



**Position Feedback For
Hydro Power & Heavy Movable Structures**



**ABSOLUTE PROCESS CONTROL
KNOW WHERE YOU ARE... REGARDLESS**

Applications



Control House

Rotary and Linear position sensors are used on the bridge to verify lift, span, skew, and barrier gate position. This important information is reported back to the operator and displayed on a meter in the console. For lift bridges, the total skew can be monitored and adjusted as necessary through other controls. Rotary or linear sensors can also report when lock bars are fully seated and locked.

Products successfully applied in this application include:

- 2120 Resolver or LDT Interface Module and Display
- 1986 Resolvers and Programmable Limit Switches (PLS)
- 1980 Rotating Cam Limit Switches with optional resolver or rotary position sensor
- 950MD and 953 LDT / Linear Displacement Transducers
- 2000/2006 Geared Rotary Limit Switches



Dam

Gemco has been supplying Rotary Cam Limit Switches (RCLS) and Brakes to the U.S. Army Corps of Engineers for more than 45 years. Our Series 1997 Gate Hoist RCLS was designed exclusively to the specifications supplied by the USACE to replace traveling nut and mechanical cam limit switches. Over the past 45 years, we have provided thousands of these units throughout the world for feedback and control of dam roller gates, miter gates, spillway gates, and lock chamber valve machinery.

The series 2000 / 2006 geared rotary limit switch is used to provide upper, intermediate, and lower limits of travel. It can also be used to monitor for "slack cable" on hoists or to provide redundant limits for additional safety.

Products successfully applied in this application include:

- 1997 Gate Hoist Rotating Cam Limit Switch for dam gates, valves, lock chambers, spillway gates, and intake structure gates
- 1980 Rotating Cam Limit Switch with optional resolver or rotary position sensor
- GEMCO Industrial Westinghouse / Wagner Brake Systems
- Electro-Thrust Brake Assemblies for Holding Gates / Valves
- 925 Mill-Duty Cable Reel Sensor
- 950MD and 953 LDT / Linear Displacement Transducers
- 2000/2006 Geared Rotary Limit Switches



Lock Chamber

Gemco has been supplying Rotary Cam Limit Switches (RCLS) and Brakes to the U.S. Army Corps of Engineers for more than 45 years. Our series 1997 Gate Hoist RCLS was designed exclusively to the specifications supplied by the USACE to replace traveling nut and mechanical cam limit switches. Over the past 45 years we have provided thousands of these units throughout the world for feedback and control of dam roller gates, miter gates, spillway gates, and lock chamber valve machinery.

Products successfully applied to this Industry include:

- 1997 Gate Hoist Rotating Cam Limit Switches for Miter Gate or valve position feedback and control
- 1980 Rotating Cam Limit Switches with optional resolver or rotary position sensor
- 2000 / 2006 Geared Rotary Limit Switches
- 950MD and 953 LDT / Linear Displacement Transducers
- 925 Mill-Duty Cable Reel Sensors
- GEMCO Industrial Westinghouse / Wagner Brake Systems
- Electro-Thrust Brake Assemblies for Holding Gates / Valves

AMETEK APT has been supplying GEMCO custom Industrial Rotary and Linear solutions designed for Hydro Power and Heavy Movable Structures markets for over 50 years.



Hydro Power

Gemco Industrial Products allow you to monitor and control the amount of water flowing through the intake structure and penstock. By providing position feedback and control of the wicket gate / governor, the turbine speed and output can be accurately managed. Rotary and linear sensors can be used on these items for position feedback, display, and control.

Products successfully applied in this application:

- 925 Mill-Duty Cable Reel Sensors
- 950MD and 953 LDT / Linear Displacement Transducers
- 955 BRIK or 956 Blok Low Profile Linear Transducer
- 1980 Rotating Cam Limit Switches with optional Resolver or rotary position sensor
- 1997 Gate Hoist Rotating Cam Limit Switch



Bascule and Draw Bridge

Gemco provides Industrial Controls that monitor and control the span and skew positions of the moveable bridge. The series 1980 Cambox provides adjustable cams to interface with drives and braking systems. An optional resolver or other position sensor can also be integrated into the Cambox to display position at the console or remotely.

