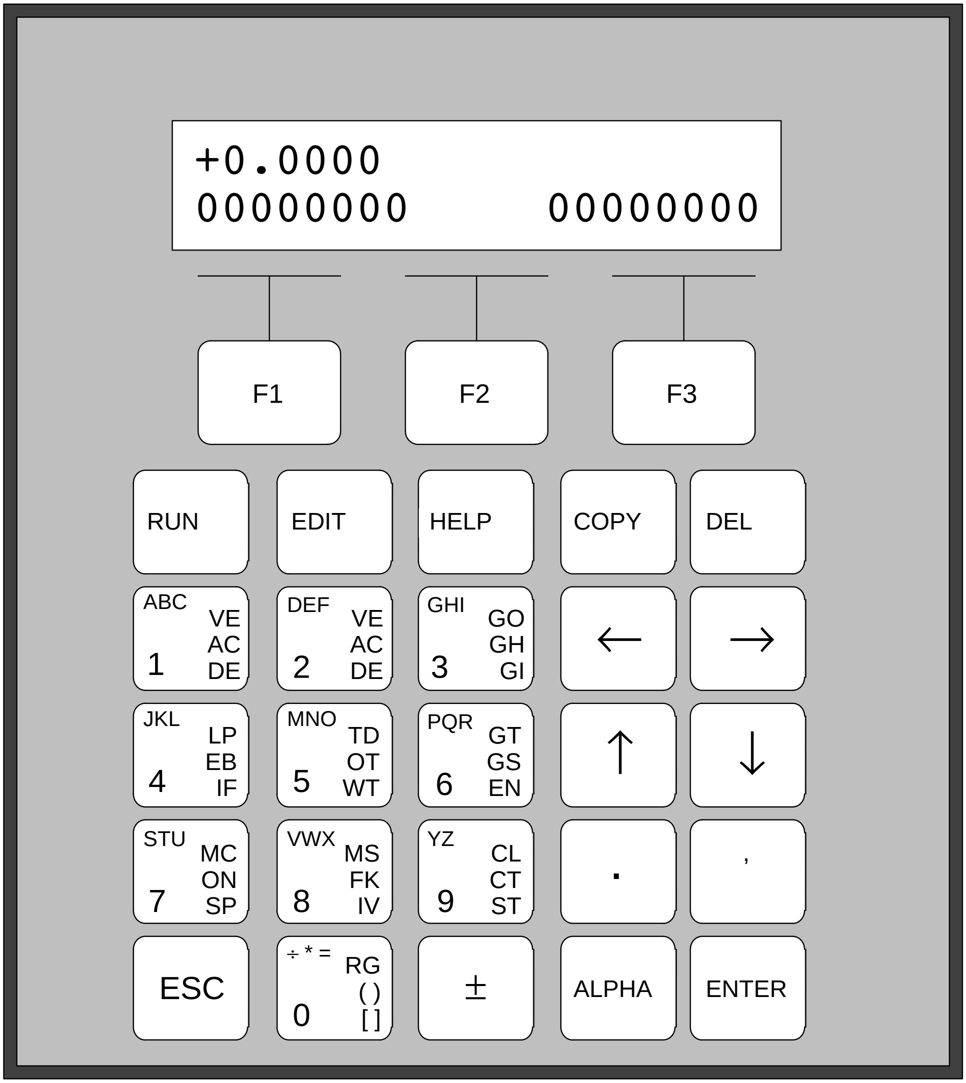
Section 4
Keypad Operation

Overview

(Firmware versions LinStep+ Sngl SB3.0; Keypad V2.90; FPGA ssr3)

The Keypad layout with the LCD display is shown in Figure 4-1.

Figure 4-1 Keypad and LCD Display



F1, F2, F3

Selector keys. Used with numeric keys to select commands in the editor. Programmable as operator menu selections. (See the FK command for information on using the function keys within a program.)

Most operations are menu–driven. A menu consists of a title bar (top display line) and as many as three options or sub–menus (bottom display line). Each option is displayed above one of the function keys, F1, F2, or F3. Press a function key to select the corresponding option. Table explains which menus are available.

Note: If a menu has more than three options, arrows on both sides of the display indicate that more options are available. Press the appropriate arrow key to display one option at a time. To exit a menu without making a selection, or to back up one menu level, press ESC.

Table 4-1

	Menu Key				
	RUN	EDIT	HELP	COPY	DEL
Menu Options	**PROG (F1)** Run programs by name or number.	**PROG (F1)** Edit or write programs.	**In Main Menu:** Provides help on the function of RUN, EDIT, or COPY.	**PROGRAM (F1)** To copy programs within a control (source file> destination file)	Deletes an entire program or in editor deletes characters
	JOG (F2) Jog either axis at low or high speeds. Press F1 or F2, and any arrow key (←↑↓→).	**SETUP (F2)** Configure system components and operating limits.	**In Menus:** Provides help on menus.	**TO PAD (F2)** To upload data from control's memory to the keypad.	
	TEST (F3) Run programs in trace mode, do amplifier shutdown and reset, and test outputs or moves.	**POS (F3)** Reset axis position to zero? YES (F1) NO (F3)	**In Sub–Menus:** Explains setup choices.	**FROM (F3)** To download data from keypad memory to a control.	
		LIST (↓) (F1) Directory of stored programs, memory usage and available space	**In Editor:** Provides command descriptions.		

RUN
Press RUN to start a program, Jog an axis, or access Test/Debug functions.

EDIT
Press Edit to change setup parameters and programs, list programs, & reset position counter.

HELP
Provides help information for keys, menus, and command syntax.

COPY
Copies one program to another within the LinStep+.

DEL
Deletes characters in the editor, or deletes entire programs from memory.

0–9
Enters numbers. Used with ALPHA key to enter characters. Used with F1, F2, F3 keys to select commands in the program editor.

ESC
Press ESC to stop a program or to move back one menu level. In program editor, it saves the program and exits the editor.

±
Selects the motion direction in program editor. May also be used in math programs or equations.

←↑↓→
Cursor control keys that are used to scroll through menu choices in the editor. Moves an axis in JOG mode.

Decimal Point
Used when entering fixed–point numbers.

Comma
Used in multi–axis programs to separate axis command parameters. Part of the syntax in message and variable "prompt" commands.

Alpha
In the editor, allows entering alpha characters for the keypad.

ENTER
In the program editor, press ENTER to save parameters that have been typed. Enters a space in the program editor mode.

Run Menu

Pressing the RUN key displays a set of sub–menus. Access the sub–menus by pressing F1 (PROG), F2 (JOG), or F3 (TEST).

Action	Display	Comments
Press RUN key	`RUN` `PROG JOG TEST`	Select a sub–menu, press F1 (PROG), F2 (JOG), or F3 (TEST).
Press F1 (PROG) to run (or execute) an existing program number. **OR**	`↑RUN PROGRAM↓` `>5`	Use the numeric keys to enter a program number to run (example, 5 and press ENTER).
Press F1 (PROG) select an existing program to run.	`↑RUN PROGRAM↓` `>12 GRIND`	Use the keys to scroll through the list of programs. Press ENTER to select the program.

JOG Menu

Pressing the RUN key displays a set of sub–menus. Press F2 (JOG).

Action	Display	Comments
Press RUN key	`RUN` `PROG JOG TEST`	
Press F2 (JOG) to JOG the motor. **OR**	`JOG AXIS 1 +0.0000` `<LO> HIGH`	Use the ←↑↓→ keys to JOG the motor. Press F1 <LO> or F2 HIGH speed.
Use the 0–9 keys to enter the desired JOG distance.	`JOG AXIS 1 +0.0000` `Dist: .012`	Press and release an arrow key to make the motor move this distance. The arrow pressed determines the direction of the move. Press and release an arrow key to move the motor again. Press ESC to terminate JOG.

Note: Jog speed and acceleration are changed in the "EDIT, SETUP, JOG" menu.

Edit Menu

Pressing the EDIT key displays a set of sub–menus.

Action	Display	Comments
Press EDIT key	`–↑EDIT↓–` `PROG    SETUP     POS`	Select a sub–menu, press F1 (PROG), F2 (SETUP), or F3 (POS).
Press ↑ or ↓ key for more sub menu selections.	`–↑EDIT↓–` `LIST`	Select a sub–menu, press F1 (LIST).

Edit, PROG Submenu Create A New Program

1. Press “EDIT, F1 (PROG)” and you will see a display with a blinking cursor as shown in Figure 4-2.

Figure 4-2 New Program

```
   –↑EDIT PROGRAM↓–
>_
```

2. Enter an unused identifying number for the program (between 1–400). (If several programs are stored, you may need to scroll the list to determine a number that has not been used.)

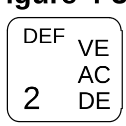
Note: You may assign a name, rather than a number, to your program if you wish. See “Naming Your Programs” later in this section.

3. Press ENTER. You will see a blank screen with a blinking cursor in the upper left corner. The program editor is now ready to accept a program.
4. Once inside the program editor, enter commands by pressing a function key and then a numeric key. Examples of creating, saving, naming, and editing programs follow.

Example of entering programming commands found on the #2 key, Figure 4-3.

- To enter the VE command (the upper command on the number 2 key), press F1 (blue) then press the number 2 key.
- To enter the AC command (the middle command on the number 2 key), press F2 (yellow) then press the number 2 key.
- To enter the DE command (the lower command on the number 2 key), press F3 (green) then press the number 2 key.

Figure 4-3



Example of entering a program using the 0–9 keys. To create a program with the commands “`AC.3 VE2 DI1 GO`”, do the following steps: (you must be in the program editor, this example is writing to program #2).

1. Press EDIT→F1→2→ENTER to get to the first line of program 2.
2. Press F2, then press the #2 key. This will enter the AC command.
3. Press the decimal key.
4. Press the #3 key.
5. Press ENTER. This will insert a space after the 3 to separate the commands.
6. Press F1, then press the #2 key. This will enter the VE command.
7. Press the #2 key.
8. Press ENTER. This will insert a space after the 2 to separate the commands.
9. Press F2, then press the #1 key. This will enter the DI command.
10. Press the #1 key.
11. Press ENTER. This will insert a space after the 1 to separate the commands.
12. Press F1.
13. Press the #3 key. This will enter the GO command.
14. Press ENTER.
15. The display should now show the program “`AC.3 VE2 DI1 GO`”.

Save the program

When you have completed the program, and the display shows the program “`AC.3 VE2 DI1 GO`”, do the following:

1. Press ESC, the menu of Figure 4-4 is then displayed.
2. Press F1 (YES) or F3 (NO).

Figure 4-4

```
    Save Program?
Yes              No
```

Edit an existing program

1. Press “EDIT, F1 (PROG)” and you will see a display with a blinking cursor as shown in Figure 4-5. Enter the name of the program you wish to edit or scroll the list to locate the program.

   Remember, ENTER inserts a space (delimiter). DEL deletes a character. Use the cursor keys to scroll through the program one line at a time.

Figure 4-5

```
  –↑EDIT PROGRAM↓–
>_
```

Naming a program

A program can be given a descriptive name in addition to the program number that the LinStep+ assigns it. Program names must be put inside of square brackets, [program name], at the start of a program. The name can be up to 14 characters, but the first 10 must be unique. Like variables, the name can be any combination of characters.

Programs or subroutines are often named to help "self document" a program. It is usually easier to remember and understand a name than a number. You may call or branch to a program by name.

Suppose your program has 20 different parts and each part has a different program name. Simply name each program so an operator will easily recognize them. When the keypad RUN key is pressed, instead of entering a number, simply scroll through the list of program names until the desired program is displayed. Then press ENTER to run the program.

Example of Naming a Program

Add a name [MINE] to the program.

To insert [MINE]:

1. Press F3.
2. Press 0 (zero) key. Insert brackets.
3. Press ALPHA. Move to next character.
4. Press #5 key. Insert M.
5. Press ALPHA. Move to next character.
6. Press #3 key three times. Insert I.
7. Press ALPHA. Move to next character.
8. Press # 5 key two times. Insert N.
9. Press ALPHA. Move to next character.
10. Press #2 key two times. Insert E.
11. Press the → key to move cursor to the right of the bracket. The program name will be as shown in Figure 4-6.

Figure 4-6

```
[MINE] AC.3 VE2 DI1 GO
```

12. Press ESC. You will be prompted as shown in Figure 4-7.

Figure 4-7

```
   Save Program_?
YES                NO
```

Entering Characters with the Alpha Key (In edit mode)
The ALPHA key allows you to enter almost any character into a program from the keypad. This is useful to name your programs or subroutines, call subroutines by name, make variable names descriptive, use operator messages or prompts, send messages over RS–232 port or use commands not on the keypad, such as EA or “ ”.

The letters are found on the 0–9 keys. To insert A, B or C on the #1 key:

1. Press ALPHA.
2. Press the numeric key with the character you want. (In this example, press the #1 key once to select A, press it twice to select B, and press it three times if you want the C).

General Rules for Using The Alpha Key

- Any number, letter or character on the 0–9 keys can be placed in a program.
- Press a numeric key 4, 5 , and 6 times to access the lower case letters.
- Press ALPHA prior to each character you wish to enter.
- Press the ← or → key to move the cursor to the next space.
- Press ALPHA to move the cursor more than one space.

Use the ↑↓ keys for additional alpha characters.
The 19 special characters shown to the right are available by pressing ALPHA and scrolling through the list using the arrow keys.

1. Press ALPHA.
2. Press ↑ or ↓ to scroll through the list of characters.
3. When the desired character is displayed, press ALPHA or ENTER to enter the character. The character will be displayed and the cursor will move one space to the right.
4. Press ESC to leave the editor. The list of characters is shown in Figure 4-8.

Figure 4-8 Alpha Characters

<table>
<tr><td><</td><td>></td><td>?</td><td>!</td><td>@</td><td>#</td><td>%</td><td>&</td><td>_</td><td>:</td></tr>
<tr><td>;</td><td>\</td><td>′</td><td>″</td><td>|</td><td>↑</td><td>↓</td><td>←</td><td>→</td><td></td></tr>
</table>

Edit, Setup Submenu Table shows the structure within the “EDIT, SETUP” submenu.

Table 4-2 Edit, Setup Submenu

Submenu	Setup Parameter	Description of Setup Parameter
MOTOR	TYPE	Motor parameters
	D–RES	Drive resolution
	DIR	Direction of travel
ENC	MODE	Select open/closed loop mode
	E–RES	Encoder resolution
	FOL–ERR	Following error
	IN–RANGE	Position maintenance window
	PMGAIN	Position maintenance gain
	PMMAX	Position maintenance maximum velocity
MECH	DIST	Distance Units
	PITCH	The spacing between the photo etched teeth of the motor platen.
	VEL	Speed units
	VMAX	Critical speed limit
	ACCEL	Acceleration units
	AMAX	Maximum rate of acceleration
I/O	INPUTS	Input functions
	OUTPTS	Output functions
	OPTOS	OPTO module configuration
	OUTSTS	Configure output states during Powerup, Fault, and Stop/Kill command.
	LIMITS	Configure EOT polarity (N.O. or N.C.)
JOG	ACCEL	Jog acceleration
	LO–VEL	Low jog velocity
	HI–VEL	High jog velocity
	ENABLE	Enable/disable jog in RUN menu
HOME	MODE	Homing method
	EDGE	Edge of home switch
	SWITCH	Type of home switch
	OFFSET	Position counter offset
	DIR	Final homing direction (positive or negative)
PROG	PWR–UP	Program to run on power up, if any
	SCAN	How to scan program select inputs
	DELAY	Program Select de–bounce time
RS–232C	ECHO	Echo characters
	UNIT#	Serial address
MISC	DISP	Display mode (not currently implemented)
	STOP–RATE	Decel rate when stop input activated
	TEST	Enable Test Menu (not currently implemented)
	PASWRD	Password setup for operator/administrator access

Edit, POS Submenu Select “Edit, POS” to Reset the Current Position to Zero.

POS is a quick way to reset the motor’s present position to (absolute) zero – a very useful setup and debugging tool.

Action	Display	Comments
Press “EDIT, POS” (F3)	`Reset Position?` `YES NO`	Press YES (F1) or NO (F3)

Edit, List Submenu Select “EDIT, ↓, LIST” to view memory usage.

LIST provides a way to view your program memory usage. Standard program storage is 60K bytes, and the maximum size of a single program is 1,024 bytes. LinStep+ will store up to 400 programs, with a maximum single program size of 1,024 bytes.

Action	Display	Comments
Press “EDIT, ↓, LIST” to display the number of programs stored.	`DIRECTORY ↑MORE↓` `PROGRAMS: 18`	
Press ↓ to display the total memory used for program storage.	`DIRECTORY ↑MORE↓` `BYTES USED: 1186`	
Press ↓ to display the total free memory available.	`DIRECTORY ↑MORE↓` `BYTES FREE: 4958`	
Press ↓ continuously to scroll through the list of programs, displaying the number of bytes used by each program.	`DIRECTORY ↑MORE↓` `5<untitled>: 56 bytes`	

HELP Menu

Press HELP to display a help message related to the menu. Help messages are often several lines, which you can scroll through using the ↓ and ↑ keys. When you are finished reading a help message, press ESC to return to the menu.

Pressing HELP in the Main Menu
HELP explains the functions available when you press any of the non–numeric keys.

Pressing HELP in Menus and Sub–Menus
HELP explains the selections available from your current menu location.

Pressing HELP In the Program Edit function
HELP provides a brief, alphabetical list of commands.

Note: A program must be selected to view the COMMAND SUMMARY.

COPY Menu

Pressing the “COPY” key displays three submenu choices.

Action	Display	Comments
Press the “COPY” key	– – – COPY – – – PROG TO PAD FROM	Select a sub–menu, press F1 (PROG), F2 (TO PAD), or F3 (FROM).

COPY, PROG Submenu Copy one program to another program.

Action	Display	Comments
Press F1 (PROG) to copy from a program.	↑SOURCE PROGRAM↓ >5	Enter the source program number. Or, if you wish, you can scroll through your list of program names. Press ENTER when finished.
Enter the new program number.	↑TARGET PROGRAM↓ >6	If the target program exists, you must first delete it (see DEL). Press ENTER when finished.

Note: Remember to change the name of the copied programs to avoid subroutine call conflicts.

COPY, TO PAD Submenu Copy a program to the keypad from LinStep+ or a PC.

Action	Display	Comments
Press F2 (TO PAD). Two messages are displayed sequentially.	Receiving From Drive Saving To EEPROM may take 40 seconds	Copies a program from LinStep+ to the keypad. When the “Saving To EEPROM” message disappears, the program has been stored in keypad memory.

COPY, TO PAD Submenu Continued

To copy a program from a PC to the keypad, connect the keypad to the RS232 port of the PC (COM1 or COM2). Start the Application Developer software and from the Communications menu, click on “Send All”. The keypad will display the message “Receiving From PC” and a few more messages will quickly appear, then disappear from the screen. When the keypad display is blank, the transfer is complete.

COPY, FROM Submenu Copy a program from the keypad to the LinStep+ or to a PC.

Action	Display	Comments

Press F3 (FROM). Four messages are displayed sequentially.	`Receiving From EEPROM`
	`Sending To Drive`
	`Waiting For Processing`
	`Saving To Memory`
		Copies a program from the keypad to LinStep+. When the “Saving To Memory” message disappears, the transfer is complete.

To copy a program from the keypad to a PC, connect the keypad to the RS232 port of the PC (COM1 or COM2). Start the Application Developer software and from the Communications menu, click on “Retrieve All” and choose “From Keypad”. The keypad will display the message “Sending to PC” and a few more messages will quickly appear, then disappear from the screen. When the keypad display is blank, the transfer is complete.

DEL Menu

The DEL (Delete) key allows you to delete any motion program.

Action	Display	Comments
Press the DEL key.	`↑DELETE PROGRAM↓` `>6`	Enter the program number. Or, if you wish, you can scroll the list of program names. Press ENTER when finished.
	`DELETE PROGRAM #6` `YES NO`	Press F1 to delete program or F3 to not delete the program.

