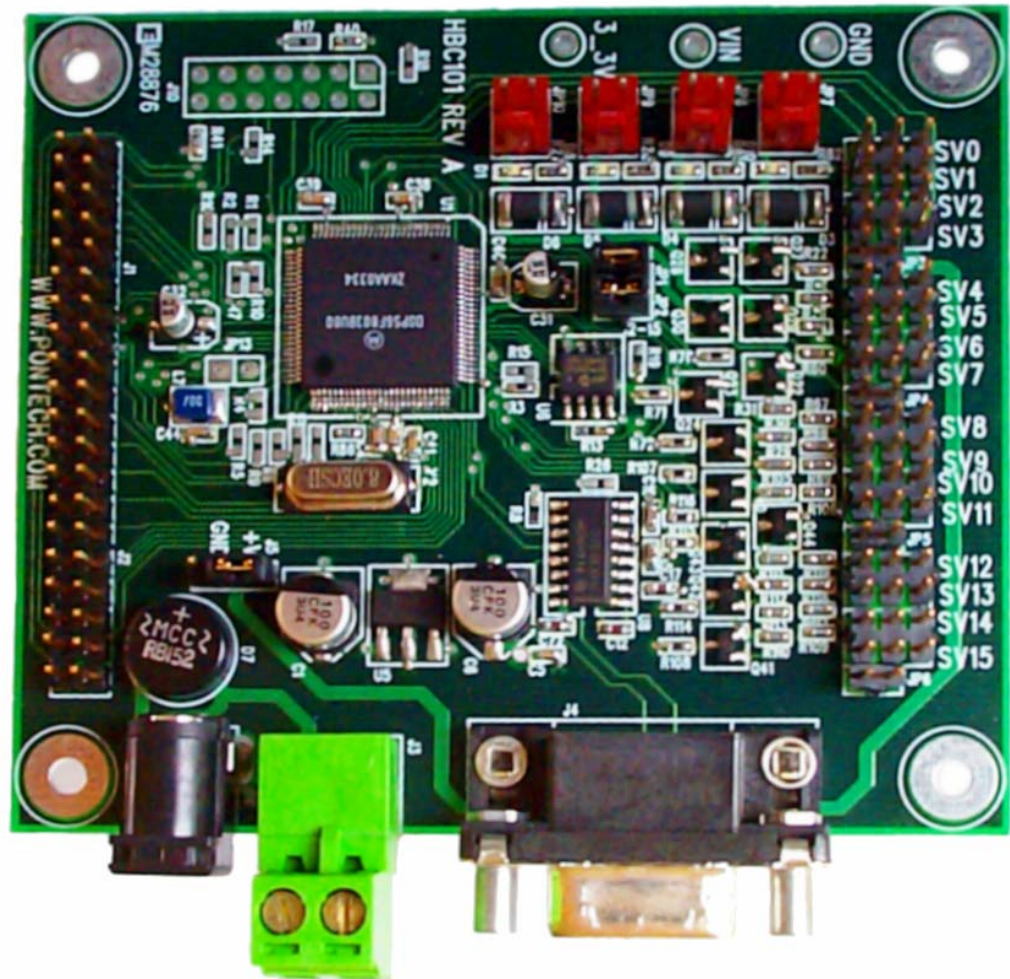


PONTECH

HBC101

Hybrid Motor Controller



Rev B Hardware Manual

November 20, 2004

www.pontech.com

Preface

This documentation reflects the technical specifications of the HBC101 Rev B. Be sure to check www.pontech.com for manual updates.

Revision History

- B: Fixed trace errors from Rev. A. Corrected Polarity of J3 to match STP10x. Removed bridge rectifier on J3, present on Rev A and X1, to allow lower voltage operation.
- A: Addition of EEPROM. Trace errors between IRQA/B and SV14/15. Green power connector J3 has reversed polarity from Rev B.
- X1: Initial Release. Green power connector J3 has reversed polarity from Rev B.