Products successfully applied in this Industry include:

- 1980 Rotating Cam Limit Switch with optional Resolver or rotary position sensor
- 2000/2006 Geared Rotary Limit Switch
- 1986 Resolvers and Programmable Limit Switches (PLS)
- 2120 Resolver or LDT Interface Module and Display
- 950MD and 953 LDT / Linear Displacement Transducers
- GEMCO Industrial Westinghouse / Wagner Brake Systems
- CATRAC® Cable and Hose Carrier Systems



Railway Lift Bridge

Gemco provides Industrial Controls that monitor and control the span and skew positions of the Lift Bridge. Position feedback of one or both sides of the lift bridge can be monitored, compared, and adjusted to prevent excessive skew. The Catrac cable and hose carrier system provides protection for hydraulic hoses and electrical cables in motion.

Products that have been successfully applied in the application include:

- 1980 Rotating Cam Limit Switch with optional resolver or rotary position sensor
- 1986 Resolvers and Programmable Limit Switches (PLS)
- 2120 Resolver or LDT Interface Module and Display
- 950MD and 953 LDT / Linear Displacement Transducers
- 925 Mill-Duty Cable Reel Sensor
- GEMCO Industrial Westinghouse / Wagner Brake Systems
- CATRAC® Cable and Hose Carrier Systems



Swing Bridge

Gemco provides Industrial Controls that monitor the span positions of a swing bridge and provides protection for the hydraulic hoses and electrical cables in motion.

Products successfully applied in this application include:

- 1980 Rotating Cam Limit Switch with optional resolver or rotary position sensor
- 1986 Resolvers and Programmable Limit Switches (PLS)
- 2120 Resolver or LDT Interface Module and Display
- 9590MD and 953 LDT / Linear Displacement Transducers
- 925 Mill-Duty Cable Reel Sensor
- GEMCO Industrial Westinghouse / Wagner Brake Systems
- CATRAC® Cable and Hose Carrier Systems

We pride ourselves on packaging these sensors to survive the most hostile environments.



Resolvers

GEMCO 1986 Resolvers have been the preferred source for rugged and accurate rotary positioning in a variety of industrial applications and are typically found in lock, dam, and bridge applications to report rotary position information back to the host controller, such as one of our PLS's or Interface Modules.

The advantage of resolver transducers over other rotary position products is that resolvers hold up better in harsh environments and they are always absolute, so if power is lost and restored, the exact position data will be communicated. In long cable runs, a resolver signal can typically go much further than other technologies. Resolvers have long been the standard rotary position method in packaging, primary metals manufacturing, stamping, automotive, tire and rubber, paper mills, and mining.

GEMCO has always been a pioneer in the design and manufacturing of "built to order" resolver packages. We can mechanically and electrically match any competitor's package while improving the overall design to enhance the performance, accuracy, or durability. Through our wide range of materials for construction and precision gear reducers, we can extend your sensor's life many times over. We offer packages with multiple sensors and gear reducers in a variety of materials. We have engineered special resolver packages with stainless steel housings, oil filled packages, high RPM, high resolution, resolver/encoder combinations, and tach generators. The resolvers can also be combined with our 1980 Camboxes to give both mechanical and solid-state position control.

1986 Series Resolvers

- Precision resolvers with absolute position packages are direct bolt-in replacements for most english and metric size encoders
- Allows up to 14-Bit resolution
- Internal precision gear reducers for multi-turn applications
- Standard foot mount unit is the most rugged in the industry
- Single or dual resolvers

For more information, request catalog Z4 – 1986 Resolver Catalog



Camboxes

GEMCO is the industry leader in Rotary Position Products with over 50 years of experience. We pride ourselves on packaging sensors to survive in the most hostile environments. Our experience on bridges, locks, dams, steel mills, foundries, ship yards, stamping presses, and many other harsh

industries has provided us with the capability to offer hundreds of custom sensor packages to meet your needs. We have the largest selection of standard and custom products. With over 1,000,000 possible combinations in our standard units alone, we are certain to have a cambox for your specific application.

A rotating cam limit switch or cambox makes it possible to open or close independent circuits at any desired angular position. The 3" diameter plastic cams are adjustable for dwells of 4 degrees through 356 degrees. Electrical switches are available in SPDT and DPDT configurations. Gear reducers and multipliers are also available. The RCLS is available with up to 40 cams / circuits packaged in standard steel or Stainless Steel enclosures. Many custom features have been developed and are available for this product. Optional 6" diameter all metal cams are also available for harsh and demanding environments. The 1980 cambox can also be supplied with an internal size 11 resolver to provide a continuous position output signal that can be interfaced with a resolver interface device. PLC cards and stand alone devices are typically used to provide the resolver excitation and process the sine / cosine return signals. Resolvers provide an absolute position feedback signal and are extremely immune to shock, vibration, and all forms of electrical noise. They can typically handle cable runs of 1,000 feet to 3,000 feet depending upon the interface device selected. In addition, we can provide a variety of other rotary sensors such as encoders, potentiometers, tach generators, or other motion sensing devices.

