CONTREX®

DEDICATED TO SIMPLIFYING MOTION. PRECISELY.

PRECISION GEAR TOOTH ENCODERS

FOR SENSING

- SPEED
- POSITION
- DIRECTION

PRECISION DESIGN

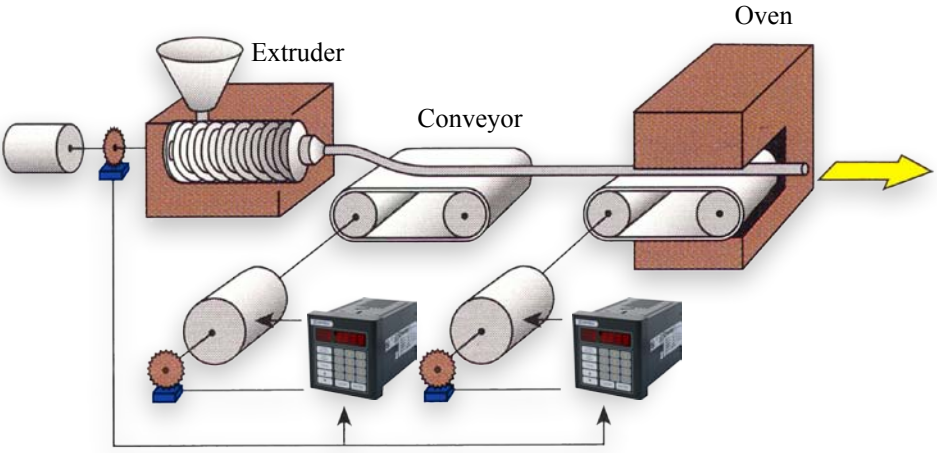
- RUGGED
- COMPACT
- COMPATIBLE

Encoders - critical to precision motion control

Encoders play a critical role in today's precision motion control systems. They provide speed, direction, and position information to motion controllers, PLCs, and other automation equipment. Without reliable and accurate encoders, many of these systems will not work as required.

In the example application in **Figure 1**, three encoders are used to send information about motor speed back to two CONTREX ML-Trim controllers.

Figure 1 - Extruder Application



The encoder on the motor shaft driving the Extruder acts as the "lead" encoder, providing master speed regulation of the entire system.

The encoders on the Conveyor and Oven motor shafts act as "follower" encoders, providing for the correct speed regulation of their individual processes. The CONTREX ML-Trim controllers automatically maintain a precise relationship between the "lead" encoder and "follower" encoders.

Precision Gear Tooth Encoders from CONTREX provide reliable, accurate encoding of motor and other rotary shafts for advanced motion control.

Basic Rotary Motion Sensing

There are numerous methods for sensing rotary motion. One of the most basic methods is to use an inductive proximity switch to sense the keyway on a motor shaft, as shown in **Figure 2**. This method does not provide direction or position information back to the control system, only speed - and at a low resolution.

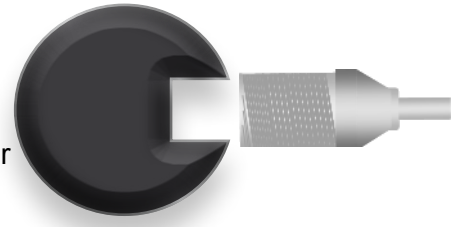
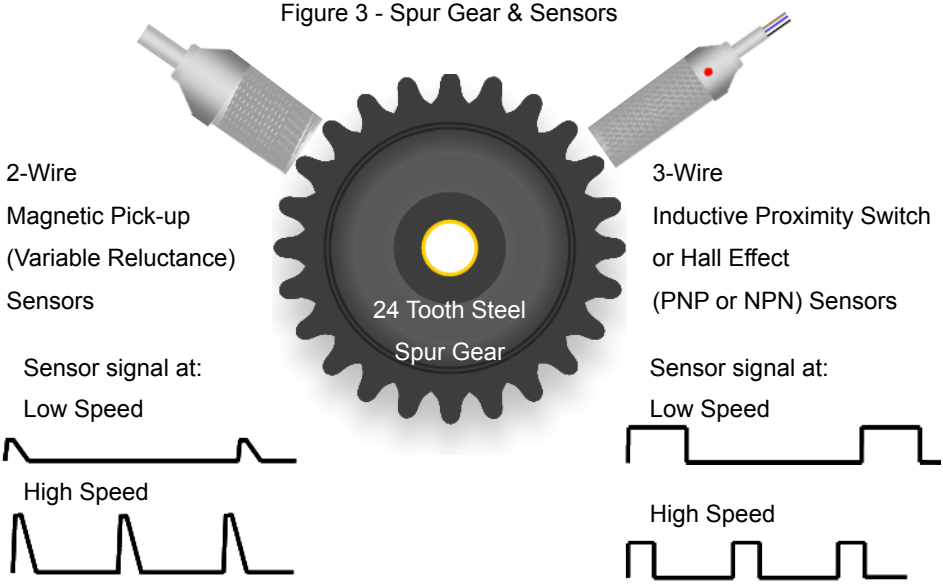