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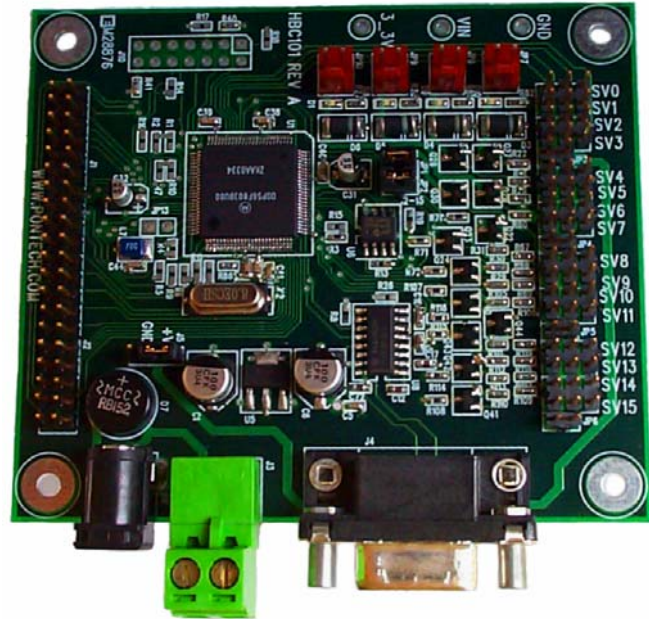
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Introduction to the HBC101

The HBC101 is an exciting evolutionary motion control product based on a Motorola DSP (Digital Signal Processor). The board can both control as well as capture RC (Radio Control) servo PPM (Proportional Pulse Modulation) signals at resolutions not seen in other servo control products. The board has eight high-resolution PPM outputs and eight high-resolution PPM inputs.

Unused servo output pins can be reconfigured as digital outputs for controlling on/off devices. Four of these outputs have been buffered so that small devices such as relays and solenoids may be directly driven.

Unused servo input pins can be reconfigured as digital inputs for detection of on/off signals. All input pins are buffered so that an input signal up to 40VDC can be detected with out fear of damaging the microprocessor.



The HBC100 is equipped with a 40 pin expansion header that can be used to add custom built expansion boards or boards currently in development by PONTECH. The expansion port allows access to the ADC, PWM and SPI subsystems of the Motorola DSP. The port can be used immediately by taking advantage of the 8-channel 12-Bit ADC (Analog to Digital Converter) for reading analog voltage between 0 and 3.3 volts.

HBC101 Feature List

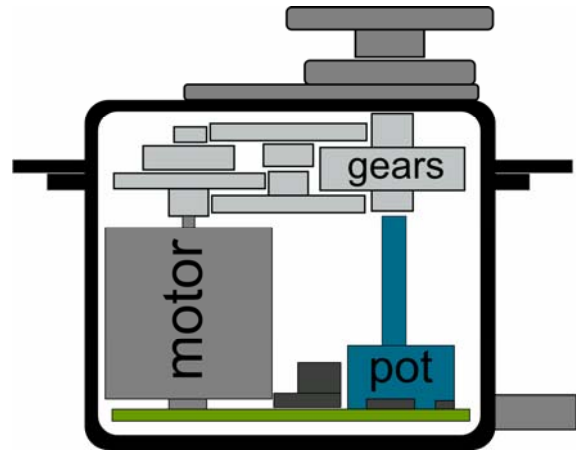
- 115,200bps maximum true RS-232 level IO
- Eight 0.009° (100ns) resolution PPM outputs (500ns to 6.5us high pulse)
- Eight PPM inputs with 0.009° (100ns) resolution (500ns to 6.5us high pulse)
- Unused servo outputs can be reconfigured for digital output. Of which, four of them can sink up to 300mA for driving small relays or solenoids
- Unused servo inputs can be reconfigured for digital input. All of which are buffered for up to a 40V input signal.
- Six 15-bit resolution 0% to 100% PWM outputs for driving H-Bridge circuits
- 8-channel 12-bit ADC pins for measuring 0V-3.3V analog signals
- Field Upgradeable Firmware
- 8K Byte EEPROM

