

New

BlueTooth Wireless Transmitter

10BASE-FL Fiber Optic Ethernet Transmitter

GSI-2000 Transmitter

“Absolute” Digital Transmitter

After researching the market and identifying the needs of the end users, GSI designed the GSI-2000 Transmitter with reliability, interface flexibility, and ease of maintenance in mind. The resulting unit has been a solid product with installations dating back to 1988.

Since 1988 the GSI-2000 Transmitter has been the standard for mechanical float gauge transmitters in the industry. It's simply the best mechanical float gauge actuated transmitter ever built. By best we mean it has the lowest cost of ownership of any float type transmitter, the longest MTBF (Mean Time Between Failure) and least MTTR (Mean Time To Repair).

Transmitters in General

A transmitter is made up of three basic components and options. The components are as follows:

Encoder, Transmitter Card, and Housing. Each of the three components and options play a significant role in the reliability of the transmitters.

Competitive Analysis: Brush Encoder

GSI's design effort started by studying existing encoders on the market and talking with the shop people that maintained this equipment in the plants, identifying the problems that customers were having with those encoding methods, then developing and testing designs to eliminate those problems.

After researching the three basic types of encoders that were on the market, 1) Absolute Brush, 2) Optical (linear and reflective), and 3) Non Absolute Up-Down Counters, GSI determined Absolute Brush Encoding was the best. Brush pick-up is the most accurate, dependable, and the easiest to maintain in the field. The average life expectancy of a brush assembly is between 6 and 8 years. At that point it's usually only the inch (millimeters) brush block that needs replacing.

GSI has never subscribed to the belief that brush assemblies are prone to failure. This belief was primarily due to a competitive manufacturer's weak design and quality control. Some of the prior design weaknesses of brush encoders included:

- The use of a Geneva gear, which accounted for a high percentage of float hang-ups (over fill).
- Brush misalignment resulting from poor mechanical fastening design.
- Brush feathering caused by inadequate brush control on reverse tracking.
- Separation of code disks from the gear plate due to moisture and warpage.
- Corrosion of the all aluminum chassis.
- An area of the code disk that allows for false calibration, if zeroed it would then step up properly for roughly twelve feet, but in reality was not properly calibrated.



Gauging Systems Inc. (GSI™)

910 Industrial Blvd., Suite A • Sugar Land, Texas 77478

Phone: (281) 980-3999 • Fax: (281) 980-6929 • E-mail: GSIHouTx@msn.com

Competitive Analysis: Optical Encoder

Optical Encoders once thought to be the answer to the problems brush encoders, have had their own problems over time. The problems with optical encoders include:

- Optical encoders can not be calibrated in direct sunlight, thus the need for level offset in nonvolatile RAM. Thus, they can't be considered a truly Absolute encoding method.
- Photo etched code disks fade due to moisture or condensation through the normal breathing of an aluminum enclosure and cause invalid data or bad data.
- Warpage of thin plastic code disks on linear encoders cause invalid data or bad data.
- Light diffusion within the code disk can cause invalid data or bad data.
- Optical pick-ups (either linear or reflective) are subject to critical alignment. Each individual bit must be aligned for proper data.
- Optical diodes are subject to electrical surges and lightning, a single diode failure can cause invalid data or bad data.
- Optical encoders are inherently sensitive to dust, dirt, moisture, condensation, and airborne pollutants.
- All Optical encoders on the market are serviced by the factory, thus higher spare part inventories are required.
- Higher voltage is needed to drive optic encoders (in quantity).

Competitive Analysis: Non Absolute Encoders

In the 70's & 80's two companies manufacturing non-absolute transmitters went out of business stemming from law suits because of overfills. Plain and simple: The use of non-absolute encoders is a safety hazard and can be a maintenance nightmare.