Figure 2 - Prox sensor and keyway

An improvement upon this method, but still very basic, is to sense a spur gear instead of the motor shaft key-way. Different sensors can be used in place of the proximity sensor, providing different signal types back to the control system, as shown in **Figure 3**.

Figure 3 - Spur Gear & Sensors



At low speeds, Magnetic Pick-up sensors do not provide strong enough signals for the control system to use. Thus, if you need creep speed, or direction and position regulation, you must use a 3-Wire solution as shown in **Figure 3**. That way, a gear tooth cannot "sneak by" the sensor without the control system knowing it.

Precision Gear Tooth Sensing

CONTREX has developed a unique gear and encoder sensor package for motion control applications. The 60 tooth precision gear has square teeth for improved sensing accuracy. The encoder sensor utilizes Hall Effect technology for sensing down to zero-speed, direction, and position.

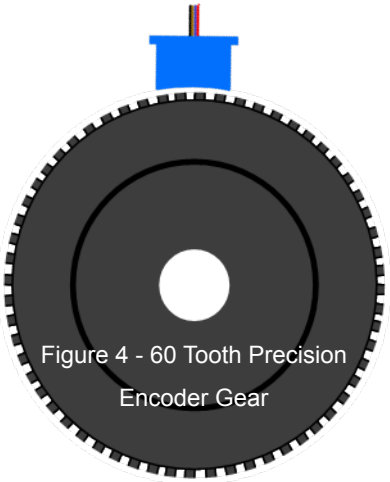
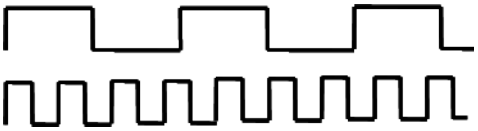


Figure 4 - 60 Tooth Precision Encoder Gear

- Cast powdered metal
- Machine finished to +/- 0.002”
- Powder coated
- 60 teeth per revolution standard
- 50% tooth - 50% gap produces a very accurate 50% duty cycle square wave signal from the encoder sensor as show here:



50% duty cycle at low speeds

50% duty cycle a high speeds

High Resolution Magnetic Sensing

(developing technology)

CONTREX is developing a high resolution encoder package for the most demanding motion control applications. As shown in **Figure 5**, it will utilize a permanent magnet embedded disk with the potential for an index pulse and absolute encoding.

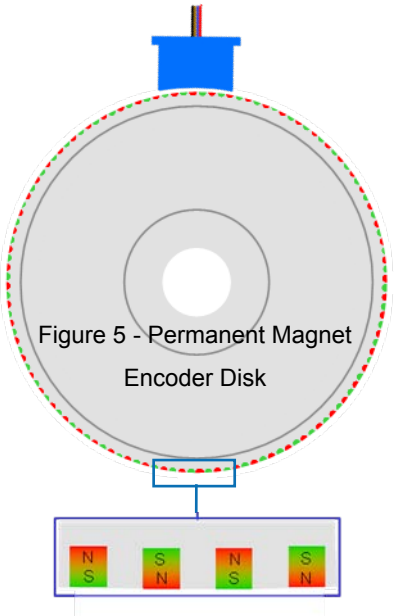


Figure 5 - Permanent Magnet Encoder Disk

- Nonferrous disk
- 128 to as high as 1024 poles
- Machine finished to +/- 0.002”
- 50% duty cycle square wave signal from the encoder sensor