Firmware Upgrading

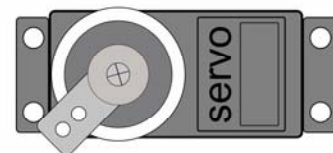
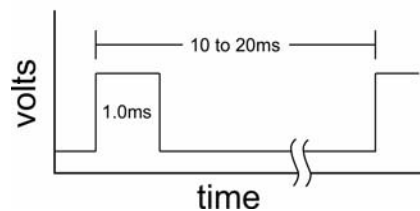
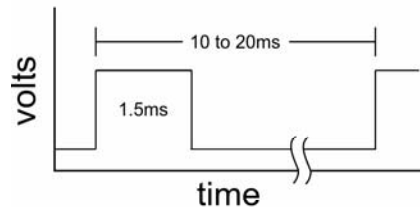
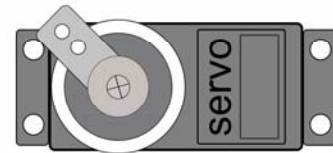
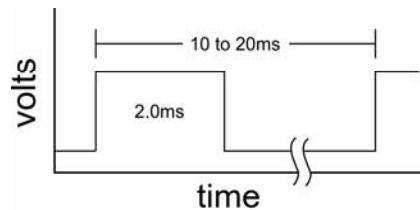
The Pontech S-Record Loader is an application created to accelerate and simplify the process of upgrading the firmware of your HBC101. For more details please read the manual for the S-Record Loader, available at www.pontech.com.

RC Servo Basics

RC servos are position controlled devices that are commanded by an external signal known as a PPM or Proportional Pulse Modulation. The internal makeup of a servo consists of a motor, gear box, motor controller, and position feedback potentiometer. The PPM signal applied to the servo is sensed by the motor controller which in turn with the position feedback potentiometer is used to move the motor. This control system internal to the RC Servo is why the device is called a servo.



The PPM signal is a high pulse in the time range of 1ms to 2ms followed by a low pulse in the range of 10ms to 20ms. The width (time) of the high pulse determines the motor position. Most servos are designed to operate with a total range of 90 degrees for the 1ms to 2ms of the high pulse, where 1.5ms is the center servo position for the motor. The high pulse can be less than 1ms or greater than 2ms to extend the operating range of the servo, but operation in this extend range comes with the possibility of damaging the servo by running the rotor into internal mechanical stops.