- Mechanical for up to 500 RPM
- Optical for up to 3600 RPM
- NEMA 1, 4, 7, 9, and 12
- Contaminant and Explosion Proof
- Up to 40 Circuits
- Gear Reducers and Multipliers Right Angle or Straight Drive
- Resolver, Encoder, Potentiometer, or other Rotary Sensor Options available
- Stainless Steel and Epoxy Paint Enclosures
- Enclosure Heaters for Extreme Outdoor Applications
- Custom Features for the most Demanding Environments

For more information, request catalog Z11 – 1980 Ordering Guide



Position Feedback Designed for Heavy Industry

Linear Displacement

Linear Displacement plays an important role in the automation and monitoring of power plant, lock, dam, and bridges. AMETEK Gemco provides industrial solutions that control and monitor the amount of water allowed into the Hydro Power plant. Applications include slice gates, intake structures, tainter valves, and governors. We can monitor and measure strokes from as small as 1 inch up to 100 feet. If you have an application requiring linear feedback and control, Gemco has the solution.

Gemco's durable and reliable linear position products are based on unique technologies, including Magnetostriction. Our sensors come in a variety of packages and with features not found in competitive units.

953 Linear Displacement Transducer (LDT)

- Magnetostrictive LDT for high shock and vibration areas (toughest in the industry)
- Resolution to 1 micron
- Lengths up to 300" in 0.1" increments also available with:
 - Voltage, Current, Digital, PWM, Start/Stop and SSI Outputs
 - Programmable Zero and Span
 - Diagnostic LED for easy troubleshooting
 - IP 68 rated



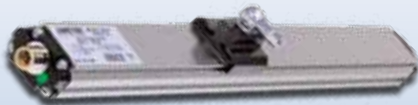
950 MD Mill-Duty Linear Transducer

- All 304 stainless steel construction – Designed to help protect the Gemco 953VMax Linear Transducer
- Adjustable trunnion and swivel ball mount standard
- Air purge fittings are standard on all units with Vortex coolers available for high temperature applications
- Custom water-cooled versions available
- Repeatable to +/- 0.001"



955 BRIK Low Profile Linear Transducer

- Aluminum extruded channel provides easy mounting
- Low cost linear position sensor
- Lengths to 180"
- Diagnostic LED for ease in troubleshooting
- Analog, digital pulses and Quadrature outputs available



For more information, request catalog Z144 – LDT Brochure

Cable Reels

The Series 925 Cable Reels can be found on the Intake Gates of Hydro Power Plants to control and monitor the position of the head gate and control the amount of water to the turbine.



The Series 925 Linear Cable Reel can be used in any linear application up to 1200 inches. The system consists of a heavy duty spring motor assembly attached to a precision machined cable drum. As the cable is pulled off the precision drum, it rotates a shaft connected to it. This shaft is precisely geared so the full number of revolutions of the drum is equal to the appropriate number of revolutions required by the chosen sensor.

The Series 925 can be used in any industrial application to monitor a linear or reciprocating machine motion. The sensor package, along with the associated electronics, (i.e. programmable logic controller, programmable limit switch, counter card, etc.) can sense the position of any linear motion and can, therefore, be used to control machines.

This approach to machine positioning has several advantages over traditional limit switches. In hostile environments, such as many steel mill applications, the cable reel sensor can be mounted remotely. This protects the sensor from excessive heat, steam, water, chemicals, and physical damage. In addition, the 925 Cable Reels can handle minor misalignments without harm, thus saving installation time. The variety of sensors available allows the system to be easily integrated to existing machine controls.

925 Mill-Duty Cable Reel Sensor

- Converts linear machine motion to rotary motion
- Provides absolute, incremental, analog, or cam switch outputs
- Outputs are electrically compatible with all existing control circuitry
- Stainless steel cable, large dual springs, and 12 gauge steel housings survive the mill environment
- Stroke Length to 100 feet

For more information, request catalog Z12 – 925 Cable Reel Brochure



Programmable Limit Switches

Programmable Limit Switches (PLS's) are used in a variety of applications from packaging and stamping to every day automation. In the Heavy Moveable Structure Industry, they can typically be found in Rail and Draw Bridge Control Houses. The PLS has a rotary Resolver input that can be located up to 1,000 feet from the PLS and is immune to shock, vibration, and temperature locations. The resolver signal is converted in the PLS to electronically simulate mechanical limit switches.