DEL is also used to delete text or numeric characters in the editor. Use the cursor control keys to move over the character you wish to delete, then press DEL.

Section 5
Setup

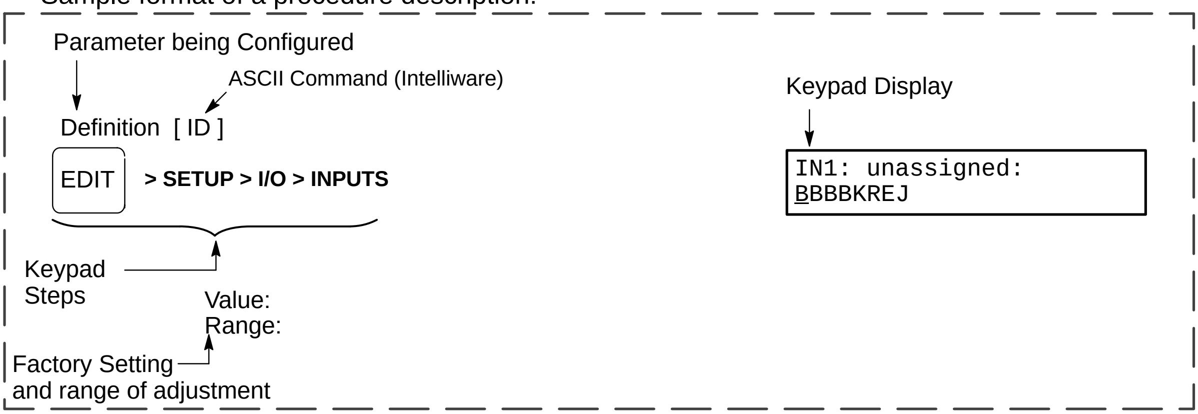
Overview

There are two ways to setup the parameters: use the keypad or use Intelliware serial communications software. The procedures presented in this section allow LinStep+ to be configured using the keypad (LXKP). If you are not familiar with the operation of the keypad, please refer to Section 4 of this manual. To ensure that LinStep+ is correctly configured, follow all the procedures so that important parameters are not overlooked.

Intelliware software (serial communications) users can refer to this section for definition of the configuration parameters. The Windows dialog boxes follow the keypad menu structure very closely. Details of Intelliware software are provided in MN1855.

Procedure Format Definition
The 2–character ASCII command appears in brackets next to the keypad command. This is the Intelliware software command. Configuring LinStep+ to a specific application requires customizing a number of software parameters to match the mechanics of the system. These parameters include motor, encoder, distance, acceleration and velocity scaling, I/O, jog, home, and serial communication.

Sample format of a procedure description:



Pressing the EDIT key displays a set of sub–menus.

Action	Display	Comments
Press EDIT key	–↑EDIT↓– PROG SETUP POS	Select a sub–menu, press F1 (PROG), F2 (SETUP), or F3 (POS).
Press F2 (SETUP) key for more sub menu selections.	–↑SETUP↓– PROG RS232 MISC	Select a sub–menu, press F1 (PROG), F2 (RS232), or F3 (MISC).
Press ↓ key for more sub menu selections.	–↑SETUP↓– I/O JOG HOME	Select a sub–menu, press F1 (I/O), F2 (JOG), or F3 (HOME).
Press ↓ key for more sub menu selections.	–↑SETUP↓– MOTOR ENC MECH	Select a sub–menu, press F1 (MOTOR), F2 (ENC), or F3 (MECH).

Configure Motor Adjustments for Current, Waveform, Rest, Idle, Inductance, and Anti–Resonance can be made while the motor is energized and moving or at rest.

Configuring Motor Type [MT11]

EDIT **> SETUP > MOTOR > TYPE > STEPER**

```
 –↑STEPPER SETUP↓–
CURRENT   A–RES INDUCT
```

Press F1 (CURRENT)

Configuring Motor Current [MIn]

EDIT **> SETUP > MOTOR > TYPE > STEPER > CURRENT**

Value: 2.0 Amps
Range: 0.0 – 8.0 Amps

```
Axis One Motor Curnt
      2.0 Amps
```

Enter Amps, press ENTER

Note: This parameter sets the motor current for your stepper motor. Entering a value outside the “Range” will reset the motor current to 0.0 Amps.

Configuring Anti–Resonance [ARi]

EDIT **> SETUP > MOTOR > TYPE > STEPER > A–RES**

Value: 7
Range: 0–30

```
 – Axis One Anti–Res –
          7
```

Enter value, press ENTER

This parameter sets the anti–resonance gain level for your motor. For example, entering AR14 sets the anti–resonance gain to 14.

Calculate AR

$AR = AR_{unloaded} - K$

Where:

$$AR_{unloaded} = (12.987) \times \log\left(\frac{9.3}{Vb\sqrt{(Tm * Jr)}}\right) \qquad K = \log \frac{\left(\frac{J_{Rotor} + J_{Load}}{J_{Rotor}}\right)}{0.155}$$

Vb = Break Velocity of Knee of Speed–Torque Curve in RPS
Tm = Low Speed Torque of Motor in Nm
Jr = Unloaded Rotor Inertia in Kg–m^2

Hint: The AR value will decrease as the J load increases. To observe this, reduce the AR value until the motor begins to hiss – then increasing your AR setting slightly.

Note: $AR_{unloaded}$ will be different for series and parallel motors, because the speed–torque curve is a component of Break Velocity and Low Speed Motor Torque.

Configuring Motor Inductance [MHa]

EDIT **> SETUP > MOTOR > TYPE > STEPER > INDUCT**

Value: HIGH
Range: HIGH or LOW

```
–Axis One Inductance–
–↑      HIGH      ↓–
```

Select value, press ENTER

Baldor motors use the Low Inducatance setting.

Configuring Waveform [WAi]

EDIT **> SETUP > MOTOR > TYPE > STEPER > WAVEFRM**

Value: Sinusoid
Range: Sinusoid or –4% 3rd Harmonic

```
–Axis One Waveform–
–↑    Sinusoid    ↓–
```

Select value, press ENTER

Depending on motor design and the current level at which it is being driven, it may be advantageous to distort the sinusoidal waveform to achieve better low speed smoothness and step–to–step accuracy. With the motor running at low speed, alternately select between SINUSOID and –4% 3rd to determine which setting produces the smoothest running condition.

Fine–Tuning Offsets

To adjust Offset Potentiometers: (Located on the top panel)
1. Run the motor unloaded at low speed.
2. Alternately adjust the pots for smoothest running condition.

Configuring Rest Mode [REi]

EDIT **> SETUP > MOTOR > TYPE > STEPER > REST**

Value: OFF
Range: ON or OFF

```
 – Axis One Rest Mode –
–↑      OFF       ↓–
```

Select value, press ENTER

When Rest Mode is enabled, motor current is reduced to 1 Amp if no motion occurs for 12 minutes. Full current is restored when the next move starts. Enabling REST (ON) improves fan life in applications where the machine is powered–up, but may not run for extended periods of time, e.g. a machine that is operated two shifts, but is left on 24 hours a day.

Configuring Idle Mode [ILi]

EDIT **> SETUP > MOTOR > TYPE > STEPER > IDLE**

Value: OFF
Range: ON or OFF

```
 – Axis One Idle Mode –
–↑      OFF       ↓–
```

Select value, press ENTER

Configuring Motor Resolution [MR10]

EDIT **> SETUP > MOTOR > D–RES**

```
 – Axis One Drive Res –
–↑  36000(Fixed)  ↓–
```

Value: 36000 (fixed)
Range: N/A

The Drive Resolution is fixed at 36,000 as shown.

Configuring Motor Direction [MDi]

EDIT **> SETUP > MOTOR > DIR**

```
 – Axis One Motor Dir –
     POSITIVE
```

Select value, press ENTER

Value: Positive
Range: Positive or Negative

Provides a convenient way to change the motor direction for a positive distance command. When POSITIVE is selected as the motor direction, the EOT+ limit switch should be wired so that moves in the plus direction will activate the switch. When NEGATIVE is selected, the EOT+ limit switch should be wired so that moves in the negative direction will activate the switch.

Configure Encoder

If you are not using an encoder, set encoder mode to OPEN LOOP and skip to MECH.

Configuring Encoder Mode [EMi]

EDIT **> SETUP > ENC > MODE**

```
 – Axis One ENC Mode –
–↑ CLOSED LOOP–PM ↓–
```

Select value, press ENTER

Value: Closed Loop–PM
Range: Open Loop, Open–Stall, Closed Loop, Closed Loop–PM

Open Loop	The OPEN LOOP position will be displayed on the keypad.
Open–stall	The OPEN LOOP position will be displayed on the keypad, and the encoder will be used for stall detection. (See Following Error)
Closed Loop	The actual encoder position is displayed on the screen. All subsequent moves are calculated from this actual position. All moves are based on encoder pulses. Stall detection is enabled. Positioning resolution will equal the resolution of your encoder.
Closed Loop–PM	Same as closed loop except for the post move position maintenance of the last commanded position. Provides a “pseudo–servo” operation for a stepper system. Closed Loop–PM will not correct position while navigating menus with the keypad.

Use PM GAIN, PM VMAX, and IN–RANGE WINDOW parameters to specify position maintenance tuning parameters.

Application Notes:
Following–error is still active while in CLOSED LOOP–PM mode. A following–error will occur when the number of correction steps exceeds the following error value. This allows the unit to signal a fault when the displacement cannot be corrected, i.e. an obstruction. Ensure proper operation in Open Loop mode before Closed Loop–PM.

Configuring Encoder Resolution [ERi]

EDIT **> SETUP > ENC > E–RES**

Value: 10000 cnts/in
Range: 1–9999999

```
– Axis One ENCODER RES–
–↑ 10000 cnts/in ↓–
```

Select value, press ENTER

This option sets the encoder resolution. The resolution is specified in encoder pulses per in of travel, post–quadrature. To prevent end–of–move dither, an encoder resolution of 8000 or less is recommended.

Configuring Following Error Limit [FEi]

EDIT **> SETUP > ENC > FOL–ERR**

Value: 10000 Steps
Range: 0–99999 motor steps (0 = Off)

```
 – Axis One Fol Error –
–↑  10000 Steps  ↓–
```

Select value, press ENTER

If a Following Error occurs, the control will enter a fault state where:

- Any motion or program being executed is immediately terminated.
- The LCD Display will indicate “Following Error”, along with an explanation.
- A fault output will be generated if defined as a “Stall” or Fault output.
- The fault must be cleared before motion can occur. A Stop or Kill, by programmable inputs or serial command, the ESC key or a RESET will clear a Following Error fault
- Bit 9 of SS response is set to 1
- Bit 1 of SD response is set to 1

Configuring Position Maintenance In–Range Deadband [IRi]

EDIT **> SETUP > ENC > IN–RNGE**

Value: 25 Steps
Range: 0–32767 steps

```
 – IN–RANGE SETUP –
WINDOW
```

Select WINDOW (press F1)

```
 – IN–RANGE WINDOW –
←     25 steps    →
```

Enter encoder steps, Press ENTER (must be a positive number)

In–Range Window specifies the position maintenance deadband or region surrounding the set–point position. The “window” is specified in post–quadrature (4 x # of lines) encoder steps. The window is the region surrounding the commanded position in which the motor shaft can reside and not be considered “out of position.” The control will try to correct the position if the motor is outside this window.

Configuring Position Maintenance Gain [PGi]

EDIT **> SETUP > ENC > PMGAIN**

Value: 10
Range: 1–32,767

```
 – Axis One PM GAIN –
←        10        →
```

Select value, press ENTER

PM Gain specifies a gain value used to determine correction velocity. The correction velocity is calculated as “displacement* correction gain” in units of steps/in. Therefore, the larger the displacement, the faster position maintenance will attempt to correct position. For example, if the correction gain is set to 3 and an active displacement of 3200 steps occurs, the correction velocity will be (3 * 3200) = 9600 steps/sec.

Configuring Position Maintenance Max Velocity [PVi]

EDIT **> SETUP > ENC > PMMAX**

Value: 1.0 in/s
Range: 0.005–9,999,999.0

```
 – Axis One PM MaxVel –
←    1.0 in/s      →
```

Select value, press ENTER

Limits the velocity of a position maintenance correction. Regardless of the magnitude of displacement of correction gain, the correction velocity will never exceed this maximum velocity setting.

Configure Your Application (Mechanics)

The MECH SETUP menu allows you to preset distance, velocity, and acceleration units convenient for your application. These units are used for all display and position reporting modes. This menu also allows you to compensate for a known amount of backlash in your mechanical system, and to set a maximum allowable speed for each axis.

Action	Display	Comments
Press EDIT key	–↑EDIT↓– PROG SETUP POS	Select a sub–menu, press F1 (PROG), F2 (SETUP), or F3 (POS).
Press F2 (SETUP) key for more sub menu selections. Press ↓ key for more sub menu selections.	–↑SETUP↓– PROG RS232 MISC	Select a sub–menu, press F1 (PROG), F2 (RS232), or F3 (MISC).
Press F3 (MECH) key	–↑SETUP↓– MOTOR ENC MECH	Select a sub–menu, press F1 (MOTOR), F2 (ENC), or F3 (MECH).
Press ↓ key for more sub menu selections.	←↑ MECH SETUP ↓→ DIST Pitch Vel	Select a sub–menu, press F1 (Distance), F2 (Pitch), or F3 (Velocity).
Press ↓ key for more sub menu selections.	←↑ MECH SETUP ↓→ VMAX ACCEL AMAX	Select a sub–menu, press F1 (VMAX), or F2 (Accel), or F3 (AMAX).

Configuring the Distance Unit [DUi]

EDIT **> SETUP > MECH > DIST**

Value: inch
Range: inch or mm

```
 – Axis One Dist Units –
←↑      inch      ↓→
```

Select value, press ENTER

This sets the distance units and unit label. All distance values are expressed in the units selected here.

Configuring Units of Velocity [VUi]

EDIT **> SETUP > MECH > VEL**

Value: in/s
Range: in/s or in/min

```
– Axis One Vel Units –
←↑      in/s      ↓→
```

Select value, press ENTER

Sets the velocity units. All velocity values will be expressed in these units.

Configuring Maximum Velocity [MVr]

EDIT **> SETUP > MECH > VMAX**

Value: 100.0 in/s
Range: 0–9999999.0

```
– Axis One MAX Vel –
←↑   100.0 in/s   ↓→
```

Select value, press ENTER

Sets the top speed of your motor. (Limits the speed from LinStep+ to prevent accidental damage to your mechanics.)

Configuring Acceleration Units [AUi]

EDIT **> SETUP > MECH > ACCEL**

Value: sec
Range: seconds or in/s^2

```
– Axis One Accel Units –
←↑      sec       ↓→
```

Select value, press ENTER

Sets the acceleration (and deceleration) units. All acceleration and deceleration values will be expressed in these units. You can specify acceleration as a rate, or in time–to–accelerate to full speed.

Configuring Acceleration Maximum [AMr]

EDIT **> SETUP > MECH >AMAX**

Value: 0.002 sec
Range: 0.002–9999999.0

```
– Axis One MAX Accel –
←↑   0.002 sec   ↓→
```

Select value, press ENTER

Sets the maximum acceleration and deceleration limit for programmed move profiles. Programmed accelerations and decelerations for moves will be limited by this parameter (like VMAX for velocity).

Configure the I/O

Each input and output is easily defined with the I/O SETUP menus. When the I/O's are defined, it is a good idea to write down the configuration for later reference.

Configuring Input Definition [IDaaaaaaaa]

EDIT **> SETUP > I/O > INPUTS**

Value: IUUUUUUU
Range: N/A

```
IN1:Unassigned
IUUUUUUU       ←↑↓→
```

Select value, press ENTER

Each input is easily configured using the keypad as described in Table 5-1. The function of each input channel is indicated by a letter at the bottom of the display.

Note: Use the ← and → keys to select an Input. Then use ↑↓ to select the definition for each input (described in Table 5-1).

Table 5-1

Char	Keypad Display	Input Character Description
B	Bin Program	Binary Program Select – allows remote program selection and execution from a PLC, switches, or outputs from a PC. Up to 255 programs may be selected using 8 binary inputs. The lowest numbered input becomes the least significant selection bit (i.e., input #1 is less significant than input #2). The act of configuring an input as a program select input also enables binary program select mode.
C	BCD Program	BCD Program Select – allows remote program selection and execution using a PLC, switches, or outputs from a computer. Up to 99 programs may be selected using BCD inputs. The lowest numbered input becomes the least significant selection bit (i.e., input #1 is less significant than input #2).
c	Clear Command Buffer	Clear Command Buffer – Clears the terminal input buffer and buffered command buffer.
D	Disable Keypad	Lock (Disable) Keypad – When activated, the keypad is disabled allowing NO user access. The keypad resumes normal operation, subject to the DIP switch pattern, when the input is released.

Table 5-1 Continued

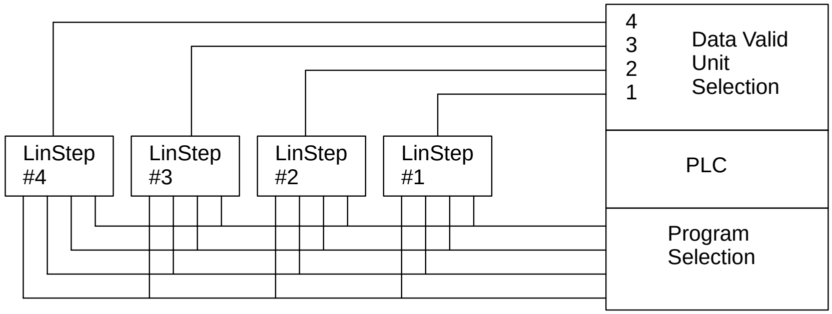
Char	Keypad Display	Input Character Description
E	Extend Jog	Extend Jog – When activated, the motor will Jog in the Extend (+) direction. When the input is released, motion stops at the Jog Accel rate. If an End of Travel limit is hit while jogging, the motor will stop at the Stop Rate (see Edit–Setup–Misc.). Before the motor can be removed from the limit, a Stop or Kill input must be activated to clear the fault generated by the End of Limit switch. Serial commands S or K will also clear the fault. The velocity is determined by the Jog Speed Input and the Jog Low and High setup parameters. When the input is off, the speed is low. If no input is configured for Jog Speed, the motor will jog at the Jog Low setting.
G	Registration	Registration – Input #1 must be configured as a Registration input – no other inputs will work. See the RG command for more details.

I	Interrupt (Run98)	Interrupt (Run 98) – When activated, motion on all axes stop at the stop–rate (see Edit–Setup–Misc–Stop–Rate). The current program is stopped, and processing continues with the first command in program 98. If no program is running when the input is activated, program 98 will run. This input is ignored while the keypad is in Edit mode. This is a positive edge triggered input, rather than a level sensitive input. If multiple inputs are configured as Interrupts, only the first edge of the first activated input will be seen. If subsequent Interrupt inputs go active while the first Interrupt input is active, no additional interrupts will be seen.
		Advanced Interrupt handling can be achieved using the INT98CTRL and ARM INT98 variables. The INT98CTRL variable determines whether Interrupts can be disabled or not. The ARM INT98 variable allows you to arm and disarm the Interrupt as desired.
		After power–up, INT98CTRL is initialized to 0. In this mode, every interrupt results in an immediate jump to program 98, even if you just entered program 98. The value of (ARM INT98) is ignored.
		When INT98CTRL=1, Interrupts can be disabled with the ARM INT98 variable. INT98CTRL=1 also initializes ARM INT98 to 1. This means the control is watching for interrupts. When INT98CTRL is set to 1 an interrupt causes the program to jump to program 98 and sets ARM INT98=0, disabling any further interrupts until you re–enable them by setting ARM INT98=1. This allows you to control when you want to re–enable Interrupts in your interrupt service routine (program 98).
		To summarize, when (INT98CTRL)=1:
		If (ARM INT98)=0, Interrupts are ignored. (ARM INT98) is internally set to 0 on the first edge if the previous (ARM INT98) value was 1. Interrupt processing will be suspended until (ARM INT98) is reset to 1. This allows for input debounce and controlling the ability of program 98 to interrupt itself.
		If (ARM INT98)=1, The system is awaiting the first INT98 input assert edge. Once the interrupt is seen the control will go to program 98. Subsequent interrupts are ignored until (ARM INT98) is set to 1.
		INT98CTRL and ARM INT98 are reset to factory values on power–up.
		Note: There is a space in ARM INT98.
		When activated, any executing program or functional operation is terminated and program I98 (interrupt program) is immediately executed. If a move is executing when the interrupt is activated, the move is terminated (decelerated at a rate determined by the Stop Deceleration rate setup parameter). The unit will go into Run mode once program I98 is completed.