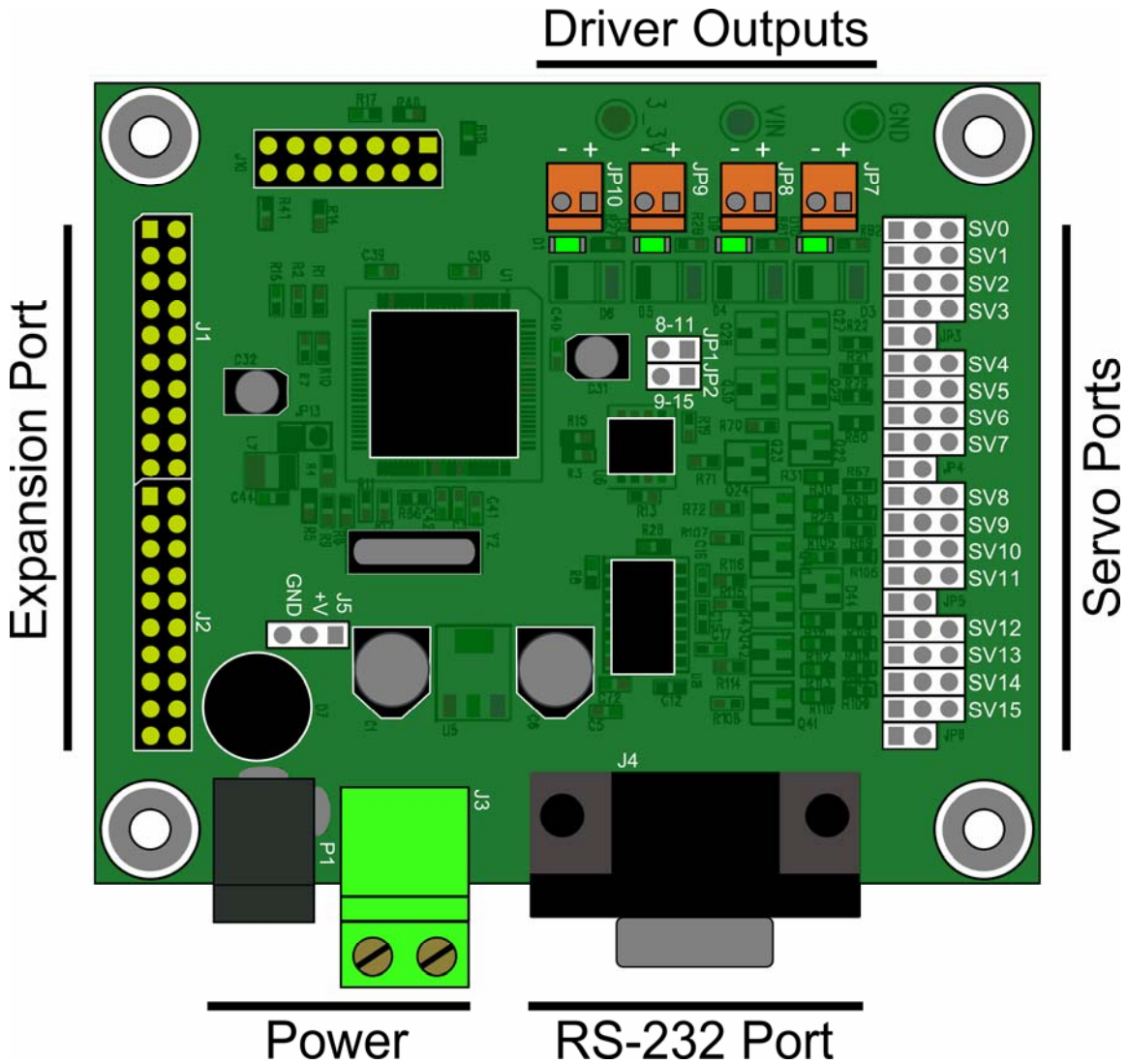


Most RC servos have a three wire connection, of these one of the most common configurations is known as the Futaba J Connector. Typical servos with this connector have the three wires connected to it color coded with the scheme of black being ground (or 0V), red being power (typically 4.8V-7V) and white being the PPM control signal.

Board Connections

HBC101 Board Connections:

The HBC101 has thirty connectors and three jumpers.



Name	Description
J1, J2	Expansion Port
J3,P1	Power input (+Vin/GND)
J4	Serial Port
J5	JTAG (Motorola Compatible)
J5	Connect +V Servo pin (SV0-7) to either +Vin or GND
JP1, JP2	Connect +Vin to Servo +V pin (8-11, 12-15)
JP3 –JP6	Expansion II
JP7-JP10	Driver Outputs 300mA sink
SV0-SV7	RC Servo Output Connections
SV8-SV15	RC Servo Input Connections

Jumper Pin Configurations

The following jumpers configure power routing to the servo connectors on the HBC101.

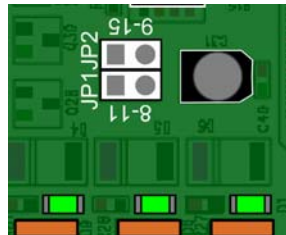
RC Servo Input Power

(Connectors: JP1, JP2)

These jumpers allow the lifting of power from the center pins of the servo inputs. This can be useful if the HBC101 is powered from a separate source than the receiver. These jumpers should be installed if powering the HBC101 through the servo input pins.

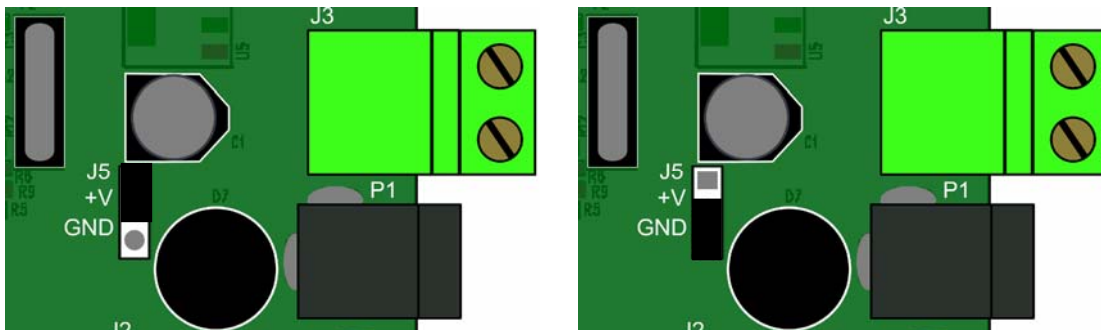
With JP1 removed, the power pin is lifted from servo inputs 8-11.