Precision Gear Tooth Encoder + Ring Kit

The most popular method of mounting the Precision Gear Tooth Encoder is with our industry leading Ring Kit. The complete kit is the thinnest in the industry and includes:

- Encoder sensor
- 60 tooth precision gear
- Ring assembly
- Junction box and wire nuts
- Mounting hardware and instructions

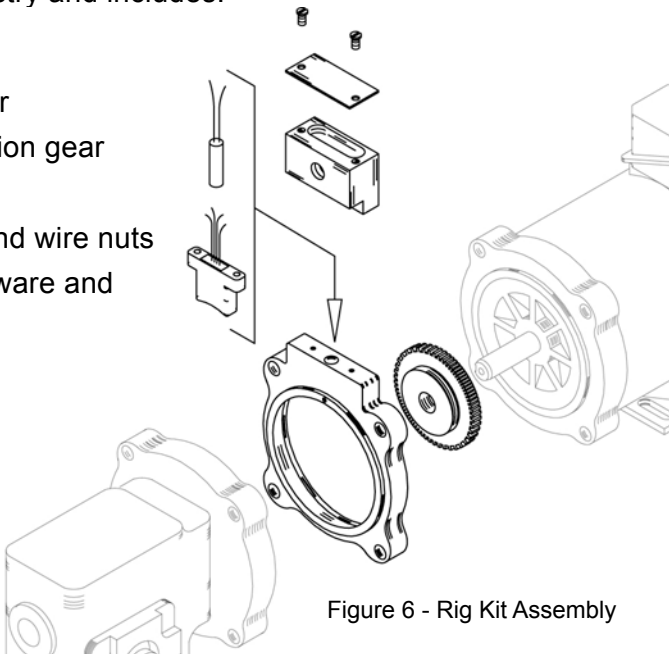


Figure 6 - Rig Kit Assembly

Convenient Mounting

When mounted to a NEMA “C” faced motor, the Ring Kit package only consumes six-tenths of a inch (0.610”) of the motor shaft. Leaving the majority of the motor shaft for mounting additional items like brakes, and gear boxes.

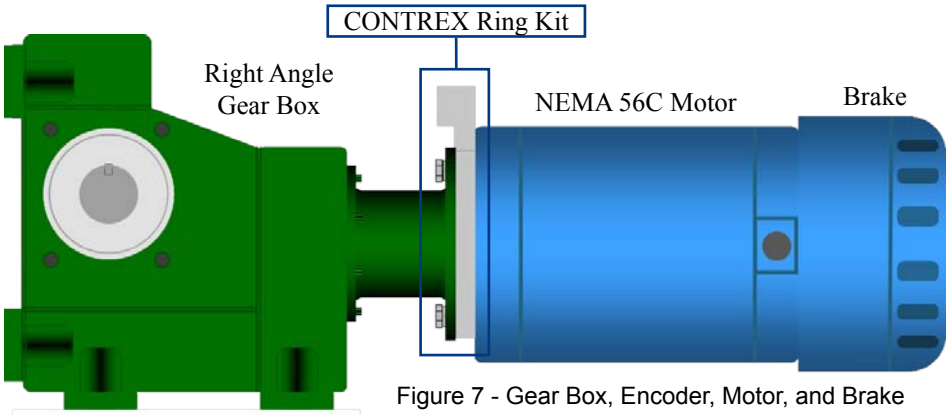


Figure 7 - Gear Box, Encoder, Motor, and Brake

Sensors

CONTREX sensors are uniquely designed for quick and easy installation into our Ring Kits, and precision encoding of our 60-tooth Gears.