Table 5-1 Continued

Char	Keypad Display	Input Character Description
J	Jog Speed	Jog Speed – When a jog input is activated, the control checks the state of this input to determine the jog speed. If the input is OFF, the system will jog at the Jog Low speed. If the input is ON it will jog at the Jog High speed. If the input is not configured the jog inputs will jog at the Jog Low speed. This input works along with the Extend Jog and Retract Jog.
K	Kill	Kill Motion – Causes the control to abruptly stop commanding further motion and terminates program execution. No deceleration ramp is used. Caution: instantaneous deceleration could cause damage to mechanics. The Stop input provides a more controlled halt.
M	Shutdown 1	Motor Shutdown – May be activated when the control is not running a program and the motor is idle. Selecting shutdown (M, m) will disconnect power to the motor, which removes current (torque) and allows the motor to spin freely.
N	Analog Input	Analog – Analog input is provided with the LXOPTO44 and LXOPTO88 options. Analog input configuration is limited to inputs 1–6 only. Analog input values (AIx – the built–in variable) are updated every 16ms.
P	Pause/Continue	Pause/Continue – When this input is grounded, program execution is stopped. Moves are not interrupted when the Pause input goes active. Command execution will pause at the end of the move, and continue when the input goes high. See the ST and RG commands for interrupting moves in progress.
R	Retract Jog 1	Retract Jog – When activated, the motor will Jog in the Retract (–) direction. When the input is released, motion stops at the Jog Accel rate. If an End of Travel limit is hit while jogging, the motor will stop at the Stop Rate. (see Edit–Setup–Misc.) Before the motor can be removed from the limit, a Stop or Kill input must be activated to clear the fault generated by the End of Limit switch. Serial commands S or K will also clear the fault. The velocity is determined by the Jog Speed (J) input and the Jog Low and Jog High setup parameters. When the input is off, the speed is low. If no input is configured for Jog Speed, the motor will jog at the Jog Low setting.
S	Stop	Stop – When activated, any program execution or functional operation is immediately stopped. This includes any motion, time delays, loops, and faults. Moves will decelerate at the stop deceleration rate. New programs will not execute until the stop input goes inactive. See the SCAN setup parameter for more information on stopping program execution. See the ST command for more information on stopping moves without halting command execution.
U	Unassigned	Unassigned – An Unassigned input acts like a programmable input, and can be used in IF and WT statements just like any of the dedicated function inputs.
V	Data Valid	Data Valid – When configured, it determines if the Binary/BCD program select inputs are processed or ignored. If the input is active, program select inputs are processed, otherwise they are ignored. This allows applications to be wired in a pseudo–bus architecture fashion with each unit sharing the same program select lines, and the data valid inputs determining which units should listen. Configuring this output can greatly reduce panel wiring. In the example shown in Figure 5-1, using the Data Valid input reduced the number of wires by one–half.
W	Warm Boot	Warm Boot (System Reset) – Clears the RAM Buffer, and resets the LinStep+ to its power–up state. Programs and setup parameters are not erased. This is typically used to restart the system when a fault condition occurs. The power–up program, if defined, will start.

Figure 5-1



Configuring Output Definition [ODaaaaaaaa]

EDIT **> SETUP > I/O > OUTPUTS**

Value: PPPPPPPP
Range:

```
OUT1: PROGRAMMABLE
PPPPPPPP        ←↑↓→
```

Select value, press ENTER

Each input is easily configured using the keypad as described in Table 5-2. The function of each input channel is indicated by a letter at the bottom of the display.

Note: Use the ← and → keys to select an Input. Then use ↑↓ to select the definition for each input (described in Table 5-2).

Note: Lower case Input Characters (b, d, h, k and m) appear on the Keypad but are not used.

Table 5-2

Char	Keypad Display	Input Character Description
A	AMP FAULT	Amplifier Fault – Output goes low on any amplifier fault. An amplifier fault may be due to temperature, motor short–circuits, excessive following error, over–voltage and excessive regeneration conditions. Note: This is not an all–inclusive fault output. Use F–Fault for this.
B	BRAKE	It is often advisable that applications using a ball screw type actuator with a vertical load use a brake to prevent the load from falling in the event of a fault. The Brake output is normally disengaged, which is actually an ON condition. When a fault occurs, power to the brake is removed and the brake is engaged. This is a “fail–safe” type of brake, controlled by an OPTO module, and it requires a customer supplied, 120VAC power supply, or 24 VDC with B Motors.
C	OVER CURRENT	Not Used.
D	DIRECTION	The output remains set until motion is commanded in the reverse direction.
F	FAULT	The fault output acts as an all–inclusive fail–safe output. Under normal operation the output is low (ON) and goes high (OFF) when any type of fault occurs. A fault can occur from any amplifier fault condition (A) as well as for the following general faults: • BMA (Board Monitor Alarm) time–out • Error finding Home – both limits were hit. The exact cause of the fault can be determined a number of ways: • Shown on keypad display • RS–232C using the SS, SD, and SA status commands (see Appendix A) • Other outputs can be configured to show more specific fault states
H	AT HOME	The output goes high as long as the axis is at home.

Table 5-2 Continued

Char	Keypad Display	Input Character Description
L	LIMIT ERROR	The output goes low if a limit switch is hit during a normal move, or if both limits are hit during a Go Home move.
M	MOVE DONE	The output goes high as soon as an axis move is started and goes low when a move is completed.
P	PROGRAMMABLE	Unassigned outputs are set to Programmable and can be used with OT commands.
S	STALL	The output goes low if the control detects a motor stall.

Configure the Optional LXOPTO 44/88

LinStep+ does not have onboard OPTO I/O. Use OPTO44 or OPTO88 module to condition your I/O. The I/O on these racks is not bi–directional, so configuration is not necessary.

Configure the Output States

Configuring OPTO States at Power–up [OEa,iiiiiiii]

EDIT **> SETUP > I/O > OUTSTS > PWR–UP**

Value: OFF
Range: ON or OFF

```
On PwrUp Output #1
←↑       OFF      ↓→
```

Select value, press ENTER

Each output is easily configured using the keypad. Select if the output should power–up in the ON or OFF state.
Note: Use the ← and → keys to select an Output (1–8). Then use ↑↓ to select the definition.

Configuring OPTO States during a Fault [OEa,iiiiiiii]

EDIT **> SETUP > I/O > OUTSTS > FAULT**

Value: NO CHANGE
Range: ON, OFF or NO CHANGE

```
On Fault Output #1
←↑   No Change   ↓→
```

Select value, press ENTER

Each output is easily configured using the keypad. Select if the output should be ON or OFF state or NO CHANGE when a fault occurs.
Note: Use the ← and → keys to select an Output (1–8). Then use ↑↓ to select the definition.

Configuring OPTO States for Stop/Kill [OEa,iiiiiiii]

EDIT **> SETUP > I/O > OUTSTS > ST/K**

Value: NO CHANGE
Range: ON, OFF or NO CHANGE

```
On ST/K Output #1
←↑   No Change   ↓→
```

Select value, press ENTER

Each output is easily configured using the keypad. Select if the output should be ON or OFF state or NO CHANGE when a stop or kill command is received.
Note: Use the ← and → keys to select an Output (1–8). Then use ↑↓ to select the definition.

Configure End of Travel Switch Polarity

Configuring Motor Type [ET]

EDIT **> SETUP > I/O > LIMITS**

Value: NORM CLOSED
Range: NORM OPEN or NORM CLOSED

```
– Axis One EOT POL –
←↑  NORM CLOSED  ↓→
```

Select value, press ENTER

Allows selection of Normally Open or Normally Closed polarity of the End of Travel switch (EOT). Use ↑↓ to select the definition.

Configure JOG Parameters

The keypad provides a convenient way to jog the motor. The parameters that control your jog operation are configured using the JOG SETUP menu:

Action	Display	Comments
Press F2 (JOG) for more sub menu selections.	–↑SETUP↓– I/O JOG HOME	Select a sub–menu, press F1 (I/O), F2 (JOG), or F3 (HOME).
Press ↓ key for more sub menu selections.	–↑JOG SETUP↓– ACCEL LO–VEL HI–VEL	Select a sub–menu, press F1 (ACCEL), F2 (LO–VEL), or F3 (HI–VEL).
	–↑JOG SETUP↓– ENABLE	Select a sub–menu, press F1 (ENABLE)

Configuring JOG Acceleration [JAr]

EDIT **> SETUP > JOG > ACCEL**

Value: 0.1 {Accel Units}
Range: 0.0–9999999.0

```
– Axis One JOG Accel –
←     0.1 sec      →
```

Select value, press ENTER

Sets the acceleration and deceleration used during a jog move. Use the numeric keys to enter a value (units were selected in the SETUP > MECH > ACCEL menu).

Configuring JOG Low Velocity [JLr]

EDIT **> SETUP > JOG > LO–VEL**

Value: 0.1 {Velocity Units}
Range: 0.0–9999999.0

```
– Axis One JOG Lo-Vel –
←    0.1 in/s      →
```

Select value, press ENTER

Sets the low speed JOG velocity. Use the numeric keys to enter a value (units were selected in the SETUP > MECH > VEL menu).

Configuring JOG Low Velocity [JHr]

EDIT **> SETUP > JOG > HI–VEL**

Value: 5.0 {Velocity Units}
Range: 0.0–9999999.0

```
– Axis One JOG Hi–Vel –
←     5.0 in/s     →
```

Select value, press ENTER

Sets the high speed JOG velocity. Use the numeric keys to enter a value (units were selected in the SETUP > MECH > VEL menu).

Configuring JOG Enable [JEi]

EDIT **> SETUP > JOG > ENABLE**

Value: Enabled
Range: Disabled or Enabled

```
– Axis One JOG Enable –
←     Enabled      →
```

Select value, press ENTER

Enables or disables JOG features. When disabled, an error message is displayed when the jog buttons are pressed. JOG is often disabled after installation to prevent access.

Configure HOME Parameters

The homing function combines the flexibility of a customized homing routine with the ease of use of calling a “canned program”. (Also see the GH command).

Action	Display	Comments
Press F3 (HOME) for more sub menu selections.	–↑SETUP↓– I/O JOG HOME	Select a sub–menu, press F1 (I/O), F2 (JOG), or F3 (HOME).
Press ↓ key for more sub menu selections.	–↑HOME SETUP↓– MODE EDGE SWITCH	Select a sub–menu, press F1 (MODE), F2 (EDGE), or F3 (SWITCH).
Press ↓ key for more sub menu selections.	–↑HOME SETUP↓– OFFSET DIR	Select a sub–menu, press F1 (OFFSET) or F2 (DIR).

Configuring Homing Mode [HMi]

EDIT **> SETUP > HOME > MODE**

Value: Switch Only
Range: Switch Only

```
–Axis One Home Mode–
←↑  Switch Only  ↓→
```

Only one selection available.

Sets how a Go Home (GH) command will execute. The control will only search for the appropriate edge of a switch.

Configuring Home Edge [HEi]

EDIT **> SETUP > HOME > EDGE**

Value: NEGATIVE
Range: NEGATIVE, POSITIVE

```
– Axis One Home Edge –
←     NEGATIVE     →
```

Select value, press ENTER

Sets the home switch active on the negative edge or positive edge of the encoder index channel. Use the ← and → keys to select.

Configuring Home Switch [HSi]

EDIT **> SETUP > HOME > SWITCH**

Value: Norm Open
Range: Norm Open or Norm Closed

```
–Axis One Home Switch–
←    Norm Open     →
```

Select value, press ENTER

Selects the type of switch used for the home input. Use the ← and → keys to select.

Configuring Home Offset [HOr]

EDIT **> SETUP > HOME > OFFSET**

Value: 0.0 {Distance Units}
Range: 0.0–999999999.0

```
–Axis One Home Offset–
←      0.0 in      →
```

Select value, press ENTER

Sets the offset from home position for the “real” home position. After a successful homing move, the home position (the factory set home position is +0.0000) is set to the offset value. Use the numeric keys to enter a value.

This allows multiple systems to have identical programs and only change the home offset value for each machine.

Configuring Home Direction [HFi]

EDIT **> SETUP > HOME > DIR**

Value: POSITIVE
Range: NEGATIVE, POSITIVE

```
–Axis One Final Dir–
←     Positive     →
```

Select value, press ENTER

Sets the direction for the Go Home (GH) move. This is the direction used to search for the encoder index mark (Z channel) after the appropriate home switch edge is found.

Configure Power–up Program

The Program Setup menu allows selection of (1) a program to be immediately run when LinStep+ is powered–up and (2) scanning conditions for the BCD or binary program select inputs.

Action	Display	Comments
Press F1 (PROG) key for more sub menu selections.	`–↑SETUP↓–` `PROG    RS232    MISC`	Select a sub–menu, press F1 (PROG), F2 (RS232), or F3 (MISC).

Configuring Power–up Program [PUi]

EDIT **> SETUP > PROG > PWR–UP**

```
– Power Up Program –
PROGRAM:0
```

Select value, press ENTER

Value: 0
Range: 0–400

Sets the program to run at power–up. The selected program is executed (run) when power is applied or after a reset. If a value of 0 is entered in this menu, or if the specified program does not exist, no program is run. Use numeric keys to enter program number.

Configuring Scan Conditions [SNaaaaaaaa]

EDIT **> SETUP > PROG > SCAN**

```
– Stop After Scan –
←↑  YYYYYYY ESC  ↓→
```

Select value, press ENTER

Value: YYYYYYY
Range: YYYYYYY, NNNNNNN

Selects the events that cause the control to stop scanning program–select configured inputs. The selected event is listed to the right of these 7 characters: ESCape, STOP, LIMIT+, LIMIT–, KILL, FAULT or INTerrupt.

If a stop–scan event is enabled, the system will stop scanning the inputs for program numbers when that condition occurs. To resume scanning, a reset (Warm Boot input or cycle power Off then On) must be given. This option has no effect if the inputs are not configured as program select inputs (either BCD or Binary).

Configuring Scan Delay [DYi]

EDIT **> SETUP > PROG > DELAY**

```
– Scan Debounce –
DELAY (ms):100
```

Select value, press ENTER

Value: 100
Range: 0–99999

Sets the amount of time required for the program select inputs (BCD or Binary) to remain stable before they are valid. The minimum time is 2 ms. If program select inputs are not stable for a time equal to or greater than the specified delay, the program will not be executed. Use the numeric keys to enter a value in ms.

Note: See Data Valid Input Configuration for an alternate approach.

Configure Serial Communications

To use the LinStep+ serial port, several things must be done first. Use the keypad to set the auto–echo and the unit's daisy chain address. The baud rate and other parameters have fixed values and may not be changed.

- Baud rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: none

Action	Display	Comments
	–RS232C SETUP– ECHO UNIT#	Select a sub–menu, press F1 (ECHO), F2 (UNIT#).

Configuring Echo Enable [ECi]

EDIT **> SETUP > RS232 > ECHO**

Value: Enabled
Range: Enabled, Disabled

```
  – RS232C ECHO –
↑    ENABLED     ↓
```

Select value, press ENTER

Enable or disable the RS–232C ECHO feature. If ECHO is disabled, characters received by the control's serial port will not be re–transmitted. ECHO must be enabled in daisy–chain applications.

Configuring Unit Number [UNi]

EDIT **> SETUP > RS232 > UNIT#**

Value: 1
Range: 1–99

```
 ↑ Unit Number ↓
NUMBER:1
```

Select value, press ENTER

Set the unit's address. Each unit in an RS–232C serial daisy chain of multiple units must have a unique Unit Number.

Configure Miscellaneous Setup Parameters

The miscellaneous set–up (MISC SETUP) parameters include the keypad display, and setting the deceleration rate used with a stop input (or with the ESC key while an axis is moving).

Action	Display	Comments
Press EDIT key	–↑EDIT↓– PROG SETUP POS	Select a sub–menu, press F1 (PROG), F2 (SETUP), or F3 (POS).
Press F2 (SETUP) key for more sub menu selections.	–↑SETUP↓– PROG RS232 MISC	Select a sub–menu, press F1 (PROG), F2 (RS232), or F3 (MISC).
Press F1 (DISP) key for more sub menu selections.	↑MISC SETUP↓ DISP Stop–Rate Test	Select a sub–menu, press F1 (DISP), F2 (Stop–Rate), or F3 (Test).

Configuring Display Format [DF]

EDIT **> SETUP > MISC > DISP**

Value: 1=POS1, 2=Blank, 3=Inputs, 4=Outputs
Range: See Table 5-3.

The “Run Time” screen of the data display can be customized. The run time screen has four 10 character segments called quadrants. Each quadrant can display one of nine data types defined in Table 5-3.

Select one quadrant, then assign a data type to that quadrant, press ESC to save the data type. Repeat this process for each quadrant.

Note: To define the text for the “text” data type, scroll to the text data type selection and press the “ALPHA” or a number key. A cursor is then displayed, enter up to 10 characters then press ENTER followed by the ESC key to save and exit.

```
<QUAD#1>   QUAD#2
 QUAD#3    QUAD#4
```

```
←↑ QUAD#1 DISPLAY ↓→
↑        POS1       ↓
```

Use the ←↑↓→keys to select a Quadrant (1–4), press ENTER.

Use the ↑ and ↓ keys to select a data type.

Table 5-3

Data Type	Description of Display Data Type
Blank	No Display
POS1	Axis Position
POS1+Unit	Axis Position with axis units
VEL1	Commanded Axis Velocity
Inputs	Discrete input status (0=Off, 1=On)
Outputs	Discrete output status (0=Off, 1=On)
SA_Status1	SA (Tell Axis Status) serial command response
SS_Status	SS (Tell System Status) serial command response
Text	User defined text

Configuring Stop Decel Rate [SRi]

EDIT **> SETUP > MISC > Stop–Rate**

Value: 80 in/s^2
Range: 0.0–99999.0

```
– Axis One Stop Decel –
←     80 in/s²     →
```

Enter a value, press ENTER

Set the deceleration rate used whenever a configurable stop input is activated, or when the ESC key is pressed during a move. Normally set to the fastest controllable deceleration rate possible with mechanics in your application.

Configuring Passwords [PWaaaa,aaaa]

EDIT **> SETUP > MISC > PASWRD**

Value: None
Range: N/A

```
– Password Setup –
OPRATR  ADMIN   CLEAR
```

Select a value, press ENTER

Passwords allow you to restrict access to the RUN, EDIT, COPY, DEL and keypad DIP switches. Select Operator or Administrator (see Table 5-4 for description).
Enter a password, use ← → and DEL keys to edit the password.

General Password Rules:

- Passwords are 4 characters maximum. 0–9, upper and lower case letters, in any combination.
- If no password is entered, there is no restriction.
- Entering the wrong password or pressing ESC at the password prompt will return the keypad to the standard run–time display.
- Select EDIT > SETUP > MISC > PASWRD > CLEAR to delete all passwords.

Note: Subsequent attempts to RUN or EDIT a program do not require a password. You are prompted to: Use Last (F1) or Reset (F3). Select Use Last to run or edit another program. Select Reset to require the next user to enter a password.

Table 5-4

Password Type	**Description**	**Gives access to these menus**
OPRATR	Operator only	RUN, EDIT, COPY, DEL
ADMIN	Administrator only	RUN, EDIT, COPY, DEL
CLEAR	Clears Passwords	

Section 6
Keypad Programming

Commands

The programming commands that can be entered from the keypad are listed in Table 6-1.