With JP2 removed, the power pin is lifted from servo inputs 12-15.



RC Servo Output Center Pin

(Connector: J5)



Short pins 1-2 of J5 for the center pin of the servo outputs to be tied to +V-IN (default). With a jumper installed in this position the output servo pins are configured for normal RC Servo operation.

Short pins 2-3 of J5 for the center pin of the servo outputs to be tied to GROUND. The jumper should only be installed in this position for use with expansion board that required these pins to be grounded.

Expansion Port

(Connecters: J1, J2)

This expansion port is provided for connection of expansion boards as well as access to ADC and other pins of the DSP.

Expansion Port Pinout

J1 and J2 are meant to be used together as a single forty pin header connector with pin one of J1 being pin one of the forty pin header.

J1 PINOUT		J2 PINOUT	
1	+VIN	1	+VIN
2	SCLK	2	IRQA
3	+3.3V	3	+3.3V
4	MOSI	4	IRQB
5	AN0	5	PWMA0
6	MISO	6	FAULTA0
7	AN1	7	PWMA1
8	SS	8	FAULTA1
9	AN2	9	PWMA2
10	CANTX	10	FAULTA2
11	AN3	11	PWMA3
12	CANRX	12	ISA0
13	AN4	13	PWMA4
14	UART1-RX	14	ISA1
15	AN5	15	PWMA5
16	UART2-TX	16	ISA2
17	AN6	17	GPIO-E2
18	N.C.	18	N.C.
19	AN7	19	GPIO-E3
20	GND	20	GND

Interfacing to a host computer

(Connector: J4)

The HBC101 is equipped with a 9-pin female RS-232 interface connector configured as DCE (data communications equipment) for easy connection to a host PC, DTE (data terminal equipment), serial port.

DB9 Pinout

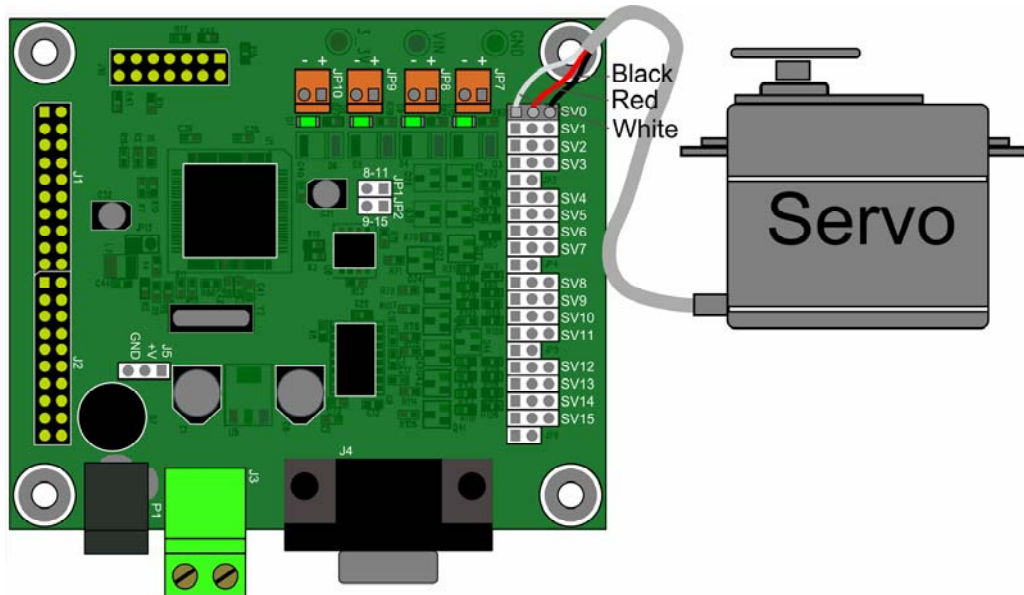
Pin	Description
1, 4, 6	Common Connection
2	Transmit
3	Receive
5	Ground
7, 8	Common Connection
9	No Connection

Connecting a RC Servo to the HBC101

(Connectors: SV0-SV7)

The servo port connectors use a 3-pin male sip (single inline pin) connector (0.1-inch spacing). The servo connector is designed for use with Futaba-type servos with J-type connectors. The servos have three colored wires, Black for ground, Red for power, and White for signal.