These devices are typically found in applications where the PLC scan time cannot keep up with the process. In many cases, the end user is looking for a simple interface that can be adapted to their machine without having to buy the PLC, HMI, and programming software but then have to struggle to write their own ladder logic. Should the PLC ever see a fault, a laptop with the host PLC software must be connected to the machine in question to diagnose the error.

PLC Encoder Modules and Programmable Limit Switches (PLS's)

- Provides monitoring of Resolver or Linear Displacement Transducer (LDT) from a remote, safe location
- Converts sensor signal to compatible digital, analog, or limit switch outputs
- High-speed output update times improve control resolution and repeatability

For more information, request catalog Z143 – 2500 PLS Catalog

Brake Systems

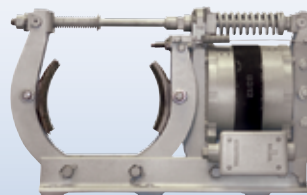
Gemco Industrial Brakes stop virtually any type of industrial machine. Applications such as draw and lift bridges, steel mills, indoor and outdoor bridge cranes, gantries, heavy-duty cranes, high-duty cycle cranes, lock and dam projects, stacker reclaimers, and commercial laundry equipment are just some of the uses for Gemco Industrial Brakes.

These field proven, high performance brake systems were originally designed and built by Westinghouse and Wagner Industrial Brakes. They are tough, reliable, and provide trouble free service. They are designed and built to exact specifications. For more than 40 years, Gemco has been an acknowledged leader in brake system technology for heavy-duty industrial applications.

GEMCO Industrial Brake Systems

- Hydraulic Brakes, AISE electric brakes
- Custom brakes engineered to requirement
- Self-adjustment feature available on electro-thrust brakes
- Competitive pricing and lead times

For more information, request catalog Z329 – Brake Overview



Gate Hoist

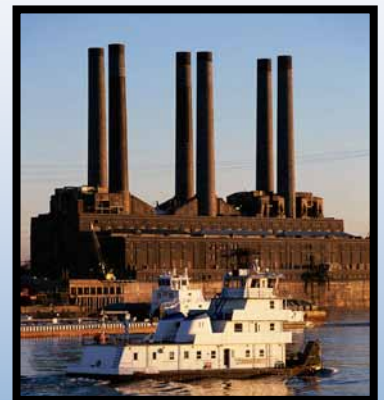
Gemco has been supplying Rotary Cam Limit Switches (RCLS) to the U.S. Army Corps of Engineers for more than 45 years. Our Series 1997 Gate Hoist RCLS was designed exclusively to the specifications supplied by the USACE. Over the past 45 years, we have provided thousands of these units throughout the world for feedback and control of dam roller gate, miter gate, and lock chamber valve machinery. We are committed to this industry and stand behind every unit we build; they are of the highest quality, most robust, and competitively priced units on the market. AMETEK/Gemco has more experience, knowledge, and expertise with these types of applications than anyone in the industry.

Previous nonmetallic cams have been designed and approved by the USACE, and we have supplied them accordingly. We are now taking our proven design and providing a metal cam per the USACE specifications. These units are designed to function according to specifications and to last for years, the switches alone are designed to survive fifteen million cycles.

1997 Gate Hoist Rotating Cam Limit Switch for Gate Control, Tainter Valve Miter Gate

- Nema 4X Stainless Steel construction
- Micro-adjust cams provide easy adjustment at any shaft position
- 6" Metal or Plastic Cams
- Internal Gear Reducer
- Incremental Motion Control Circuits (Available)
- Custom Design Units

For more information, request catalog Z45 – 1997 Gate Hoist Brochure



Know Where You Are... Regardless

www.mfcp.com

CATRAC® Cable & Hose Carriers



CATRAC® is used on various types of machinery, such as lift and swing bridges as a means of safely and efficiently conveying power, electrical, air, or fluid (or a combination of these) to equipment in motion. CATRAC is designed to be maintenance free and to protect cables and hoses from abrasion, wear and twisting. A wide variety of options are available.

The center pivot design allows for smoother cycling and minimal hose movement. The CATRAC design offers “no pinch points” to insure operator safety. Standard side links are high tensile steel for maximum strength. Steel CATRAC is zinc plated with a yellow dichromate dip for superior corrosion resistance. Optional materials, such as aluminum and stainless steel are available.