Table 6-1 Keypad Program Command List

AC	Acceleration	GH	Start Home	OT	Outputs On/Off
CL	Not Implemented	FK	Function Key	MS	Message to Display
CT	Not Implemented	GI	Go Immediate	ON	On Condition
DA	Distance Absolute	GO	Go (Start a Move)	“__”	“Message to Serial Port”
DC	Distance to a Change	GS	Gosub	RG	Registration Move
DE	Deceleration	GT	Go To Program	SP	Set Position
DI	Distance Incremental	IF	If (conditional)	ST	Stop Move on Input
EB	End of Block	IV	Input Variable	TD	Time Delay
EN	End of Program	LP	Loop	VE	Velocity
		MC	Move Continuous	WT	Wait

AC Acceleration — syntax – ACr

Value: N/A
Units: seconds, in/sec^2 or units/sec^2 (set in EDIT > SETUP > MECH > ACCEL)
Range: Unit scaling dependent

Sets the acceleration and deceleration ramps on all velocity changes. The deceleration value (DE) is the same as the acceleration value unless DE is specifically set after the AC command (the value of DE must then be changed every time AC is changed). Change only AC if you want a symmetrical move profile.

Examples:

AC2 VE12 DA3 GO	Sets acceleration and deceleration to 2.
DE.5 VE12 DA6 GO	Accel stays at 2, decel changes to 0.5.
VE20 DA0 GO	Acceleration and deceleration remain at 2 and 0.5.
AC4 DA2 GO	Acceleration and deceleration become 4.
DE3 AC1 DI3 GO	DE reset to 1 by AC1 before the move is made.

CL Not Implemented syntax –

Value:
Units:
Range:

CT Not Implemented syntax –

Value:
Units:
Range:

DA Distance Absolute syntax – DA±r

Value: N/A
Units: set in EDIT > SETUP > MECH > DIST
Range: Unit scaling dependent

Sets the next move position, referenced from absolute zero. The absolute zero position is established after a Go Home move (GH) and/or with the Set Position (SP) command. Absolute positioning is typically used to move between a number of known locations, or if the physical work area is restricted.

Incremental (DI) and absolute moves may be mixed; the control keeps track of the absolute position.

Example:

AC2 DE.5 VE12 DA3 GO	Moves to absolute position 3 units.
DA3 GO DA3 GO	Moves once to absolute position 3 units.

DC

Distance to Change syntax – DC±r

Value: N/A
Units: set in EDIT > SETUP > MECH > DIST
Range: Unit scaling dependent

Defines complex, multiple velocity move profiles, or to change an Output at a specific point during the move. It defines the distance at which a change will occur, "on the fly", while the motor is still moving. At the specified distance you can change the velocity, acceleration, deceleration or change the state of an output(s). The DC command must follow the DA or DI command which specifies the total move distance.

The DC distance is interpreted as an absolute position when used with DA and an incremental position when used with DI. When used with DI, the value of DC should be specified as a positive number. When multiple DC's are specified within an incremental move (DI), the incremental distance specified by the DC command is taken from the last DC command, not from the beginning of the move. A maximum of 20 DC commands within a move profile are supported.

Examples:

AC.05 DE.05 VE10 DA4 DC1 OT100 DC2 OT010 DC3 OT001 GO
While moving to an absolute position of 4 units turn on output 1 at 1 unit, output 2 at 2 units and output 3 at 3 units.

AC.05 DE.09 VE30 DA6 DC3 VE15 GO
Move to absolute position 6 units with a starting speed of 30. At 3 units, reduce speed to 15 (change–on–fly) and complete move.

AC1 DE.5 VE20 DI–8 DC1 OT10 DC3 OT01 GO
Move an incremental distance of negative 8 units. After 1 unit turn on output 1 and after 3 MORE units of motion, turn off output 1 and turn on output 2.

AC.05 DE.15 VE50 DI15 DC5 VE10 DC5 VE5 GO
At a starting speed of 50, begin moving an incremental distance of 15 units. After 5 units, ramp down to 10 speed. After 5 MORE distance units ramp down to 5 speed and continue until the final position is reached.

Example: (Distance to Change)

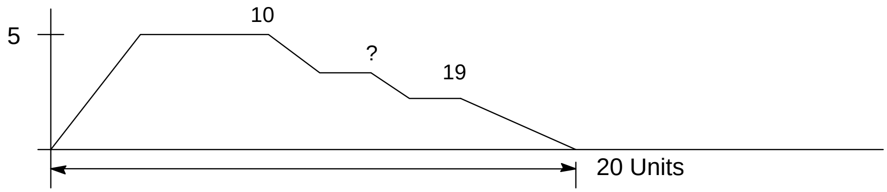
The DC command can only be used when the motor is moving at constant speed (no acceleration of deceleration). Issuing a DC command before a previous DC command has finished executing is invalid and can cause unpredictable results. (For example, “AC1 VE DA20 DC1.75 VE7.5 GO” is incorrect use of the DC command). The initial acceleration ramp requires 2.5 units to reach velocity S= $0.5V_t$, the DC1.75 is an invalid trigger position and is ignored. The following formula ensures the use of valid DC trigger positions:

$$DC_n - DC_{n-1} - \frac{(|V_{n-1} - V_n|)^t}{2} \geq 0$$

Where:
n is the commanded DC distance (n=19 in this example)
n–1 is the previous commanded DC distance (for example 10)
V is the velocity
t is the acceleration time
(The first commanded DC move in a profile, n–1 is the beginning of the move).

Examples of DC move profiles:, AC = seconds, VE=ips.

AC1.6 DE0.8 VE5 DA20 DC10 AC2.5 VE3 DC? VE2.5 GO



To calculate DC_n (or DC? in the example)

$$DC_n = \frac{(|5 - 3|)\ (2.5)}{2} + 10 = 12.5$$

“?” must be ≥ 12.5 distance units. Also, the DC trigger position and the DC? VE2.5 segment must be verified or determined before the beginning of the move declaration. If “?” is chosen to be 13.35 (a valid trigger position), use the beginning of the decel ramp as DC_n in the DC formula. A decel ramp from 2.5 to 0 requires 1 distance unit in 0.8 seconds (S= $0.5V_t$).

$$19 - 13.35 - \frac{(|0 - 2.5|)\ (0.8)}{2} = 5.65$$

Since the result is positive, the DC13.35 VE2.5 is a valid segment.

AC.05 DE.05 VE10 DA4 DC1 OT100 DC2 OT010 DC3 OT001 GO

{While moving to an absolute position of 4 units, turn on output 1 at 1 unit, output 2 at 2 units and output 3 at 3 units}

AC.05 DE.09 VE30 DA6 DC3 VE15 GO

{Move to absolute position 6 units with a starting speed of 30. At 3 units, reduce speed to 15 (change–on–fly) and complete move}

AC1 DE.5 VE20 DI–8 DC1 OT10 DC3 OT01 GO

{Move an incremental distance of negative 8 units. After 1 unit, turn on output 1, and after 3 additional units of motion, turn off output 1 and turn on output 2}

AC.05 DE.15 VE50 DI15 DC5 VE10 DC5 VE5 GO

{At a starting speed of 50, begin moving an incremental distance of 15 units. After 5 units, ramp down to 10 speed. After an additional 5 distance units, ramp down to 5 speed and continue until the final position is reached}

DE Deceleration syntax – DE±r

Value: N/A
Units: seconds, in/sec^2 or units/sec^2 (set in EDIT > SETUP > MECH > ACCEL)
Range: Unit scaling dependent

Sets the deceleration ramp for all negative velocity changes. This value is the same as the acceleration value unless a deceleration is specified. The value is used on subsequent moves unless it is re–specified by an acceleration (AC) or deceleration (DE) command.

Examples:

AC2 VE12 DA3 GO	Sets acceleration and deceleration to 2.
DE.5 VE12 DA6 GO	Accel stays at 2 and decel changes to 0.5.
VE20 DA0 GO	Acceleration and deceleration remain at 2 and 0.5.
AC4 DA2 GO	Both acceleration and deceleration become 4.
DE3 AC1 DI3 GO	AC1 sets both the accel and decel to 1.

DI Distance Incremental syntax – DI±r

Value: N/A
Units: set in EDIT > SETUP > MECH > DIST
Range: Unit scaling dependent

Specifies a move distance relative to the current position. Such moves are called incremental moves, as opposed to the absolute move (DA). Use incremental moves when there is no concern for origin, such as feed–to–length applications. DI is also often used inside a loop to shorten a program. Incremental and absolute moves may be mixed; the control keeps track of the absolute position.

Example:

AC.1 VE60 DI2 GO DI1 GO DI–4 GO
Move 2 units in the + direction. Move 1 more unit in the positive direction. Move 4 units in the negative direction. The final absolute position is –1.0000.

EB End of Block syntax – EB

Value: N/A
Units: N/A
Range: N/A

The EB command designates the End of a Block of loop or IF commands. Every LP, LW, LU, and IF statement must have an EB associated with it.

Examples:

LP2 DI3 GO EB	Performs the move twice
IF1,1 DI5 GO DI10 GO EB GH3	If input 1 is On, make 2 moves before homing. If input 1 is Off, jump to the GH command.

EN End of Program syntax – EN

Value: N/A
Units: N/A
Range: N/A

EN marks the end of a program or subroutine. It is optional at the end of a program. If EN marks the end of a subroutine, command execution continues from the command following the gosub (GS) command that called the subroutine. If the routine was not called from another program, the EN command simply stops execution. The control continues to monitor the program select inputs (if defined). The EN command can be used anywhere in a program to stop command execution.

Example:

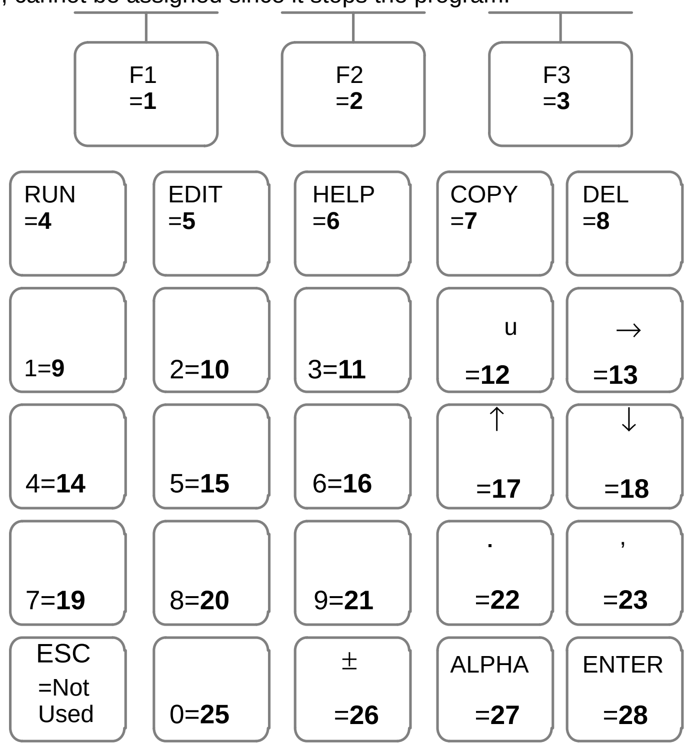
IF2,1 EN EB DI2 GO	If input #2 is on, stop the program, or return to the calling program. If not, move 2 units.

FK Function Key syntax – FKi,i,..,i

Value: N/A
Units: N/A
Range: i=1–28

The FK command allows you to define a function key within your program. The FK command pauses processing until the buttons you have “armed” are pressed. The number of the button pressed is assigned to the system variable, (FKEY). You can then manipulate or directly use this variable to branch to other routines or make other decisions. FK allows the programmer to redefine the keypad’s function keys as operator menu selection buttons. You can even write your program with menus that look and feel like our setup menus. The returned values of the FKEY’s are:

Note: 24, the ESC key, cannot be assigned since it stops the program.



Example:
FK1,2,3,4
GS(FKEY)
Pauses command execution until F1, F2, F3, or RUN is pressed on the keypad. (FKEY) is assigned a value of 1–4. Subroutine 1–4 is called with the GS(gosub) command.

Figure 6-1 shows how to use the keypad function keys as an operator interface. A 3–screen menu program is provided

1. Write a menu message (MS) on the keypad display above the corresponding function keys.
2. Use the FK command to pause command processing until the operator selects a valid function key. Only keys explicitly defined in the FK statement are considered valid.
3. Gosub to the appropriate program.

Figure 6-1 Example 3–Screen Menu Program

Program 20:	
[SCREEN 1]	Name the main program
MS1,“ “	Clears keypad screen
MS3,“Select a Part”	Writes a Message
MS21,”Part A Part B Part C”	Writes a message above function keys
FK1,2,3,17,18	Wait for selected key press
GT(FKEY)	Jumps to prog# 1, #2, or #3 if F1,F2, or F3 is pressed Jumps to prog #17, or #18 if the up or down arrow keys are pressed.
EN	End of Routine
Program 18:	
[SCREEN 2]	
MS21,“Part D Part E Part F”	Writes a message above F1, F2, F3.
FK1,2,3,17,18	Wait for selected key press
IF(FKEY)=17 GT[SCREEN 1]	EB If Up arrow goto screen 1
IF(FKEY)=18 GT[SCREEN 3] EB	If Down arrow goto screen 3 (FKEY)=(FKEY)+3 Add offset to FKEY variable to goto correct part subroutine.
GT(FKEY)	Jumps to part D, E, F in program#4, 5, or 6
EN	End of Routine
Program 17:	
[SCREEN 3]	
MS21,“Part G Part H Part J”	Writes a message above function keys.
FK1,2,3,17,18	Wait for selected key press
IF(FKEY)=17 GT[SCREEN 2] EB	If Up arrow goto screen 2
IF(FKEY)=18 GT[SCREEN 1] EB	If Down arrow goto screen 1
(FKEY)=(FKEY)+6	Add offset to FKEY variable to goto correct part subroutine
GT(FKEY)	Jumps to part G, H, J in program #7,8 or 9
EN	End of Routine

The programs to make Parts A, B, C, D, etc. are in program numbers 1–9. To continuously cycle through put a GT[SCREEN 1] at the end of each part program.

GH Start Home syntax – GH±r

Value: N/A
Units: set in EDIT > SETUP > MECH > ACCEL > VEL
Range: Unit scaling dependent

Initiates a homing routine (seeks the home switch) to establish a home reference position. When it reaches home, the position counter is set to zero or to the Home Offset (HO) value selected in the EDIT > SETUP > HOME menu. The motor will move at the GH velocity (n) and direction (±) specified until it either finds a home limit switch or determines that it can not find one between the two end–of–travel limit switches. The Go Home move uses the last acceleration and deceleration specified.

The exact homing routine used, and the ultimate end position of your system's home reference, depends on the values of your EDIT > SETUP > HOME parameters (edge, level, final approach direction, and offset) and if you have specified open or closed loop moves in the EDIT > SETUP > ENCODER menu. The control will reverse direction when the first End of Travel limit switch is encountered while searching for a Home switch. If the second End of Travel switch is encountered, the unit will abort the Go Home move and generate a fault. Assuming the presence of an operational home switch, the control will seek a home position according to the parameters you specified (edge, level, final approach direction, and offset).

Closed loop systems will normally home with more accuracy than open loop systems because encoders have a Z marker pulse. In a typical Go Home routine, the control will first sense the edge of the switch defined in the Go Home SETUP menu. It will then decelerate the motor to a stop at the last defined deceleration rate. The final homing motion is determined by the Go Home options selected in the SETUP menu. The final homing direction dictates the direction from which the final approach to the switch is made. The edge selected will determine which side of the home switch this final approach will be based from.

In a "closed loop" mode Go Home routine, the control will additionally slow to a creep speed and stop when it sees the encoder's "Z" Marker Pulse after seeing the reference edge of the switch. If a marker pulse is not seen within one motor revolution after the reference edge of the switch is seen, the final homing routine will be aborted.

Note: Homing Mode directly affects or reconfigures the function of the GH command.

Examples:

AC.5 DE.5 GH–20	Go Home in the negative direction at a speed of 20
AC.5 DE.5 GH20	Axis one Go Home in the positive direction at a speed of 20.

GI Go Immediate syntax – GI or GIi

Value: N/A
Units: N/A
Range: N/A

The GI command begins a defined move profile in the same manner as the GO command. Unlike the GO command, where program execution waits until all defined moves have terminated, GI allows program execution to continue when the move has begun. This allows for other program defined processes to take place while an axis is moving, such as independent multi–axis moves, OT commands, and conditional IF blocks.

Examples:

VE1 DI20 GI MS1, “Axis #1 is moving” TD2

In this example, when the DI20 move begins, program execution immediately displays the “Axis #1 is moving” message for 2 seconds. When the TD2 command has executed, the program will terminate; however, axis #1 will continue to move until the DI20 distance is reached. A Stop, Kill, or press of the ESC key will halt a GI based move either inside or outside program execution.

The GI command can cause program execution and moves to be asynchronous. To re–synchronize the end of a GI move with program execution, use the Wait (WT) command, i.e. WT#1 will wait for only axis #1. If a program error occurs during a GI move, the move will stop at the Stop Decel Rate.

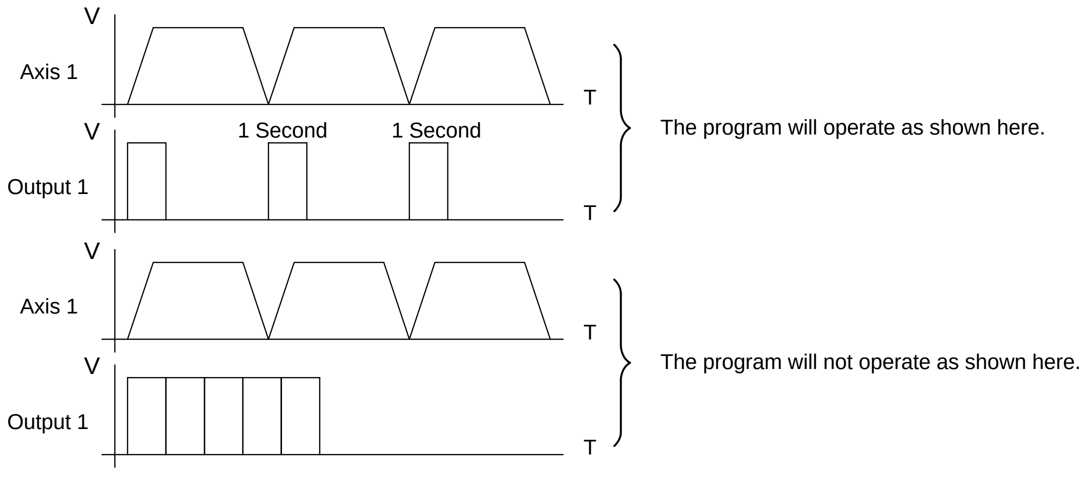
VE1 DA100 GI OT1,1 DA0 GI IF1,1 MS1, “All moves done” EB

If a GI move is in progress and an additional move is commanded on the same axis, the additional move will not begin until the GI move has completed.

In this program, one may expect to see the message “All moves done” immediately after the DA100 move begins. In reality, the program will wait at the DA0 GI until the DA100 move has completed before continuing. More simply stated, a move cannot be commanded to begin on an axis that is already moving.

Since GI allows program execution to continue, there can be programming issues when using GI. For example, in the program fragment “LP VE2 DI10 GI OT1 TD1 OT0 EB” shown in Figure 6-2, after the first pass through, the loop command (LP) will wait at the GI command since subsequent GI moves must wait for the present move to finish.

Figure 6-2



GO

Go (Start a Move) syntax – GO or GOi

Value: N/A
Units: N/A
Range: i=1–16

GO executes a move profile defined by some combination of AC, VE, DE, DI, DA, DC, or MC commands. Actual motion of a new profile will occur after a short calculation of the motion trajectory. GOn pre–calculates the move and waits for Input number “n” to activate before executing. This variation is sometimes useful for applications needing very short, repeatable move calculation delays. It is more often used simply to shorten code, since it functions like the combination of Wait on Input and Go (WTn GO) yet it pre–calculates the move. Like other commands using I/O, GOn does not restrict you from using an input even if it has been configured for some predefined function.