- 5 to 24VDC voltage range
- -40°C to 125°C temperature
- Housing that eliminates the need for gapping
- Limited lifetime warranty

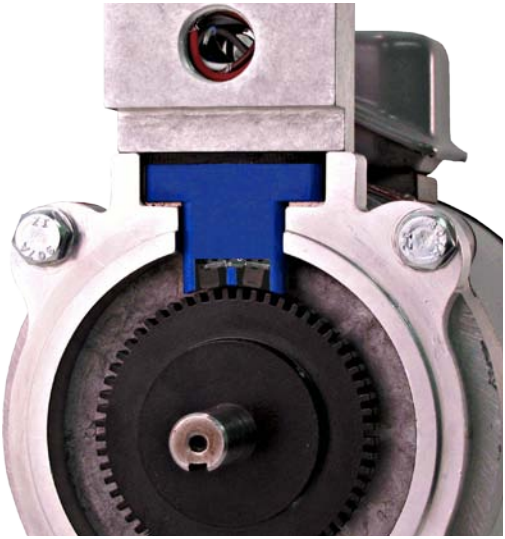


Figure 8 - Sensor in Ring Flange

Encoding - Decoding

All of CONTREX's Precision Gear Tooth Encoders are capable of 2X decoding. What we mean by 2X decoding is that both the *leading edge* and *trailing edge* can be seen by the decoder as 2 recordable, evenly spaced events. This works with CONTREX's encoders because the output signal is precisely half ON and half OFF - no matter the speed.

Figure - 9 Encoded - Decoded Pulse Train Signal

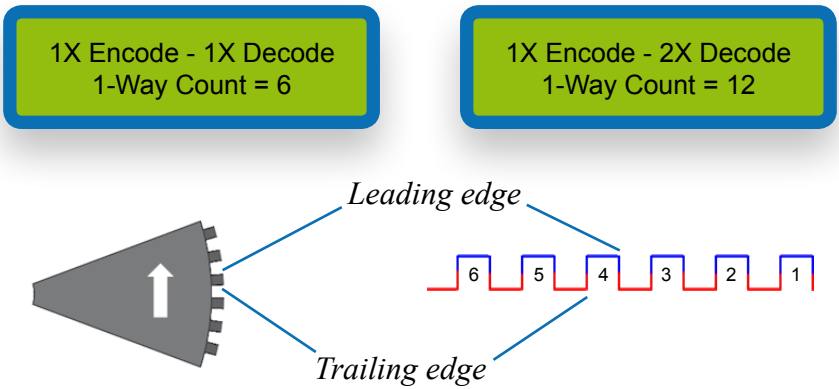
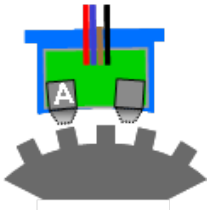


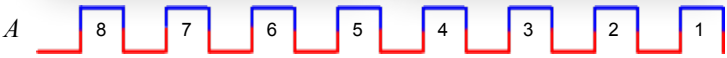
Figure 9 shows how six Precision Gear teeth are encoded into six, evenly spaced sensor pulses. With 1X decoding, the counter records only six events. With 2X decoding, the counter records 12 events - thus improving resolution.