A non absolute encoder is a device that counts up or down in increments, holding the count in volatile memory. As long as power is supplied to the transmitter it works. However, any glitches in power cause the resetting or zeroing of the transmitter, i.e.,

power surge, loose wire, corrosion in a J-box, water in a J-box, etc. Schemes to back-up the system with batteries in the transmitter have a poor track record to date.

In 1987 Gauging Systems Inc. designed a non-absolute Hall Effect (magnetic pick-up) transmitter. We then made appointments with most of the major U.S. based oil companies. After two weeks of hearing nothing but stories about overfills, terminal damage, fire, and EPA clean up costs, GSI took the transmitter off the market.

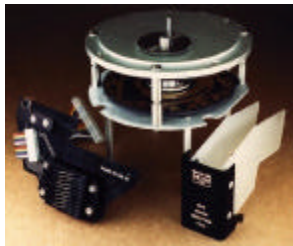
Because of the down sizing of most oil companies, i. e., early retirement, promotions, etc. many people with tank gauging expertise are gone. Thus, some knowledge of past problems has been lost, with some companies now installing the non-absolute technology again.

What is scary is that a few manufacturers are now marketing the same 70's - 80's non-absolute technology. Except for the use of newer IC's and plastic parts instead of metal (lower cost) within the encoder it's the same basic design as before.

The problems with Non Absolute Up-Down encoders include:

- Resetting to a zero level upon loss of power.
- Recalibration of transmitters is required upon loss of power.
- Battery backup is prone to failure in the field due to circuit design and condensation.
- Replacement of the optical pickup requires full encoder / transmitter disassembly or the expense of wholesale replacement of the encoder.
- No cam alarms are available on non absolute encoders.
- Circuit is prone to lightning or surges with gas caps going to earth ground.
- A hand held calibration unit is required to recalibrate the transmitter in the field.

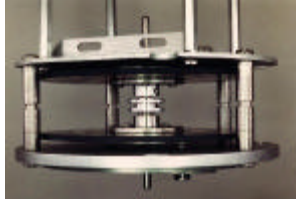
NOTE: GSI strongly recommends the use of secondary high level alarms and/or a Differential Pressure Transducer as backup when using non-absolute transmitters.



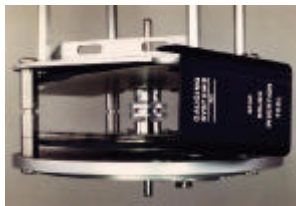
The GSI 2000 Absolute Brush Encoder

The GSI-2000 Encoder is designed to convert the shaft rotation from the mechanical gauge to Grey code for interrogation by the GSI Transmitter Card.

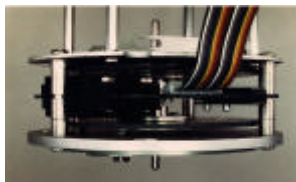
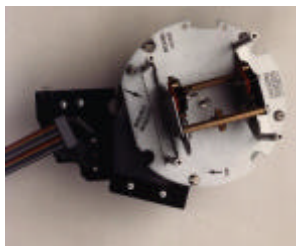
The GSI Encoder consists of two identical, copper/nickel/gold plated disks (one disk for measuring Feet and the other for measuring Inches and 16ths of Inches). A removable brush block is inserted into the encoder to make contact with etchings on the disks as the float moves up and down in the tank. Since these brushes are always in contact with the disks, the transmitter will always keep track of current level, even when recovering from power failures (without battery back-up), hence the term "ABSOLUTE ENCODER".