Examples:

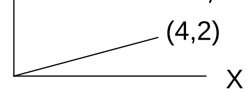
AC.05 DE.05 VE50 DI5 GO	GO initiates calculation of a move profile using buffered parameters (.05 unit Accel and Decel Ramp, speed 50, 5 unit incremental move) and executes it.
AC.05 DE.05 VE50 DI5 GO2	When input 2 is activated, immediate execution of the motion calculation already in the buffer is performed.

GP

Go Point(Start a Move) syntax – GP or GPn

Value: N/A
Units: N/A
Range: N/A

Example:
`VE2 AC.1 DA4,2 GP`



The GP command allows a LinStep+ two axis to execute a linear interpolated move. An example of the GP move is shown. The path velocity, acceleration and deceleration are specified by the parameters traditionally defined for one axis move. These parameters are defined once and each GP move there after will use these values until new values are entered. The end point of the move is specified by a two axis DA or DI command to the appropriate X and Y coordinates.

In the example, the path velocity is 2 user units/sec, path acceleration is .1 sec and the X,Y position is (4,2).

The GPn command specifies a discrete input must be active before executing the move. Although both axes move during a GP move, all GP parameters refer to the path movement rather than the individual axis movements.

Notes:

GP will work with any velocity or acceleration unit.

The largest GP move is restricted to X2+Y2 <= (231–1)^2 in units of steps.
For example, the longest simultaneous X,Y point move is:
Steps: `DA1518500249,1518500249`
If resolution is 8000: `DA189 812.5311,189 812.5311`
If resolution is 25000: `DA60 740.0099,60 740.0099`

Commanding moves larger than X2+Y2 <= (231–1)^2 will produce unpredictable results.
The DC command does not recognize an interpolated move as a ’single’ move and will treat the axes independently. Therefore, using a DC during a GP move will cause unpredictable results unless the user has calculated the necessary values to preserve the vector move.

GS Gosub syntax – GSi and GS[name]

Value: N/A
Units: N/A
Range: i=1–400, [name] = any legal program name

Jumps to program number or name and returns to the calling program when command processing reaches the EN command in the sub–routine. After the return, execution continues at the command immediately following the GS statement. Subroutines may be nested 16 levels deep. A Goto (GT) clears the subroutine stack, preventing future Gosubs from overflowing the stack or returning to the wrong location.

Example:

DI10 GS[Part A] GO	Run program "Part A", return and make a 10 unit incremental move.

GT Go to Program syntax – GTi or GT[name]

Value: N/A
Units: N/A
Range: i=1–199 (1–400 with 30k memory option), [name] = any legal program name

GT branches to the program number or name specified. All subsequent commands in the calling program are ignored. Nested loops and subroutine calls are cleared by a GT command.

Examples:

IF10 GT[PART A] EB	IF input 1 is on and input 2 is off, jump to program "Part A"
IF01 GT20 GT30 EB EN	IF input 1 is off and input 2 is on, run program 20. Program 30 is never run. Use the GS command if you want to return to this program and goto program 30.

IF If

syntax – IF (Mathematical expression)
IFxx (assumes first input is input 1)
IFi,xx ...

Value: N/A
Units: N/A
Range: i=starting input number 1–8
x=0; input high. X=1; input low (grounded). x=anything else; ignore input changes.
expression = any valid expression (see math and variables definitions)

Allows the conditional execution of a block of commands based on the evaluation of an expression or input state. If the expression or input state is TRUE, the commands between the IF and the EB are executed. If FALSE, execution continues with the command following the EB. An IF statement should not be confused with a WT statement. An IF statement evaluates, true or false, based on the conditions at the instant the command is processed. A WT statement pauses command processing until the condition is true.

Note: An End of Block (EB) command must be used with every IF command.

IF blocks can be nested up to 16 levels deep. To increase flexibility (primarily with programmable logic controllers) the IF command allows you to use configured inputs with the command. To help prevent this added flexibility from causing programming confusion, you can specify any character as an input (x). This allows you to self document your IF statements. For example, assume you configure input #3 as a "JOG SPEED" input. Programming like "IF01J10" can help remind you that you are already using input #3 as "JOG SPEED".

Examples:

IF14,1 GO EB	If input 14 equals 1 Go
IF12,010 GO EB	If inputs 12–14 equal 010 Go
IF110 GO OT3,1 EB	If inputs 1–3 equal 110 Go and turn on Output #3
IF(TEMP) > 50 OT1 EB	If temperature variable > 50 turn on Output 1
IF(PARTS)=25 GS20 EB	If PARTS variable = 25 Gosub to Program 20

IV Input Variable

syntax – IVi,(variable),min,max

Value: N/A
Units: N/A
Range: i=1–40 display position characters
variable= any legal variable name
min=the minimum range value (optional); max=the maximum range value (optional)

Allows operator input of variable information under program control. It is usually used with the message command (MS) to prompt for operator input of the variable specified in the IV statement. The cursor is placed at character position “i”. The program waits until a number is entered before continuing execution. You are not allowed to type past the end of either display line. Variables store 4 digits to the right of the decimal place.

When minimum and/or maximum range values are specified, the IV command will not accept inputs outside this range (one of the following messages is displayed on the keypad):

- Input below minimum, Press ESC to resume
- Input above maximum, Press ESC to resume

Variables can be used in a math equation, conditional expression or to set any command parameters (Example: DA, DC, VE, AC, LP, IF, TD, etc.). A variable can be used anywhere in a program a real number or integer is used. Use care when performing math on variables used in LP statements. LP will truncate the non–integer portion of the variable. For example: (COUNT)=25*.2 LP(COUNT) will only loop 4 times because (COUNT)=4.9999. A small offset can be added to variables used in LP statements to avoid this problem. (COUNT)=(COUNT)+.1 will guarantee that (COUNT) will be greater than 5, so the program will loop 5 times.

Examples:

MS1,“”	Clears the Display
MS1,“How many?: ”	Writes string beginning at character 1, top line
IV12,(PIECES),1,15	Waits at 12th character for the # of pieces in the range 1–15.
MS1,“”	Clears the Display
MS1,“How long?: ”	Writes string beginning at character 1, top line
IV12,(LENGTH)	Waits at 12th character for the # of pieces.
LP(PIECES)	Loops the number of pieces entered
DI(LENGTH)	Defines the desired move length/distance.
GO	Moves the length commanded
EB	Ends the loop.

LP

Loop

syntax – LPi

Value: 0
Units: N/A
Range: N/A

Causes all commands between LP and EB to be repeated “i” times. If LP is entered without a number following it or a 0, the loop will repeat continuously.

Note: An End of Block (EB) command must be used with every LP command.

Up to 16 nested loops (one inside the other) are allowed. Each LP command must have a corresponding EB command to end the block (loop). A GT command within a loop will terminate the loop, clear the loop stack and jump to a new program.

Example:

AC.09 DE.09 LP3 VE30 DI1 GO EB VE7 DI–3 GO EN
The motor will perform an incremental 1 unit move at speed 30 three times and then a 3 unit move at speed 7 in the other direction.

syntax – MC+

MC Move Continuous

Value: N/A
Units: N/A
Range: N/A

Sets move profiles to “continuous move”, using the AC, DE and VE parameters. Move Continuous is enabled on an axis with the “+” sign. “MC+” enables the mode for axis one. DI, DA and DC commands reset the mode to distance.

Each MC+ segment must contain a GO command. Accelerations, Velocities, and Decelerations may be changed in any segment. If no change is specified, the last parameter value will be used. It is not valid to issue positional commands (DI, DA, DC, GH, SP) to an axis while it is moving in continuous mode. Any command is valid within an MC segment except Distance Commands (DA, DC, & DI).

The direction of the move is specified by the sign of the VE parameter. If the sign of the VE parameter changes between two segments, the control will automatically stop the motor (at the programmed deceleration rate) and change directions to the new speed. This makes changing directions based on variable inputs very easy to program using a scaled variable as the VE parameter.

When a MC+ segment is started, it will continue to move at the speed specified by VE until another VE is commanded, the ESC Key is pressed, or an End Of Travel, Kill Motion, Interrupt, or Stop Input is activated. A commanded velocity of zero (VE0) stops a Mode Continuous move. Motion will also stop if the edit, help, copy, or delete menus are opened.

After a continuous move segment has started, command processing will continue when constant velocity is reached. Other commands are then processed sequentially. This allows you to do things like:

- Have asynchronous inputs change the speed of an axis
- Make motion profile changes based on time delays or input states
- Manipulate I/O while moving as a function or time, distance, or input states
- Change speed based on analog inputs or variables
- Have an operator update the speed of an axis through the keypad
- Servo to an analog input
- Make a one axis joystick using analog inputs

If a motor is making a move when it comes to the end of a program, the motor will continue moving, even after the program ends. This allows you to:

- Put different MC moves in different programs and select different speeds by running different programs.
- Change speeds based on Binary or BCD program select lines
- Call MC+ moves as subroutines
- Run from “hosted” RS–232C mode, where the computer commands speed changes
- Run another program from the keypad that does not violate MC syntax. So you could run another program from the keypad to change speeds, manipulate I/O, interface with an operator or calculate arithmetic.

Move Continuous Continued

Examples:

1. Basic Move Continuous syntax. Demonstrates how to change speed and stop MC+ moves based on time delays and input conditions.

MC+	Enable Move Continuous on axis 1
AC.1 DE.2	Set the acceleration and deceleration rates
VE50	Set top speed to 50
GO	Start the Move Continuous move, command processing will continue when axis 1 reaches constant velocity
TD2	Delay for 2 seconds at speed
VE25 GO	Decel to 25
WT111	Wait for inputs 1,2, and 3 to go active
VE0 GO	Stop the move

2. Demonstrates how to prompt an operator for speed changes on a one axis LinStep+. The move is started after the initial velocity prompt. The velocity only changes when the operator enters a new value using the keypad. The move can be stopped by entering a velocity of zero, or when any of the stop conditions defined above exist.

[One Axis MC]	
MS1,“Enter the Velocity”	Prompt the operator
IV23,(V)	Put the operator input in variable (V)
MC+ AC1	
VE(V)	Use operator inputted variable (V) as new speed
GO	Change velocity of axis 1 to the new speed
GT[One Axis MC]	Repeat

3. Demonstrates the use of WT, OT and TD commands in continuous move.

MC+ AC3 VE3 GO	Start first segment
WT8,1 AC.1 VE10	GO Wait for input 8 and change speed
TD5 AC.3 VE.2 GO	Wait for 5 seconds and change speed
WT3,1 VE–10 GO	Wait for input 3 and change speed and direction
OT11	Turn on outputs 1 and 2
TD10 VE0 GO	Wait 10 seconds and stop the move

MS Message to Display

Value: N/A
Units: N/A
Range: n=1–40 characters (20 on each line)

syntax – MS,“” returns to the initial runtime display
MSn,“”
MSn,“user text”
MSn,(variable)

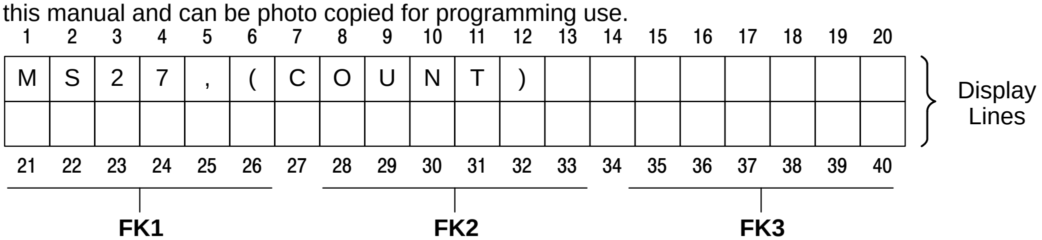
MS allows messages to be displayed on the keypad’s display. Messages are usually to prompt for operator input, display function key prompts, or as a diagnostic tool.

MS,“” can be used to restore the initial axis position and I/O display during program execution. MSn,“” clears the display from the n th character to the end of message. MSn,“user text” prints user text beginning at the n th character. MSn,(variable) writes the value of the variable beginning at the n th character. These variations to MS all disable the initial position and I/O display until program execution stops. MS,“” can be used to restore the initial axis position and I/O display during program execution.

Examples:

MS1,“”	Clears the Display.
MS3,“Part Count”	Writes string beginning at character 3, top line.
MS27,(COUNT)	Displays the value of the variable (COUNT), beginning at position number 27 (7th character, 2nd row).

This keypad programming template shows the relationship of the each character position to the location of the function keys. This will help you align messages on the display. A larger version is located in the back of this manual and can be photo copied for programming use.



ON On Condition (On Event)

Value: N/A
Units: N/A
Range: N/A

syntax – ONn,GTx
ONn,GSx
ONn,0 Clear the event
n= On EOT Limit

Allows conditional program execution based on an event. When the programmable event occurs, the current program and move are interrupted and program execution begins at the predefined interrupt program. The interrupt program can be defined as a GT or a GS. Defining the interrupt as a GS allows program execution to return to the exact point in the original program where the interrupt occurred. The ON command currently supports End–of–Travel (EOT) as an event conditional.

After an ON event is defined, it is active in all user programs and need not be redefined except to change the interrupt program type, number or name, or clear the event condition.

Example: Using ON to handle an EOT event.

```
[POWERUP]
ONL,GT[ON EOT]            [Goto [ON EOT] {on an End–of–Travel input}
GT[HOME]                  {Home the machine}

[MAIN]
LP                        {Loop forever}
   VE5 DA20 GO            {Define move}
   DA0 GO                 {Define move}
EB

[ON EOT]
IF(SA1)&256               {Check if EOT– switch was hit (bit #9 in SA)}
   VEI DA0.5 GO           {Move off EOT– switch}
   GT[HOME]               {Home the machine}
EB
VEI DA–0.5 GO             {Move off EOT+ switch}
GT[HOME]                  {Home the machine}

[HOME]
GH3                       {Home}
GT[MAIN]                  {Jump to main loop}
```

OT

Output (turn outputs On/Off)

Value: N/A
Units: N/A
Range: i=1 to 16

syntax – OTi,xx ..
OTxx (assumes first input is input 1)
i= starting output number 1–16
x=0; input high. X=1; input low (grounded).
x=anything else; ignore input changes.

Sets both discrete and digital Opto output states. After an output is turned on (low), it remains on until changed by another output command, a reset input (software warm–boot), or power is cycled. All outputs are turned off (high) at power up or during a reset.

For flexibility, the OT command allows you to use configured outputs anytime. To help prevent programming confusion, you can use any character in the “don’t change” section of your output statement. This allows you to self–document your OT statements. For example, assume you configured output #3 as a “FAULT” output. Programming like “OT01F10” can help remind you that you are already using output #3.

Example:

OT4,1	Turn on Output 4.
OT2,0D1	Turn Outputs 2 off, leave 3 as is, and turn 4 on.
OT110	Turn Outputs 1 and 2 on, and 3 off.

“”

Quote

Value: N/A
Units: N/A
Range: N/A

syntax – Any ASCII Character

The “” command transmits an ASCII string from the serial communications interface. A “” without any string transmits a carriage return character (ASCII 13).

Example:

“Move Complete”	Transmits string only out serial interface.
“”	Transmits a carriage return only.

RG Registration

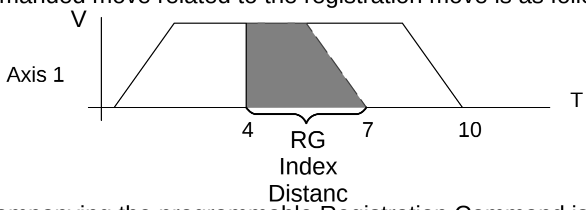
syntax – RGr

Value: N/A
Units: N/A
Range: N/A

The Registration command (RG) specifies a distance to be moved from the current position – as commanded by a specific input trigger. For example, in the following program of 10 user–units on axis #1, the input trigger is received at user–unit 4, to move 3 user–units from the point where the input trigger was received.

VE2 AC.1 DA10 RG3 GO

Assume the input is an optical sensor that triggered on a registration mark at a position of 4 user–units. The commanded move related to the registration move is as follows:



T=4 RG Input Trigger
T=7 RG End of Move
T=10 Ends at Commanded Position

Accompanying the programmable Registration Command is the configurable Registration Input: G (also G in Serial Setup Commands). To configure a Registration input from the keypad, choose EDIT > SETUP > I/O > INPUTS. An input configured as a Registration Input is designated by a G on the keypad input status display. The RG Command will only function if the corresponding input has been configured as a Registration Input.

Note: Registration Input is only configurable on Input #1 for Axis #1.

SP Set Position

syntax – SP±r

Value: 0
Units: set in EDIT > SETUP > MECH > DIST
Range: varies with distance units

Sets the current absolute position to "n". This command is typically used to adjust or shift a coordinate system. It is often done after a series of incremental moves to reset the absolute coordinate frame.

Example:

MC+ GO WT1,1 VE0 GO SP10.5 After the move is complete, sets the current position of axis 1 to 10.5.

SQ

Square Root

syntax – SQr,(var)

Value: N/A
Units: N/A
Range: 0.0001 – 214748.3645

The SQ command calculates the square root of a number and returns the result in a user defined variable. The n parameter in the syntax can be a number or a variable parameter, however, the second parameter must be a previously defined variable for which the square root result is stored. If the second parameter is not a defined variable, you will get a Bad Variable Name error. Following mathematical convention, SQ will produce an Invalid Parameter error for negative "r" values. The return value is accurate to the 0.01 place.

Example: This program calculates the square root of 27.96 and stores the value in the user defined variable (SQRESULT).

(SQRESULT)=0 <u>SQ27.96,</u>(SQRESULT)   The returned value in (SQRESULT) is 5.28.

ST

Stop Move on Input

syntax – STn (or ST#n)

Value: N/A
Units: N/A
Range: 0–8 inputs

ST stops move execution upon activating the input specified by n.
ST0 disables (turns off) the STn command.
ST#1 stops the move on axis #1. (Allows program command conditional program termination).

After ST is executed, the specified input is monitored during every "move profile". If the input is activated, the current "move in progress" is terminated, stopping all motion until the input is deactivated or an ST0 is processed. LinStep+ will process and calculate commands, but will wait at the next GO command until the ST input changes.

The motor is stopped at the deceleration rate specified in the Stop Decel Rate parameter. Once issued, Stop on Input remains active until it is turned off by the ST0 command, a reset is issued, or power is cycled.

Example:

<u>ST1</u> AC1 DE1 VE25 DA6 GO VE50 DA0 GO EN

Move to absolute position 6 units. If input 1 is activated while moving, Stop Motion. When the input is deactivated, immediately execute the next move profile which is to move to the absolute zero position. If input 1 is not activated while moving, the motor would complete its 6 unit move before executing the move back to absolute zero.

TD

Time Delay

syntax – TDr

Value: N/A
Units: seconds
Range: r=0.01 – 99999.99

Delay r seconds before executing the next command.

Example:

VE50 DI4 GO OT11 <u>TD.5</u> OT00

Move 4 units, turn outputs 1 and 2 on, delay .5 seconds, and turn outputs 1 and 2 off.

VE

Velocity

syntax – VEr

Value:
Units: in/sec set in EDIT > SETUP > MECH > VEL
Range: varies with velocity units

Sets the maximum velocity during a move profile. If the acceleration rate is too slow or the move distance is too short, the motor may make a triangular move (velocity vs. time) and the motor may never reach the specified speed. When VE is specified, the value is used in all subsequent moves until re–defined.

Example:

AC.1 DE.2 VE50 DA4 GO	Move to absolute position 4 units with a top speed of 50 in/sec.