One-way Encoding - Decoding



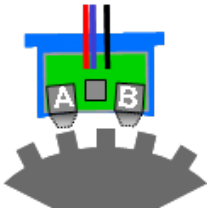
1X Encode - 1X Decode
1-Way Count = 8

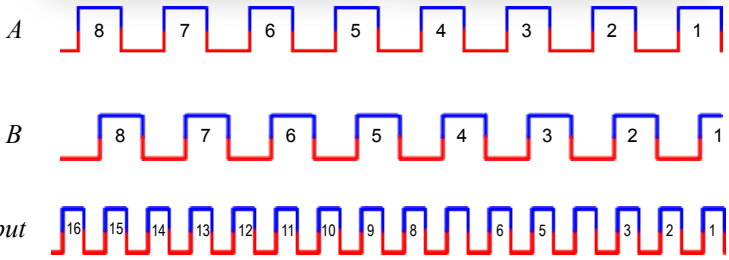
1X Encode - 2X Decode
1-Way Count = 16



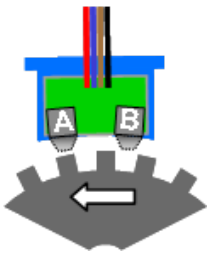
2X Encode - 1X Decode
1-Way Count = 16

2X Encode - 2X Decode
1-Way Count = 32



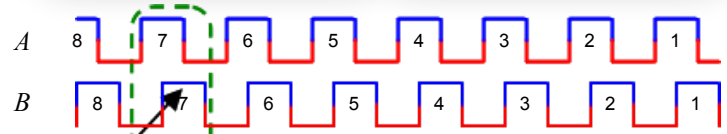


Quadrature Encoding - Decoding



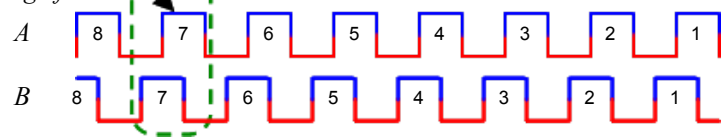
1X Encode - 1X Decode
Quadrature Count = -16

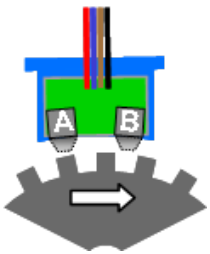
1X Encode - 2X Decode
Quadrature Count = -32



Counter-clockwise
"B" switches high first

Clockwise
"A" switches high first





1X Encode - 1X Decode
Quadrature Count = +16

1X Encode - 2X Decode
Quadrature Count = +32

CONTREX Ring Kits & Accessories Price Sheet

Prices effective August 1, 2010. Prices subject to change without notice. General Sales Terms and Conditions apply.

Ask about custom sensors, leads, connectors, and gears.

PART NO.	DESCRIPTION	US $
Ring Kits - 60 Tooth Gear, 5-24VDC 4-wire Open Collector Quadrature Sensor w/ Pull-up Resistor		
7300-1600	QRK56C, 5/8" bore 5-24V quad sensor w/ pull-up resistor	$189.00
7300-1601	QRK143TC, 7/8" bore 5-24V quad sensor w/ pull-up resistor	$189.00
7300-1602	QRK182TC, 1-1/8" bore 5-24V quad sensor w/ pull-up resistor	$240.00
7300-1603	QRK213TC, 1-3/8" bore 5-24V quad sensor w/ pull-up resistor	$240.00
7300-1604	QRK254TC, 1-5/8" bore 5-24V quad sensor w/ pull-up resistor	$240.00
7300-1605	QRK71D Metric Face, 14mm bore 5-24V quad sensor w/ pull-up resistor	$194.00
Ring Kits - 60 Tooth Gear, 5-24VDC 4-wire Open Collector Quadrature Sensor w/o Pull-up Resistor		
7300-1610	QRK56C, 5/8" bore 5-24V quad sensor w/o pull-up resistor	$189.00
7300-1611	QRK143TC, 7/8" bore 5-24V quad sensor w/o pull-up resistor	$189.00
7300-1612	QRK182TC, 1-1/8" bore 5-24V quad sensor w/o pull-up resistor	$240.00
7300-1613	QRK213TC, 1-3/8" bore 5-24V quad sensor w/o pull-up resistor	$240.00
7300-1614	QRK254TC, 1-5/8" bore 5-24V quad sensor w/o pull-up resistor	$240.00
7300-1615	QRK71D Metric Face, 14mm bore 5-24V quad sensor w/o pull-up resistor	$194.00
Ring Kits - 60 Tooth Gear, 5-24VDC Differential Line Driver Quadrature Sensor A A' B B'		
7300-1620	QRK56C, 5/8" bore 5-24VDC differential line driver sensor A,A',B,B'	$199.00
7300-1621	QRK143TC, 7/8" bore 5-24VDC differential line driver sensor A,A',B,B'	$199.00
7300-1622	QRK182TC, 1-1/8" bore 5-24VDC differential line driver sensor A,A',B,B'	$250.00
7300-1623	QRK213TC, 1-3/8" bore 5-24VDC differential line driver sensor A,A',B,B'	$250.00
7300-1624	QRK254TC, 1-5/8" bore 5-24VDC differential line driver sensor A,A',B,B'	$250.00
7300-1625	QRK71D Metric Face, 14mm bore 5-24VDC differential line driver sensor A,A',B,B'	$204.00
Ring Kits - 60 Tooth Gear, 5-24VDC 3-wire Open Collector Factor 2X Sensor w/ Pull-up Resistor		
7300-1650	2XRK56C, 5/8" bore 5-24V Factor 2X sensor w/ pull-up resistor	$199.00
7300-1651	2XRK143TC, 7/8" bore 5-24V Factor 2X sensor w/ pull-up resistor	$199.00
7300-1652	2XRK182TC, 1-1/8" bore 5-24V Factor 2X sensor w/ pull-up resistor	$250.00
7300-1653	2XRK213TC, 1-3/8" bore 5-24V Factor 2X sensor w/ pull-up resistor	$250.00
7300-1654	2XRK254TC, 1-5/8" bore 5-24V Factor 2X sensor w/ pull-up resistor	$250.00
7300-1655	2XRK71D Metric Face, 14mm bore 5-24V Factor 2X sensor w/ pull-up resistor	$204.00
Ring Kits - 60 Tooth Gear, 5-24VDC 3-wire Open Collector Factor 2X Sensor w/o Pull-up Resistor		
7300-1660	2XRK56C, 5/8" bore 5-24V Factor 2X sensor w/o pull-up resistor	$199.00
7300-1661	2XRK143TC, 7/8" bore 5-24V Factor 2X sensor w/o pull-up resistor	$199.00
7300-1662	2XRK182TC, 1-1/8" bore 5-24V Factor 2X sensor w/o pull-up resistor	$250.00
7300-1663	2XRK213TC, 1-3/8" bore 5-24V Factor 2X sensor w/o pull-up resistor	$250.00
7300-1664	2XRK254TC, 1-5/8" bore 5-24V Factor 2X sensor w/o pull-up resistor	$250.00
7300-1665	2XRK71D Metric Face, 14mm bore 5-24V Factor 2X sensor w/o pull-up resistor	$204.00