The GSI-2000 Encoder eliminates the problems normally encountered with prior brush encoders, optical encoders, and non-absolute (up-down) encoders. A summary of these improvements implemented by the GSI encoder design is listed below:

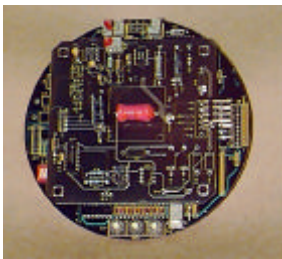


- GSI uses an Absolute brush encoder which generates a direct reading from 0-96 feet with no "Unidentified Areas" as is common with other absolute encoder manufacturers.
- The GSI-2000 encoder eliminates the Geneva gear found on conventional units by utilizing direct drive gearing.
- Maintenance down time is reduced by Drawer mounting the brush block for quick change. This greatly improves alignment by making the brush assembly drawer self-aligning.
- Accuracy is improved because of the unique design of the brush assembly. Bi-directional tracking does not cause our brush fingers to feather. Rotational direction does not matter.
- Code disk life cycle is greatly extended. Our code disks are backfilled to reduce frictional effects, and are constructed of 1/8" thick epoxy with durable copper/nickel/gold plating for increased wear resistance.
- GSI has virtually eliminated tracking misalignment by increasing actual code disk track width by 40%.
- Chassis corrosion has been eliminated by using only stainless steel and anodized aluminum mechanical components.
- Maintenance time is reduced by using a plug-in ribbon cable between the brush assembly PC board and the transmitter card.
- Replacement time is decreased by making the encoder assembly highly accessible within the housing and using (key hole) quick-lock fastening.



Transmitter Cards

The Transmitter Card is used to convert the Grey code output from the GSI Encoder (electromechanical device) to a communications protocol for data telemetry over a cabling method (Hard wire, Fiber optics, Radio, Cellular, Modem, or Satellite) to data collection devices. Data collection devices that have been interfaced range from Satellite transponders, Fiber muxes, Flow meters, PLC's, RTU's, Field Interfaces, DCS's, and various tank gauging and SCADA software packages.



A significant strength of the GSI-2000 Transmitter is the versatility to be able to utilize different Transmitter Cards or Personality Modules to emulate different Electrical standards and communication protocols. For new tank farm applications this allows the selection of the most economic cabling method and data collection method for both tank gauge information and other tank farm I/O. For existing facilities GSI offers the user the flexibility to replace existing (non supported, broken, or problematic) transmitters in the field with GSI transmitters with the same electrical standard and protocol as that of the original manufacturer, without having to change the system architecture, i.e., field wiring, field interface, receiver, etc.

Though most applications require only one transmitter per tank, the GSI-2000 Transmitter can be equipped with two transmitter cards for those customers with two independent communication requirements. Units can be provided with two digital or a digital and analog output. In addition, the two digital outputs can be different electrical standards and communication protocols. This provides for significant flexibility with relatively little added expense. This application takes the place of two transmitters and a Drive Elbow, used mostly within pipeline terminals where access to fill tanks is required by both companies (by the pipeline and terminal operation).

To reduce component level failures, mil-spec or industrial specification components are used in the manufacturing of the transmitter cards, including the

gold-pin sockets. All transmitter cards are protected with a conformal coating to guard against possible short circuit and to prevent corrosion from moisture. All transmitter cards are burned-in at the factory for a minimum of 100 hours before final test and shipment.

GSI was the first tank gauging manufacturer to utilize open system architecture with utilization of the IEEE RS 485 electrical standard and Modbus RTU protocol as a standard communications format. GSI is also the first manufacturer to install fiber optic transmitters and system architecture within the tank gauging industry.

Temperature Input

All GSI transmitter cards have the capability of transmitting temperature in one form or another. The older mark-space transmitters utilize a "G" feature relay that when powered allows the reading of the spot temperature/wire resistance at the temperature convertor. Transmitters manufactured since the mid 70's have utilized temperature A/D's on the transmitter card. Thus, the temperature spot RTD or average temperature probe is run directly into the transmitter at tank side and the temperature data incorporated into the transmitter's communication format.

The type of temperature sensor that will be utilized must be specified when ordering. The choices are: No Temperature, Spot bulb (RTD or RTD/Bi-Metal Combination), or Average temperature probe. It should be noted that this specification is merely for the "type of input", the physical RTD or Averaging Probe is not included. The type of temperature element (Copper or Platinum) and the temperature curve must be specified in order to receive a properly calibrated transmitter.