WT

Wait

syntax – WTi,xx...
WTxx... (assumes first input is input 1)
WTexpression
WT#1, (synchronized the program after a GI move)
i = starting input number, 1–16
x=0; input high. X=1; input low (grounded).
x=anything else; ignore input changes.
expression = any valid expression (see math and variables definitions)

Value: N/A
Units: N/A
Range: 1–16

Causes LinStep+ to wait for the specified condition to be true before continuing program execution. Either digital or analog input conditions may be used. The WT command allows use of configured inputs in the expression. To help prevent this from causing programming confusion, you can use any character as an input (x). This allows you to self document WT statements. For example, assume input #3 is set to “JOG SPEED”. Programming like “WT01J10” can help remind you that you are already using input # 3.

Example:

WT4,1 GO	Wait for input 4 to equal 1 before moving.
WT2,010 GO	Wait for inputs 2–4 to equal 010 before moving.
WT110 GO	Wait for inputs 1–3 to equal 110 before moving.
WT#1	Causes program execution to halt (wait) until GI move is complete.

Table 6-2 Summary of Expressions, Operators and Functions

<table>
<tr><td>[ ]</td><td>Name Program</td></tr>
<tr><td>( )</td><td>Name Variable</td></tr>
<tr><td>&&</td><td>Logical AND</td></tr>
<tr><td>||</td><td>Logical OR</td></tr>
<tr><td>!</td><td>Logical NOT</td></tr>
<tr><td>!=</td><td>Not Equal</td></tr>
<tr><td>+</td><td>Add</td></tr>
<tr><td>–</td><td>Subtract</td></tr>
<tr><td>*</td><td>Multiply</td></tr>
<tr><td>/</td><td>Divide</td></tr>
<tr><td>=</td><td>Equal</td></tr>
<tr><td>></td><td>Greater Than</td></tr>
<tr><td>>=</td><td>Greater Than or equal to</td></tr>
<tr><td><</td><td>Less Than</td></tr>
<tr><td><=</td><td>Less Than or equal to</td></tr>
<tr><td>&</td><td>Bitwise Boolean AND</td></tr>
<tr><td>|</td><td>Bitwise Boolean OR</td></tr>
<tr><td>++</td><td>Increment Variable (single)</td></tr>
<tr><td>+=n</td><td>Increment by n</td></tr>
<tr><td>– –</td><td>Decrement Variable (single)</td></tr>
<tr><td>–=n</td><td>Decrement by n</td></tr>
<tr><td><<</td><td>Shift Left</td></tr>
<tr><td>>></td><td>Shift Right</td></tr>
<tr><td><<n</td><td>Shift Left by n</td></tr>
<tr><td>>>n</td><td>Shift Right by n</td></tr>
</table>

Helpful Hints

Programming your application

This section provides additional information that may be helpful to begin programming the LinStep+. Also, several practical examples are given that can be used or modified. More program examples are available on the Intelliware disk set.

Programming Overview

First, you must decide how the LinStep+ fits into the overall machine control hierarchy. Generally there are three ways that the LinStep+ may be used:

1. Stand–alone mode – controls all the Inputs/Outputs and motion.
2. With a PLC – the PLC runs the machine and calls on the LinStep+ via program select lines for motion.
3. In a “hosted” mode – the PC sends serial commands to the LinStep+ for execution. The LinStep+ uses a sequential, interpretive command processor. This means that commands in a program are executed one at a time, and that one command must be completed before the next command is processed.

`[Move] VE4 DI10 OT01 GO OT10` **Example of "Hosted" Mode Program**

In the program [Move], the maximum move velocity is set to 4, the command incremental distance is set to 10, output 1 and output 2 are turned off and on simultaneously, axis one then moves 10 units. After axis one stops moving, output 1 is turned on and output 2 is turned off. These changes of outputs 1 and 2 occur at the same time.

The flow of the program is controlled with WT (wait for an event or condition to occur), TD (wait for a pre–set amount of time to elapse), and IF (if a certain condition is true at this instant, then execute a block of commands) statements. External controllers such as PLC and computers can be coordinated by the digital outputs and ASCII serial commands. The commands that can be entered from the keypad and used in a program are listed in Table 6-1.

Variables

Memory space allows for up to 100 variables. All variables are stored as fixed point numbers. All variables are global. All standard variables are volatile, though non–volatile variables are available as well. Variables can be used in many parts of the program, such as:

- Arithmetic
- Conditional Expressions
- Loop Counts
- Distance and velocity commands
- Set values
- Set command values or parameters
- Set analog signals
- Read analog or temperature input
- Display information such as position or velocity
- Any place that a number can be used, a variable can be used

Variable Names

Descriptive variable names can be assigned, instead of V1, V2, etc. Variable names can be up to 14 characters, but the first 10 characters must be unique. A name can contain other printable ASCII characters, such as numbers, underscores, exclamation points, even spaces. Upper and lower case characters are supported within variable names, and these variable names are case sensitive. ASCII control characters such as LF and CR are not supported. All variables must be enclosed in parentheses, (variable name). Parentheses are not legal variable characters.

Built–in Variables

Some variable names are pre–defined. They can be used in expressions, to set voltages, to test conditions, or to display information to the keypad display or an external serial device.

Variable Name	Description of Built–in Variable	Type
(AI1) to (AI6)	Analog Inputs 1 through 6	Read Only
(AROWREL)	Current status of any of the four arrow keys	Read Only
(CPOS1)	Commanded position of axis 1	Read Only
(EPOS1)	Encoder position of axis 1	Read Only
(VEL1)	Commanded velocity of axis 1	Read Only
(POS1)	Current Position of axis 1	Read Only
(#F1) thru (#F50)	Non–volatile, limited use, user system variables	Read/Limited Write
(FKEY)	Value of Function Key pressed	Read Only
(LASTKEY)	Value of last Function key pressed	Read Only
(TERM)	Sends variable out RS–232 port	Write Only
(1TW)	Scans inputs 1–4 for BCD Digit	Read Only
(2TW)	Scans inputs 1–8 for BCD Digit	Read Only
(TIME)	Elapsed Time (ms) since power up or since reset	Read Only
(CRCS)	Value of the EEPROM setup checksum	Read Only
(CRCP)	Value of the EEPROM program checksum	Read Only
(SA1)	Integer value of the status of axis 1 (SeeRS232 command SA)	Read Only
(SD1)	Integer value of the drive status of axis 1 (See RS232 command SD)	Read Only
(SS)	Integer value of the system status (See RS232 command SS)	Read Only
(INT98CTRL)	Enables/disables (ARM INT98) trigger option	Read and Write
(ARM INT98)	Enables/disables INT98 input if (INT98CTRL) is enabled	Read and Write

Examples of how to use Built–in Variables

(PIECES)=10	Assigns 10 to variable
(SPEED)=(AI12)*(VEL SCALE)	Speed = analog input times a scalar
MS21,“Enter Length” IV32,(LENGTH)	Prompts user and gets feed length
VE(SPEED)	Sets velocity to value in variable
MS1,(POS1)	Displays present position of axis 1 on keypad screen
(TERM)=(POS1)	Sends the present position of axis 1 out the RS–232 port
(TEMPERATURE)=(AI9)	Reads in temperature from an analog input
(AO15)=4012	Sets the analog output to 4012
(#F1)=(PIECES)	Stores the value of Pieces in FLASH memory variable #F1

Using Built–in Variable (AROWREL)

(AROWREL) is a built–in Boolean read only variable that determines the status of any of the four arrow keys. When used with (FKEY), the program can detect if an arrow key is being held down. (AROWREL) will only return the status of the four arrow keys. If a different key is pressed, (AROWREL) will return the value 0. (AROWREL) will return one of these values:

(AROWREL)=0 One of the arrow keys is being held down.

(AROWREL)=1 The arrow key has been released.

Example JOG application using (AROWREL) and (FKEY):

```
[MAIN]                  {Program #1}
FK12,13                 {Wait for a Left or Right arrow key}
GT(FKEY)                {Jump to arrow key program #12 or #13}

[LEFT ARROW]            {Program #12}
MC+                     {Enable MC mode}
AC.1                    {Start MC move}
VE1                     {Move in positive direction}
GO
LP
    IF(AROWREL)=1       {Check status of arrow key}
        VE0             {Stop MC move on key release}
        GO
        GT1             {Return to main program}
    EB
EB

[RIGHT ARROW]           {Program #13}
MC+                     {Enable MC mode}
AC.1                    {Start MC move}
VE–1                    {Move in negative direction}
GO
LP
    IF(AROWREL)=1       {Check status of arrow key}
        VE0             {Stop MC move on key release}
        GO
        GT1             {Return to main program}
    EB
EB
```

Non–Volatile Variables

(#F1) through (#F50) are fifty user variables stored in non–volatile flash memory so they retain their values through power cycles, warm boots, and system resets. Standard user variable are lost at power down or reset. When one of these variables is changed (i.e. used on the left side of a equal (=) sign, the new value is written to, and stored in the user non–volatile flash.

Note: Flash memory has a limited read/ write lifetime (100,000 writes before failure), variable values that change frequently should not be stored as these variables. Examples include loop count variables, and POS1 and POS 2 variables. LinStep+ will allow only 1,000 FLASH writes between power cycles. This limit is set to prevent damage to non–volatile memory due to a simple programming mistake or misunderstanding. When this write limit is exceeded, all programs will stop running, an error message will be displayed, and the appropriate status bits will be set.

Example: At the start of each part run, a program called [Set–up] is used to initialize a number of variable part parameters. During production the program called [PARTS] is run. This program reads from the FLASH variables, but does not generate any writes to the FLASH, so the lifetime of the FLASH is not compromised.

[Set–up]	{Program #1}
MS1,“Feed length?: ”	Writes string beginning at character 1, top line
IV12,(LENGTH),1,15	Loads the part length to variable (LENGTH)
MS1,“Feed Speed?: ”	Writes string beginning at character 1, top line
IV12,(SPEED),.05, 5	Loads the speed into volatile variable (SPEED)
(#F1)=(LENGTH)	Loads the length into non–volatile variable (#F1)
(#F2)=(SPEED)	Loads the speed into non–volatile variable (#F2)
EN	
[PARTS]	[PARTS] runs on power up, unless new parameters are entered.
(LENGTH)=(#F1)	Load part specific variable from non–volatile #F1.
(SPEED)=(#F2)	Load part specific variable from non–volatile #F2.
LP(NUMBER)	Loop (NUMBER) of times
DI(LENGTH)	Move (LENGTH)
VE(SPEED)	at (SPEED) velocity
GO	
OT1 TD.1 OT0	Change output to indicate part done
EB	End the loop Block

Arithmetic Operands and Equations

Addition (+), subtraction (–), multiplication (*), and division (/) are easily performed. Expressions may only contain one operand. Complex equations require multiple statements. Variables and fixed point numbers may be mixed in arithmetic equations. All user arithmetic and variable storage uses 32 bit integer and fractional representation. The + and – symbols have a dedicated button on the keypad. Pressing the button will change between the two. The *, /, and = are accessed with the Alpha+0+ ... keystrokes.

Example:

(X)=(Y)*10
(AO15=(VOLTAGE) + (ERROR)

Examples of incorrect use:

(X)=1+2–3	This statement is incorrect because it has more than one operand.
(Length)=(Total)*0.3125	This statement is incorrect because it has more than four decimal places.

Instead, you should use:

(X)=1	
(X)=(X)+2	or (X)+=2
(X)=(X)–3	or (X)–=3

and

(Length)=(Total)*3.125	Multiply the significant figures
(Length)=(Length)*.01	Then move the decimal place
or	
(Length)=(Total)/32	32 bit storage of fractional decimal number

Boolean Operators

Boolean operators & and **|** perform their respective bitwise Boolean functions on immediate or variable parameters. As an example, isolate a specific bit from an SD response to determine if axis #1 drive is enabled. This corresponds to a bit #5 (10000) Binary, (16) Integer in the SD response. The example program segment is written as follows:

(DRIVE STAT)=(SD1)&16 IF(DRIVE STAT)=16 MS,1“Drive Enabled” EB

The 16 corresponds to an integer weight of bit #5 (10000).

Logical Operators

Conditional commands (IF,WT, LU, LW) support logical operations of AND (&&) and OR (||). Two expressions may be logically AND'd or OR'd within one conditional command. For example:

(A)=5 (B)=2.5 IF(A)>2&&(B)=2.5 MS1, "True Statement" EB

In this program, the message "True Statement" appears since BOTH conditional statements are true.

Increment/Decrement Variables

Four syntaxes are supported by variables: ++ (Single Increment), += (Value Increment), — (Single Decrement), –= (Value Decrement). These operators will initialize any uninitialized variable to zero before incrementing or decrementing it for the first time.

(Variable Name)++	Increments a variable value by 1
(Variable Name)+=n	Increments a variable value by n
(Variable Name)– –	Decrements a variable value by 1
(Variable Name)–=n	Decrements a variable value by n

Expressions

Other Programming Samples

Five conditional expressions are supported: less than (<), equal to (=), greater than (>), less than or equal to (<=), and greater than or equal to (>=). The IF and WT commands can use these expressions to direct program flow or wait for an analog input to meet a condition. The > and < symbols are entered into the keypad editor with the ALPHA+↑+↑...↑

Examples:

IF (X)>10 GS20 EB	If X is greater than 10 gosub to program #20.
WT(AI12)<(MAX TEMP)	Wait for the temperature to go below the maximum before continuing command processing.

These sample programs provide an idea of how to solve simple programming tasks. To aid your program documentation, comments are placed in {brackets}. These comments are stripped from the program as it is downloaded for execution to help conserve memory. Files should be saved before downloading save the comments.

Example:

DI10,2 GO	Moves to load position
DI15,15 GO	Moves to unload position

Create a Message and Read an Input Variable

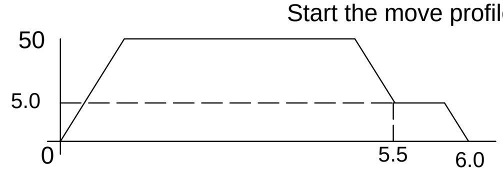
[GET PARTS]	Name the subroutine
MS1,“”	Clears the Display
MS1,“How many?: ”	Writes string beginning at character 1, top line
IV12,(PIECES)	Waits at 12th character for the # of pieces.
MS1,“”	Clears the Display
MS1,“How long?:: ”	Writes string beginning at character 1, top line
IV12,(LENGTH)	Waits at 12th character for the length.
LP(PIECES)	Loops the number of pieces entered
DI(LENGTH)	Moves the length entered.
GO EB	

Create a Menu (menu display on keypad display for operator)

MS1,“”	Clears keypad screen
MS21,“PART1 PART2 PART3”	Writes a message above function keys.
FK1,2,3	Waits for a Function Key to be pressed
(FKEY)=(FKEY)+50	Add an offset to FKEY
GT(FKEY)	Goto program #51, 52, or 53. (50 + 1, 2, or 3)

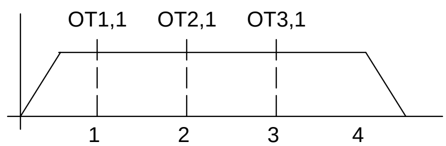
Fast In, Slow Feed Move (Using the Distance to Change (DC) command)

AC.05	Set acceleration
DE.09	Set deceleration
VE50	Set first velocity
DA6	Set total move distance
DC5.5	Set point where you want to change speed
VE5	Set second speed
GO	Start the move profile



Setting an Output=On (on–the–fly)

AC.05	Set acceleration
VE10	Set velocity
DA4	Set total move distance
DC1	Set point to turn on...
OT1	Output 1
DC2	Set point to turn on...
OT2,1	Output 2
DC3	Set point to turn on...
OT3,1	Output 3
GO	



Read a 4 Digit BCD number, 2 Digits at a time

[GET 4 BCDS]	Returns value of 4 digit BCD number
OT01	Connect ground of first two BCD digits
(4 DIGIT BCD)=(2TW)*100	Make value of first two digits the MSB
OT10	Connect ground of 2nd two BCD digits
(4 DIGIT BCD)=(4 DIGIT BCD)+(2TW)	Add value of 2nd two to 1st two * 100

Reading an Analog Input Value

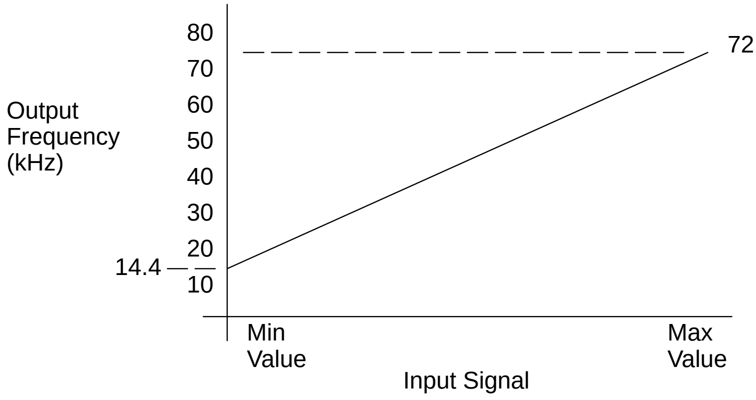
The value of the analog system variables (Al I –AI6) are scaled from 14,400 to 72,000 Hz. This value is actually a scaled frequency read from the OPTO module representing the analog signal. These input values are updated every 16 milliseconds. If your program needs to display this value in units such as VOLTS, you will need to scale the value to VOLTS in your program. The scaling factor depends upon the type of OPTO module used. For example: a ”J ” thermocouple uses a different factor than a ”K” thermocouple. Due to slight variances in the output frequency from module to module, it is recommended that the OPTO be calibrated by querying the corresponding AIx value with no input signal connected to the OPTO. This value should be used as the zero input reference frequency.

Example: Use a 0–10VDC analog input. 0V=14,400; 10V=72,000 or 5.760 Hz/volt.

(VOLT)=(AI2)	Read the value of analog input #2 into variable volts
(VOLT)=(VOLT)–14400	Remove frequency offset
(VOLT)=(VOLT)*1.736	Scaling factor multiplied. by 10,000
(VOLT=(VOLT)*.0001	Scaling back to volts

The variable (VOLT) is now in units of volts. If you are waiting for a condition to occur or doing a comparison, (see below) there is no need to go through the conversion process.

(TEMP)=(AI9)	Read in temperature from analog input
WT(AI12)<45000 GO	Wait for analog input 12 <45000 (<5.3 VDC using the previous example) before moving
IF(AI12)<45000 GO EB	Go if analog input 12 < 45000



Section 7
Troubleshooting

Overview

The system troubleshooting procedures involve observing the status of the LED's. The tables in this section provide information related to the indications provided by these devices.

Table 7-1 Operating Mode Indications, 1 Axis

LED	Color	Status	Comments
ON	Green	Power is applied.	Not a failure.
	Yellow	Power is applied and "Shutdown" was issued.	Not a failure if Indexer issued a valid shutdown command.
	Red	Power is applied and "Overtemperature" condition exists.	Allow driver to cool down. Determine reason for overtemperature, high ambient temperature, lack of air flow, motor current too high, adjust standby current.
Step	Green	Incoming Steps, Direction CW	Not a failure.
	Yellow	Incoming Steps, Direction CCW	Not a failure.
	Red		
Bus	Green		
	Yellow	Continuous on=overvoltage condition Flashing = Regen condition	Verify input voltage is proper. Not a failure. Regen operation is not a failure.
	Red	Undervoltage condition	Verify input voltage is proper
FLT	Green		
	Yellow	Interlock condition.	Verify motor connections.
	Red	Motor short.	Replace motor.

Additional Information (General)

Symptom	Possible Cause	Possible Remedies
The keypad is blank with no backlight.	The keypad is not receiving +5VDC.	Verify all wiring is correct. Verify that the +5VDC is between 4.8 and 5.2V.
Display is difficult to read	Contrast ratio is incorrectly set	Adjust the contrast with the pot on the back of the keypad.
The ON LED is yellow.	FLASH memory is corrupt.	The operating system and user programs must be reloaded.
The ON LED is red.	A Fault has occurred.	The fault can be determined with the keypad or by using serial status commands (SS, SA, SD).
Motor moves the wrong distance	Wrong Gear Ratio.	Check distance units
	Motor stalled.	Check motor current, inductance, anti–resonance settings Check Speed Torque required for move, reduce acceleration.
Motor stalls	Acceleration and/or velocity too high.	Reduce acceleration and/or velocity.
	Motor configured incorrectly.	Check motor current, inductance and anti–resonance settings.
Motor direction is wrong	The motor phases are miswired.	Verify connections, or swap A+ with A–.
	The system real direction is reversed.	Change the control's direction parameter.
The control does not respond to keypad input.	The keypad is disabled.	Check the switch settings on the back of the keypad.
The motor "whines"	The inductance or anti–resonance setting is incorrect.	Verify the Inductance setting. Operation is best with motors 4 mH or above. If this does not help, verify the anti–resonance setting.