Price Sheet Continued...

Ring Kits - 60 Tooth Gear, Magnetic Pick-up Sensor		
7300-0980	RK56C, 5/8" bore magnetic pick-up sensor	$120.00
7300-0982	RK143TC, 7/8" bore magnetic pick-up sensor	$120.00
7300-0934	RK182TC, 1-1/8" bore magnetic pick-up sensor	$175.00
7300-0936	RK213TC, 1-3/8" bore magnetic pick-up sensor	$175.00
7300-0987	RK254TC, 1-5/8" bore magnetic pick-up sensor	$175.00

Ring Kits - 30 Tooth Gear, Magnetic Pick-up Sensor		
7300-0981	RK56C-30, 5/8" bore magnetic pick-up sensor	$132.00
7300-0983	RK143TC-30, 7/8" bore magnetic pick-up sensor	$145.00
7300-0984	RK182TC-30, 1-1/8" bore magnetic pick-up sensor	$199.00
7300-0985	RK213TC-30, 1-3/8" bore magnetic pick-up sensor	$310.00

Sensors ONLY		
5800-1412	SM3N-A smooth 0.375"Dia. X 1.38"L barrel magnetic pick-up sensor	$30.00
5800-1410	SM3N threaded barrel magnetic pick-up sensor; replacement for old ring kits	$35.00
6500-0038	SM5XP Explosion-proof magnetic pick-up sensor (use 7000-0450 flange kit)	Call
7200-0990	Quadrature 5-24VDC 4-wire open collector sensor w/ pull-up resistor	$110.00
7200-0991	Quadrature 5-24VDC 4-wire open collector sensor w/o pull-up resistor	$110.00
7200-0992	Quadrature 5-24VDC differential line driver sensor A A' B B'	$120.00
7200-0993	2X one-way 5-24VDC 3-wire open collector sensor w/pull-up resistor	$120.00
7200-0994	2X one-way 5-24VDC 3-wire open collector sensor w/opull-up resistor	$120.00