Connect the cable with the **black wire** to the pin of the connector closet to the silk screen labels (SV0...SV7) on the PCB, and the **white wire** away from the outside edge of the board as shown below.



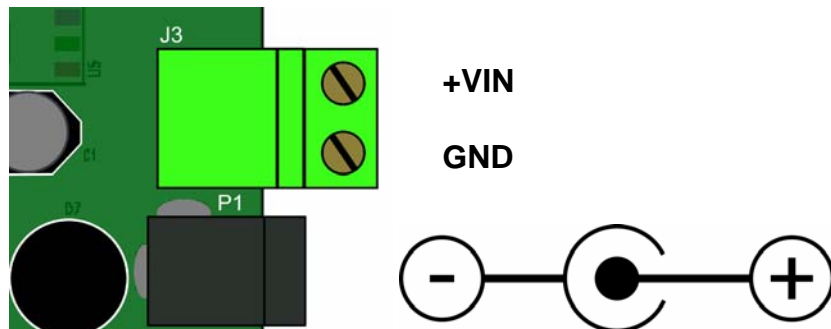
Power Requirements and Connections

(Connectors: J3, P1)

The HBC101 requires a minimum of 3.8VDC for proper operation of the LDO(Low Drop Out) voltage regulator that is used to power the micro controller logic. Power to the board can be provided via J3, P1. It is not recommended that more than 10VDC be applied to either power connection.

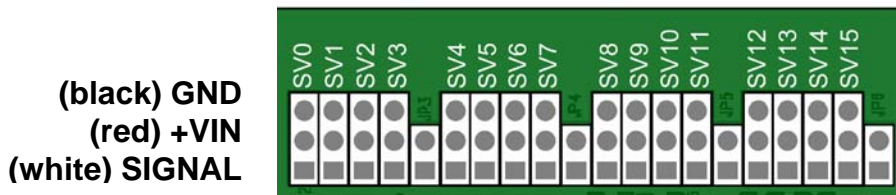
The minimum current requirement for the HBC101 depends on the application. The board itself with no external devices (such as relays or servos) connected will operate on about 200mA of current. When connecting external devices the current requirement for each device must be added to the total power required for the board. As a rule of thumb, it is recommended that the power source be capable of delivering 0.5A to 1A per servo connected, but this value also can vary depending on the servo type and load on the servos connected. Small batteries can often deliver large instantaneous currents required for servos for a low cost in a small package.

Connector P1 can be used to power the board using an off the shelf wall wart DC power source. The connector is configured as a tip positive ring, negative input and will be marked with the following diagram.



NOTE: some “Rev A” PCB’s may be configured as “Rev B”, this configuration consists of a the D7 bridge rectifier being removed. If your board is a “Rev A” PCB that has been modified please be aware the GND and +VIN pins of J3 are reversed.

Power can also be applied using a servo battery pack through either the servo (SV) input or output pins. The ground connection is closet to the board edge and +VIN is the center pin.

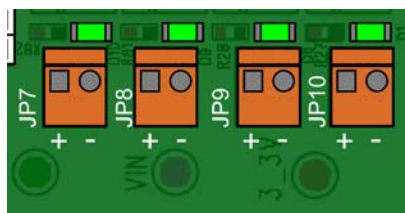


NOTE: Do not apply power to the two pin JP connectors between the SV connectors.

Driver Outputs

(Connector: J7-J10)

These connections can be used to power small relays or solenoids that draw up to 300mA each. Each output has an associated LED that lights when the output is energized. Also note that JP7-JP10 are connected to SV0-SV3. So any signal present at SV0 will also be present at JP7, and so on.



NOTE: The polarity is not marked on the PCB of both Rev A and Rev X1.

Notes

Warranty and Copyrights

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ProLinear/PONTECH, Inc. warrants its products against defects in materials and workmanship for a period of 90 days.

If you discover a defect, ProLinear/PONTECH, Inc. will, at its option, repair, replace, or refund the purchase price. Simply return the product with a description of the problem and a copy of your invoice (if you do not have your invoice, please include your name and telephone number).

The warranty shall become void if the product has been damaged by accident, abuse, or misuse.

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