Additional Information Continued

Symptom	Possible Cause	Possible Remedies
No RS232 communication but keypad works.	If the keypad works, the RS232 port is working. Something else is wrong (wiring, configuration, address).	Refer to Section 5, "Configure Serial Communications". Verify PC COM port is set to 9600 baud, 8 data bits 1 stop bit, no parity.
RS232 communication and keypad do not work.	The keypad is disabled.	Verify that you do not have an RS485 version. Enable the keypad by the switch on back of keypad.
	The serial port is not working.	Contact Baldor.
"Hit A Limit"	A limit switch has been activated.	Either the motion commanded was not correct, or the EOT switch is incorrectly positioned on your system.
"Amplifier Fault"	Multiple drive faults have occurred.	The fault can be determined with the keypad or by using serial status commands (SS, SA, SD).
"Over Temperature Fault"	Internal Fan is not operating or Heatsink Tunnel is clogged or restricted.	Remove obstruction, or clean tunnel by removing unit, use screwdriver to prevent the fan from turning, and blow shop air through the tunnel. Return unit to installation.
	Ambient air in cabinet is too hot.	If multiple units are installed within the enclosure, ventilation must be adequately to remove heat.
	The fan does not operate.	With power off, verify the internal fan connections. If properly connected, the fan may have failed. Contact Baldor.
"Over Current Fault"	Motor is miswired or damaged. The LinStep+ has short circuit protection, but you must correct the problem to clear the fault.	With power off verify all connections. Verify current setting is correct for the motor rating. Verify the motor phases are not open or shorted (phase to phase and phase to ground). The resistance in each phase should be about the same and only a few ohms. If the phases are open or have a large resistance, the motor is probably damaged and should be replaced.
"Over Voltage Fault"	Excessive bus voltage. Usually caused by a regen condition that overwhelms the internal power dump circuit. It can also be caused by high line voltage, or voltage spikes.	Eliminate the regen event by reducing the load or make the move less aggressively by reducing the commanded acceleration or velocity. Verify AC line voltage is within the limits.
"Interlock Fault"	Motor connector does not have an interlock jumper, or motor has been disconnected.	Connect motor connector with Interlock.
"Following Error"	Motor stalled.	Confirm proper motor configuration (current, AR, mH). Make a less aggressive move.
	Wrong encoder resolution set.	Verify the encoder settings are correct. Incorrect settings can cause a following error.
"Encoder Wired Backwards"	Encoder position is changing opposite the commanded move.	Verify motor and encoder wiring. Reverse phases of either motor or encoder. Contact Baldor for assistance.
"Encoder Fault"	Attempted closed loop motion and encoder position is unchanged.	Verify encoder wiring.
"Error Finding Home"	Both EOT switches were activated without finding the home switch.	Verify home switch connections and configuration (NORM OPEN or NORM CLOSED).
"Invalid Program"	Attempted to "call" an empty program (i.e. GT, GS).	Verify program number, or define program "called".
"Program Too Large"	Program length exceeds 1024 bytes.	Divide program into smaller programs or reduce program size.
"Insufficient Memory"	All stored user programs exceed 60K.	Reduce program size, or delete programs.
"Invalid Program #"	Program number exceeds 400 or program name does not exist.	Verify program name and number.

Additional Information Continued

Symptom	Possible Cause	Possible Remedies
"Unknown Command"	A command not in the command set has been issued.	Check program for data entry errors.
"Command Is Too Long"	Command and parameter string exceeds 80 characters.	Reduce command string size.
"Too Many Parameters"	Parameter list exceeds amount supported by command.	Reduce parameter list size.
"Invalid Parameter"	Parameter type is invalid.	Verify parameter with command syntax.
"Bad Command Syntax"	Command and parameter list has invalid syntax.	Check program for data entry errors.
"Too Many Nested LPs"	Program exceeds 16 nested loops.	Reduce nested loops.
"Too Many Nested GSs"	Program exceeds 16 nested gosubs.	Reduce nested gosubs.
"Too Many Nested EBs"	Program exceeds 16 nested IF blocks.	Reduce number of nested IF blocks.
"Bad Variable Name"	A variable used as a command parameter is undefined (misspelled).	Verify variable name, or define variable with an initial value.
"No Free Variables"	Attempted to define more than 100 user variables.	Reduce number of user variables.

Serial Communications Problems

1. Test your terminal or terminal emulation software. Disconnect the motor and transmit a character. Receiving double characters (XX) when entering single characters (X), indicates your computer is set to the half duplex mode. Change to the full duplex mode.
2. Host transmit (TX) must be connected to receive (RX) of the drive unit, and receive (RX) of the host must be connected to transmit (TX) of the drive. If communication fails, try reversing these connections at either the host or the LinStep.
3. Many serial ports require handshaking. Jumper RTS to CTS, and DSR to DTR at host connector Jumpers 9 pin (25 pin) RTS to CTS 7 to 8 (4 to 5); DSR to DTR 4 to 6 (6 to 20).
4. Configure the host to the identical baud rate, number of data bits, number of stop bits, and parity.
5. Check all grounds. Use DC common or signal ground as your reference. Do not use earth ground or shield.
6. Check your cable length. If any cable is over 50 ft. long, you should be using a line driver, optical coupler, or shield. Shields must be connected to earth ground at one end only.

Section 8
Specifications & Product Data

Identification

LinStep+ LX **1 P 1 A– 0xF9**

Linear Stepper Driver

Number Axes
1=1 Axis
2=2 Axis

Driver Type
D = LinStep
P = LinStep Plus

Input Voltage
1=115VAC
2=230VAC

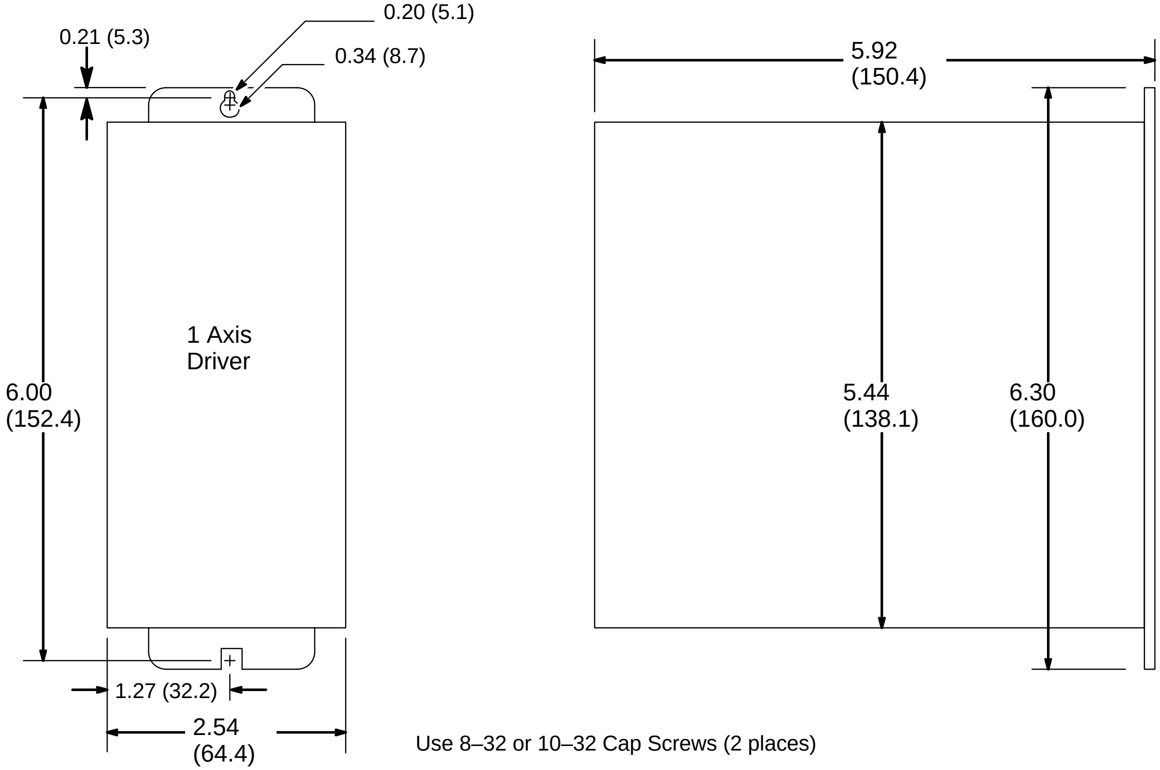
Rated Output Current
03F9 = 3.9 Amperes
06F9 = 6.9 Amperes
07F9 = 7.9 Amperes

General Specifications

Description	Unit	LX1P1A07F9	LX1P1A03F9	LX1P2A03F9
Input Voltage Range Nominal Minimum Maximum	VAC	115 92 132		230 184 265
Input Frequency	Hz	50/60 ±5%		
Nominal Output Bus (@ 115 / 230 input) Nominal Minimum Maximum	VDC	160 88 220		320 176 440
Adjustable in 0.1A increments	A_{RMS}	0.1 – 7.9	0.1 – 3.0	0.1 – 3.9
Resolution	in (mm)	5.5 x 10^{-5} (1.02 x 10^{-3})		
Efficiency	%	85		
Motor Inductance	mH	2 – 60		8 – 240
Switching Frequency	kHz	20		
Encoder	–	Optically Isolated, differential line driver, 5VDC, 500 KHz Max (2 MHz post quadrature)		
Inputs	–	8 – Programmable + 2 Limit and 1 Home inputs. (24VDC maximum – optically isolated ≤ 3mA sink current at ≥ 0.7Volts)		
Output Power	–	12VDC @ 250mA (Pull–ups) 5VDC @ 200mA (encoder)		
Programmable Outputs	–	8 – Open collector (100mA maximum sink current).		
Programming	–	Keypad or Serial communications		
Operating Temperature	°F (°C)	32 to 100 (0 to 40); 122 (50) Maximum		
Operating Altitude	ft (m)	8300 (2540) Maximum		
Storage Temperature	°F (°C)	–13 to 158 (–25 to 70)		
Humidity (non–condensing)	%	10–90		
Shock		10G (according to DIN IEC 68–2–6/29)		
Vibration		1G @ 10 – 150 Hz (according to DIN IEC 68–2–6/29)		

Protection & Indicators	Description
LED Indications	Green – Normal operation; Red – Fault condition; Amber – FLASH fault Protection
Short Circuit	Disable on phase–to–phase, or phase–to–ground detected
Undervoltage	Disable if supply drops below 90 VAC
Over Temperature	Disable if heatsink > 70 °C
Interlock	Disable if interlock connection broken
Regen/Overvoltage	Disable if bus voltage exceeds 220 VAC on 115 VAC units, 440 VAC on 230 VAC unit

Dimensions



For safe operation, allow a clearance distance between each control and on all sides of each control.

For safe operation, allow a clearance distance between each control and on all sides of each control. At least 3 inches (75mm) top and bottom clearance must be provided for air flow. Between drivers (each side), allow at least 0.1 inch (2.5mm).

Section 9
CE Guidelines

CE Declaration of Conformity

Baldor indicates that the products are only components and not ready for immediate or instant use within the meaning of “Safety law of appliance”, “EMC Law” or “Machine directive”.

The final mode of operation is defined only after installation into the user’s equipment. It is the responsibility of the user to verify compliance.

The product conforms with the following standards:

DIN VDE 0160 / 05.88	Electronic equipment for use in electrical power installations
DIN VDE 0100	Erection of power installations with nominal voltages up to 1000V
DIN IEC 326 Teil 1 / 10.90	Design and use of printed boards
DIN VDE 0110Teil 1-2 / 01.89	Dimensioning of clearance and creepage
DIN VDE 0110Teil 20 / 08.90	distances
EN 60529 / 10.91	Degrees of protection provided by enclosures

EMC – Conformity and CE – Marking

The information contained herein is for your guidance only and does not guarantee that the installation will meet the requirements of the council directive 89/336/EEC.

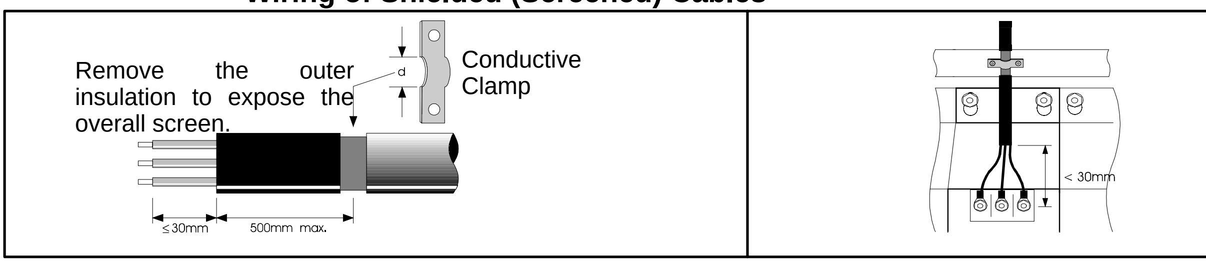
The purpose of the EEC directives is to state a minimum technical requirement common to all the member states within the European Union. In turn, these minimum technical requirements are intended to enhance the levels of safety both directly and indirectly.

Council directive 89/336/EEC relating to Electro Magnetic Compliance (EMC) indicates that it is the responsibility of the system integrator to ensure that the entire system complies with all relative directives at the time of installing into service.

Motors and controls are used as components of a system, per the EMC directive. Hence all components, installation of the components, interconnection between components, and shielding and grounding of the system as a whole determines EMC compliance.

The CE mark does not inform the purchaser which directive the product complies with. It rests upon the manufacturer or his authorized representative to ensure the item in question complies fully with all the relative directives in force at the time of installing into service, in the same way as the system integrator previously mentioned. Remember, it is the instructions of installation and use, coupled with the product, that comply with the directive.

Wiring of Shielded (Screened) Cables

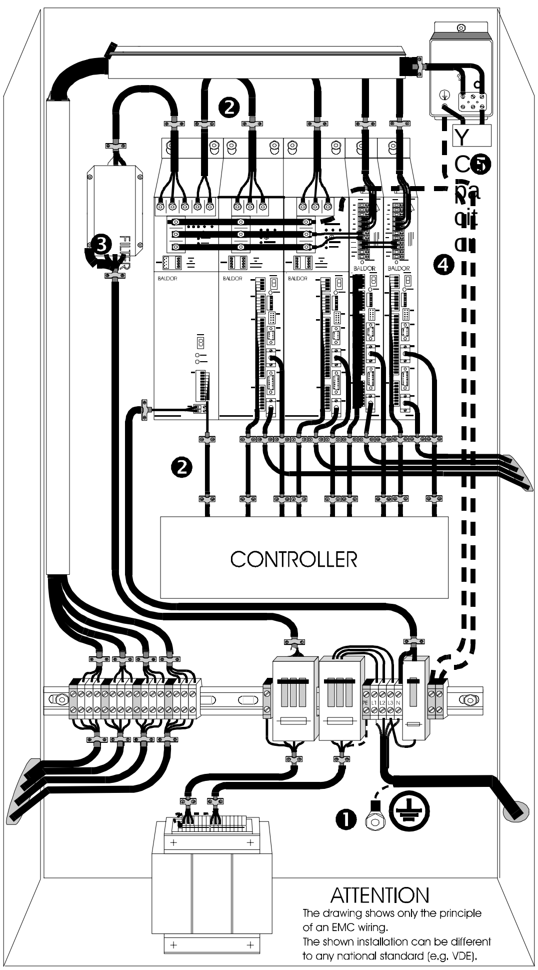


Using CE approved components will not guarantee a CE compliant system!

1. The components used in the drive, installation methods used, materials selected for interconnection of components are important.
2. The installation methods, interconnection materials, shielding, filtering and grounding of the system as a whole will determine CE compliance.
3. The responsibility of CE mark compliance rests entirely with the party who offers the end system for sale (such as an OEM or system integrator).

Baldor products which meet the EMC directive requirements are indicated with a “CE” mark. A duly signed CE declaration of conformity is available from Baldor.

EMC Wiring Technique



1 **CABINET**

The drawing shows an electroplated zinc coated enclosure, which is connected to ground.
This enclosure has the following advantages:

– All parts mounted on the back plane are connected to ground.

– All shield (screen) connections are connected to ground.

Within the cabinet there should be a spatial separation between power wiring (motor and AC power cables) and control wiring.

2 **SCREEN CONNECTIONS**

All connections between components must use shielded cables. The cable shields must be connected to the enclosure. Use conductive clamps to ensure good ground connection. With this technique, a good ground shield can be achieved.

3 **EMC – FILTER**

The EMI or main filter should be mounted next to the power supply (here BPS). For the connection to and from the main filter screened cables should be used. The cable screens should be connected to screen clamps on both sides. (Exception: Analog Command Signal).

4 **Grounding (Earth)**

For safety reasons (VDE0160), all BALDOR components must be connected to ground with a separate wire. The diameter of the wire must be at minimum AWG#6 ($10mm^2$). Ground connections (dashed lines) must be made from the central ground to the regen resistor enclosure and from the central ground to the Shared Power Supply.

5 **Y–CAPACITOR**

The connection of the regeneration resistor can cause RFI (radio frequency interference) to be very high. To minimize RFI, a Y–capacitor is used. The capacitor should only be connected between the dynamic brake resistor housing and terminal pin R1 (lead from Flex).

Recommend: 0,1µF / 250VAC Type: PME265
BALDOR–Ordering–No.: ASR27104

EMC Installation Instructions

To ensure electromagnetic compatibility (EMC), the following installation instructions should be completed. These steps help to reduce interference. Consider the following:

- Grounding of all system elements to a central ground point
- Shielding of all cables and signal wires
- Filtering of power lines

A proper enclosure should have the following characteristics:

A) All metal conducting parts of the enclosure must be electrically connected to the back plane. These connections should be made with a grounding strap from each element to a central grounding point . [1]

B) Keep the power wiring (motor and power cable) and control wiring separated. If these wires must cross, be sure they cross at 90 degrees to minimize noise due to induction.

C) The shield connections of the signal and power cables should be connected to the screen rails or clamps. The screen rails or clamps should be conductive clamps fastened to the cabinet. [2]

D) The cable to the regeneration resistor must be shielded. The shield must be connected to ground at both ends.

E) The location of the AC mains filter has to be situated close to the drive so the AC power wires are as short as possible.

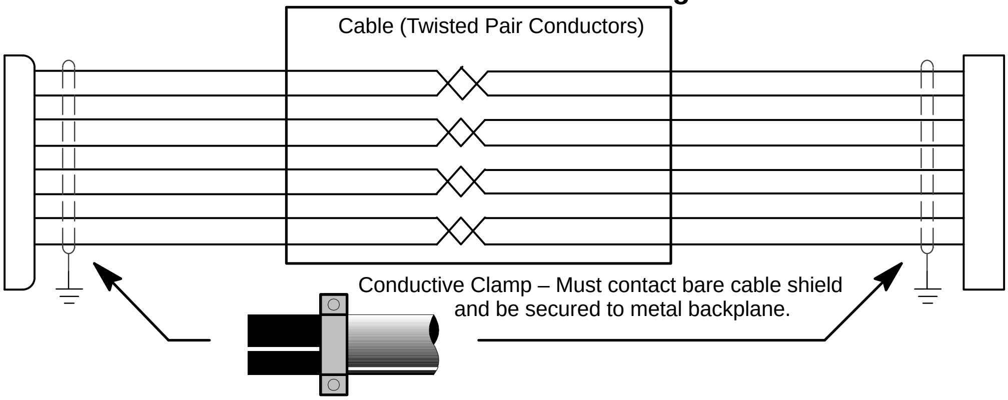
F) Wires inside the enclosure should be placed as close as possible to conducting metal, cabinet walls and plates. It is advised to terminate unused wires to chassis ground. [1]

G) To reduce ground current, use at least a $10mm^2$ (6 AWG) solid wire for ground connections.