Flange - Ring ONLY (w/o hardware)		
7000-0450	XRF56C & 143TC ring, for SM5XP Explosion-proof sensor	$109.00
7000-1540	3RF56C & 143TC ring, for 0.375"Dia. barrel sensor	$64.00
7000-1541	3RF182TC, 213TC, & 254TC ring, for 0.375"Dia. barrel sensor	$119.00
7000-1602	SRF56C & 143TC ring, for blue slot sensor	$59.00
7000-1603	SRF182TC, 213TC, & 254TC ring, for blue slot sensor	$109.00
7000-1604	SRF71D ring, for blue slot sensor	$59.00

Price Sheet Continued...

PART NO.	DESCRIPTION	US $
	Precision Gears ONLY	
5800-0382	SG-30T-058 5/8" bore 30 tooth standard gear	$42.00
5800-0383	SG-30T-078 7/8" bore 30 tooth standard gear	$55.00
5800-0347	SG-30T-118 1-1/8" bore 30 tooth standard gear	$55.00
5800-0348	SG-30T-138 1-3/8" bore 30 tooth standard gear	$170.00
5800-1700	PG-60T-058 5/8" bore 60 tooth precision gear	$30.00
5800-1701	PG-60T-078 7/8" bore 60 tooth precision gear	$30.00
5800-1702	PG-60T-118 1-1/8" bore 60 tooth precision gear	$35.00
5800-1703	PG-60T-138 1-3/8" bore 60 tooth precision gear	$35.00
5800-1704	PG-60T-158 1-5/8" bore 60 tooth precision gear	$35.00
5800-1740	PG-60T-14M 14mm bore 60 tooth precision gear	$35.00
5800-1681	PG-60T-000 NO bore 60 tooth precision gear	$25.00

Note 1: The primary motor frame sizes are reflected in the description. Additional corresponding frames are listed below.

- 143TC; also for 148TC, 149TC, 182C, 184C
- 182TC; also for 184TC, 189ATC, 213C, 215C, 254C
- 213TC; also for 215TC, 219ATC, 2110ATC, 254UC, 256UC
- 254TC; also for 256TC, 281ATC

Note 2: 30 tooth gears are not suitable for quadrature encoding using 7200-0990 to 7200-0992 slot sensors. They are not suitable for 2X encoding using 7200-0993 or 7200-0994 slot sensors. They may be used for 1X one-way encoding using 7200-0990 or 7200-0991 sensors

Limited Lifetime Warranty

CONTREX Inc. provides a **Limited Lifetime Warranty** for our standard "Blue Slot Sensors" used in conjunction with CONTREX's Precision Gears and warrants that sensor is to be in good working order for the lifetime of the original installation. Should this product, in CONTREX's opinion, fail to be in good working order during the warranty period, CONTREX will, at its option, repair or replace this product at no charge, provided that the product has not been subjected to abuse, misuse, accident, disaster or non-CONTREX authorized modification or repair.

The former generation "Yellow Slot Sensors" do not qualify for Limited Lifetime warranty. Custom "Blue Slot Sensors" do not qualify for Limited Lifetime warranty.

You may obtain warranty service by returning it to: CONTREX Inc., 8900 Zachary Lane North, Maple Grove, MN 55369. Product returned to CONTREX must be pre-authorized by contacting CONTREX Inside Sales 1-800-342-4411. CONTREX will return the repaired or replaced sensor by prepaid ground shipment service.

CONTREX Inc. reserves the right to substitute an equivalent product if available or to retract Lifetime Warranty if no replacement is available.

All other Terms and Conditions as stated in CONTREX Inc., General Sales Order Terms and Conditions (form DS11-2n) apply.

Your CONTREX Authorized Reseller/Distributor

CONTREX - as one of the most experienced names in precision speed and motion control, we have used our three decades of application know-how to create ready-to-use controllers with advanced built-in motion programs.

Motion controllers to work with any drive - AC, DC, or Servo

CX-Series Controllers

M-Series Controllers

ML-Series Controllers

DC drives for precision control or 1/4 to 2 HP motors

M-Drive

ML-Drive

DS53-3 Rev. A