We also offer a line of Mill Duty CATRAC that is used in rugged applications and environments such as steel mills. These CATRACs offer a box beam type carrier for maximum strength and stability. Spring loaded rods offer the customer easy access to cables and hoses. They also eliminate the concern of fitting sizes that must pass through the (fixed) compartment opening on a box beam style carrier. Hardened shoulder bolts and locknuts (referred to as bolted construction) are recommended for use in rugged environments. The CATRAC is manufactured so that pieces or sections can be removed or replaced in the field.

Our CATRAC product offers: a variety of sizes from 2” to 14” high links, carrier options from welded carriers, split aluminum bar carriers, rod carriers, removable pipe, spring loaded rods, vertical pins, double deck, custom radius “M” dimension (including double radius), custom and special widths, including single widths, double widths, triple widths, etc. We offer various support systems from a single stationary roller support to a complete CATRAC carriage support system.

We can provide you with the optimum system to suit your needs either with our standard carriers and options, or by means of a custom designed system. In addition to our standard systems used in a linear motion, we can also provide you with double radius side mounted systems. Contact our applications engineers for additional information or to discuss your needs in detail.

Get on the right track with CATRAC Cable & Hose Carriers.

- All steel or nylon construction
- Prevents twisting and wear of cables
- Steel construction can withstands severe hydraulic shock loads
- Steel, Stainless Steel, and Nylon construction available
- Nylon resists corrosion and is non-conductive

For more information, request catalog Z88 – Catrac Catalog

Interface Modules

The Gemco 2120 Interface Module can typically be found on the consoles in the control house. The Gemco 2120 is an accurate, absolute position sensing device for use with our rugged Resolvers or Linear Displacement Transducers.



They can be used as simple indicators of position or as a PLC interface module that generates digital signals. In addition, they are used as analog outputs to feed positional and velocity information to the host control.

In harsh, noisy environments, encoders mounted on machines can experience mechanical failures as well as inconsistent signal transmission due to ambient electrical noise invading the signal. A Gemco transducers (resolver or LDT) at the machine can transmit a noise immune position signal to a safe location up to 3,000 feet away. At that location, the signal is converted by our Series 2120 PLC Interface Module to binary, BCD, gray code, or analog outputs for use by the PLC or host controller.

PLC Encoder Modules and Programmable Limit Switches (PLS)

- Provides monitoring of resolver or Linear Displacement Transducer (LDT) from a remote, safe location
- Converts sensor signal to compatible digital, analog, or limit switch outputs
- High-speed output update times improves control resolution and repeatability

For more information, request catalog Z7 – 2120 Brochure

Rotary Limit Switches

Gemco manufactures a complete line of geared rotary limit switches (RLS) that provide upper, lower and / or intermediate limits for moving machinery and mechanisms. When motion is expressed in shaft rotation, we can provide limits that are adjustable throughout the entire range of movement. Rotary Limit Switches can be used for material handling on crane or winch drums, hoists, lifts, screw jacks, or platforms. They can also be used to limit gate travel on locks, dams, intake water structures, or any moving item.



- Gemco’s Rotary Limit Switch offers the broadest range of standard gear selections of any switch available. Standard reduction ratios range from 5:1 through 5333.3:1 or multipliers up to 1:3
- Nema 1, 12, 4, 4X, 7, and 9 Enclosures
- 2, 3, and 4 circuit designs
- Rugged duty die cast aluminum alloy or fiber alloy (plastic) enclosures Also available in cast iron or naval bronze, 1B / 2B
- All metal gearing
- Standard 25 degree cams or optional long dwell cams

For more information, request catalog Z16 – 2000/2006 Rotary Limit Switches or Catalog Z11 – 1980 Rotating Cam Limit Switch.

Industry Specific Application Notes Available Upon Request

Title	Request Literature Number
Lock and Dam Fill Valves	Z358
Miter Gate Control	Z359
Crane Limit Control	Z352
Valve Position	Z327
Brake Solutions	Z340
Hydraulic Cylinder Position Feedback	Z244

Other Products



- LINEAR DISPLACEMENT TRANSDUCERS
- PLC INTERFACE PRODUCTS
- ROTARY POSITION PRODUCTS
- PROGRAMMABLE LIMIT SWITCHES
- EXTREME DUTY CABLE REEL PRODUCTS
- ROTARY LIMIT SWITCHES
- RESOLVERS
- MILL DUTY ENCLOSURES
- ULTRA HIGH SPEED PLS
- SAFETY PRODUCTS



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