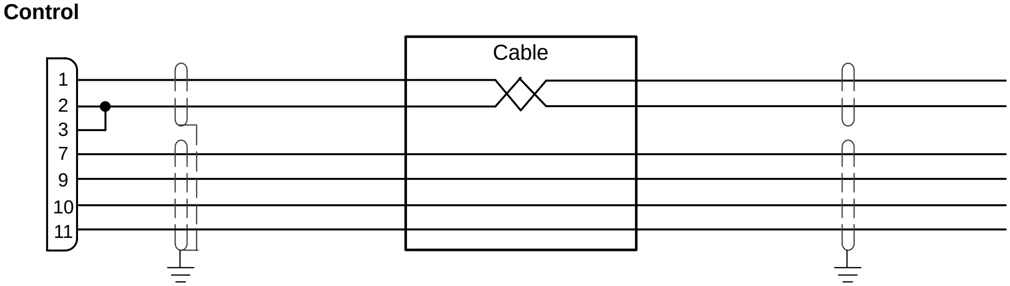
[1] Grounding in general describes all metal parts which can be connected to a protective conductor, e.g. housing of cabinet, motor housing, etc. to a central ground point. This central ground point is then connected to the main plant (or building) ground.

[2] Or run as twisted pair at minimum.

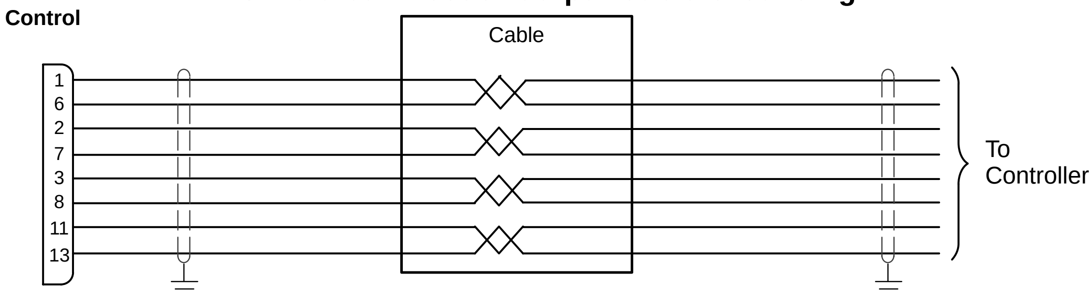
Cable Screens Grounding



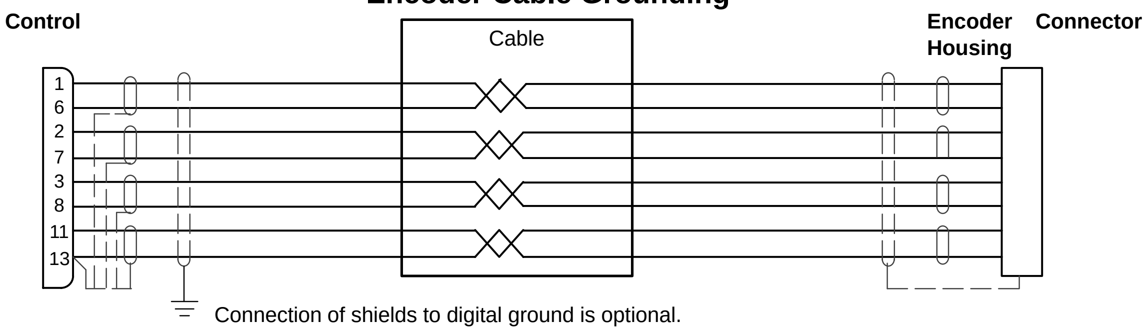
Input Signal Cable Grounding



Simulated Encoder Output Cable Grounding



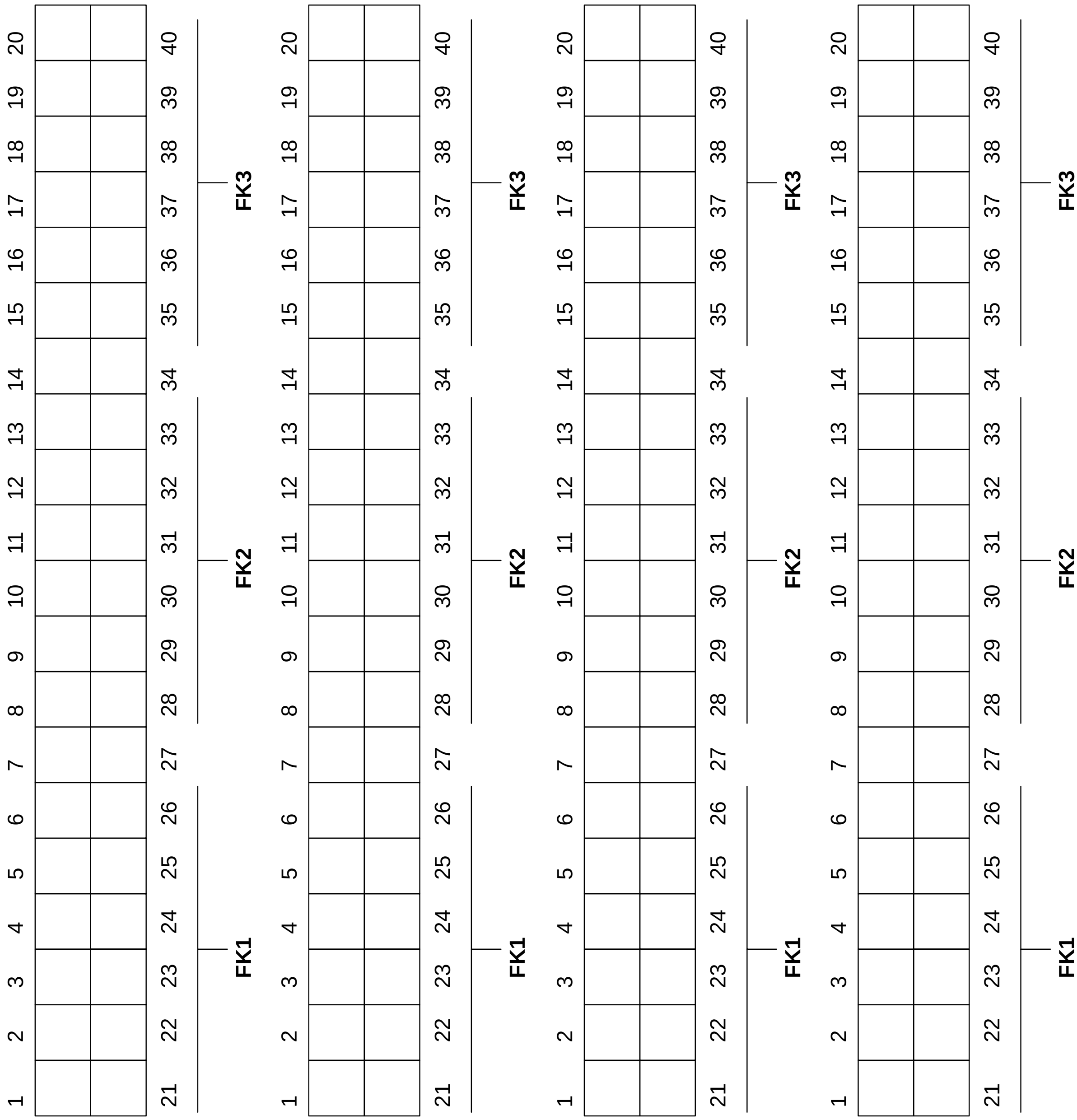
Encoder Cable Grounding

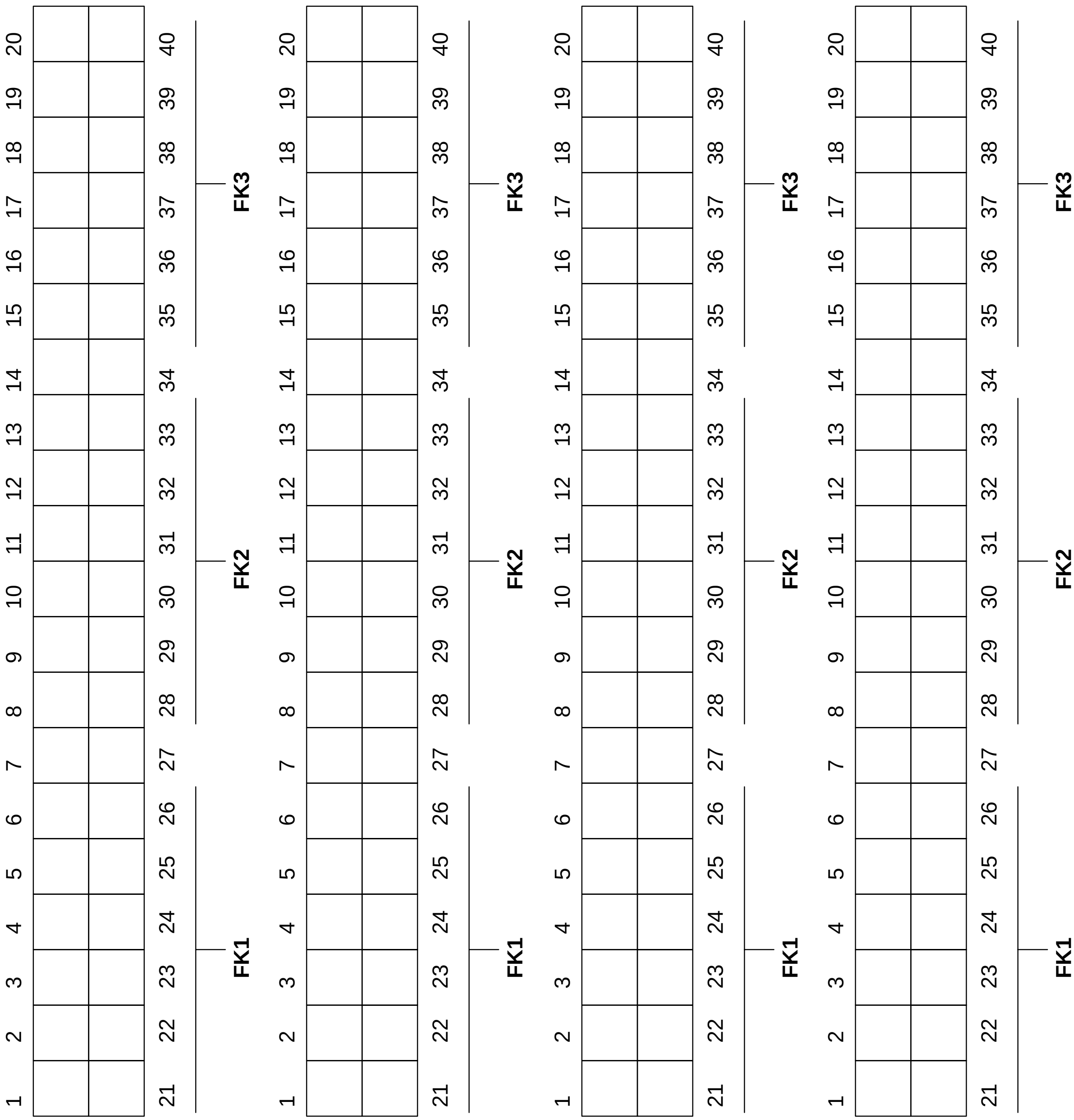


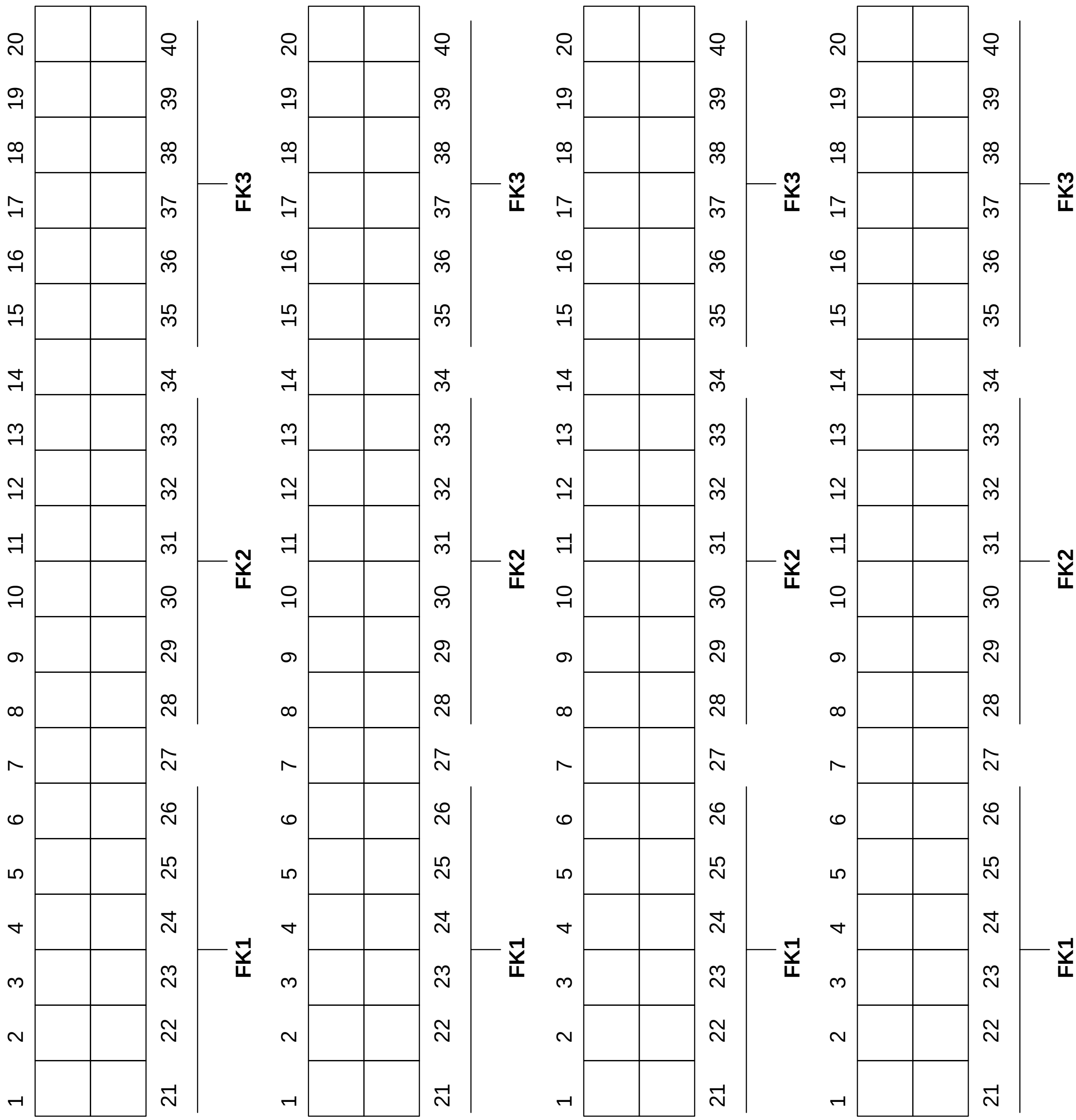
Connection of shields to digital ground is optional.

Appendix A

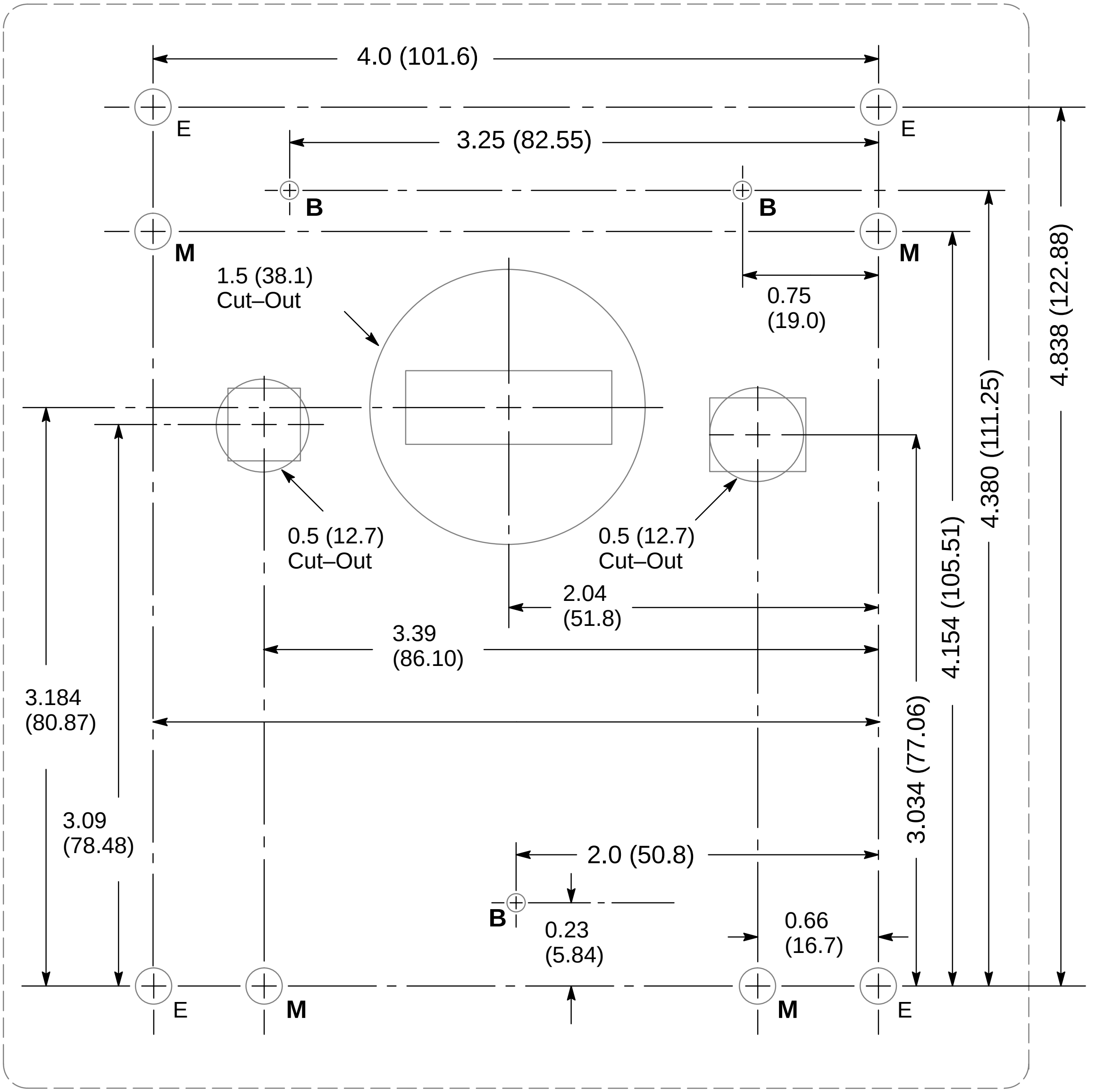
Programming Template




1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
FK1
FK2
FK3


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
FK1
FK2
FK3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
FK1
FK2
FK3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
FK1
FK2
FK3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
FK1
FK2
FK3

Remote Keypad Mounting Template



Installation Notes.

1. For SAE mounting (6–32 hardware) mark and drill holes “E” with $^{3}/_{16}$″ drill bit.
2. For metric mounting (M3.5 hardware) mark and drill holes “M” with $^{3}/_{16}$″ drill bit.
3. For Ball–Head Removable mounting mark and drill holes “B” with $^{5}/_{32}$″ drill bit.
4. To prevent damage to keypad, mounting screws must not extend more than 0.2″ into keypad.
5. To isolate the keypad from the enclosure, use non–conductive mounting hardware.

BALDOR MOTORS AND DRIVES

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