Communication Protocols

For new tank gauging projects GSI recommends RS485 Modbus RTU or Modbus ASCII protocol because of the advantages it offers regarding speed, distances, noise immunity, powering, and general acceptance by the industry. However, for those applications that may have existing hosts with other protocols, GSI can provide the 2000 Transmitter with transmitter cards that emulate a wide variety of other protocols from other manufacturers (i.e. L & J Engineering, Whessoe-Varec, GPE Controls, etc.).

The GSI Transmitter Card Selection Guide provides a breakdown with more detail regarding available protocols, wiring & powering requirements, and acceptable encoder assemblies.

Lightning Protection

Lightning / Surge Protection is offered as an option with the GSI-2000, but is highly recommended for geographic areas where this is a common occurrence. Surge Protection Boards are installed in an independent conduit as part of the complete assembly, as illustrated. They have been engineered for ease of maintenance by the utilization of edge connectors for easy removal, inspection, and replacement.



The theory of Lightning Protection is based on a floating “common” in the field and referencing all surge components to the common for clamping induced surges. GSI utilizes a combination of MOV’s, Gas Caps, Transorbs, and Inductors with the GSI-2000. The units utilized are dependent on the Protocol and Electrical Standard selected by the customer.

Transmitter Calibration

Calibration of the GSI-2000 Transmitter can be accomplished in any of several ways. The GSI Portable Interface Unit (PIU) is a self-contained unit specifically developed by GSI for calibration, trouble-shooting, and general diagnostics. It includes software, a battery for powering the transmitter, and cables/connectors for interface with the transmitter and a Lap-top PC. Additional information is available regarding this product under separate product data sheet, as well as the GSI Portable Field



Analyzers which can be utilized for the same purpose. A GSI Voltage & Current Analyzer (VI) is available from GSI to perform diagnostics regarding power related problems.

It should be noted that when the GSI-2000 Transmitter is installed onto a GSI-2570 Series

Mechanical Gauge containing a “Dual Calibration Assembly” (DCA), the gaugehead and the transmitter can be calibrated simultaneously with little effort. Please see the Product Data Sheet on the DCA for additional information.

Limit Switches

Optional Cam Alarm Switches can be provided with each unit if required by the customer. Units can be provided with 0, 2, 3, or 4 Limit Switches. However, enough room exists in the housing for up to 6 Limit Switches (as a special order) should there be an application with this requirement.

Limit Switches are provided as “Normally Open” as a standard when ordered unless the customer specifies “Normally Closed”. This option can be easily modified in the field by changing the position of the spade lug connector.

The Limit Switch Gear Ratio is available in typically three settings (100:1, 70:1 and 50:1). The 70:1 setting is the standard offering unless otherwise specified. This setting is defined by the worm gear installed at the factory and is not field modifiable. We recommend that tanks with heights of 48 FT and below be set at 50:1 and tanks above 48 FT be set at 100:1. Custom ratios are available upon request.



Cam dwell time is the “high cam” angle. This is the number of degrees that the microswitch will remain actuated in the “high lobe position” or the length of time that an actuation will remain on until a second actuation occurs. 5 degrees dwell time will be the shortest time and 30 degrees will be the longest. GSI offers cam dwell times of 5, 10, and 30 degrees with the GSI-2000 Transmitter when the Limit Switch option is selected.

Discrete I/O and other Options

The GSI-2000 Transmitter can be provided with 4 optically isolated Discrete Inputs as an option, if so specified. Additionally, 2 Dry Contact Outputs are available via the transmitter card as a separate option.

A Heater / Drain option is available if the transmitter units are planned for installation in consistently harsh climates below 32 F. This option requires an independent power supply and conductors to be provided by the customer (1 pair, 24 Vdc @ 6.0 amp).

A Dessicant option is available for installation in climates with consistently high humidity. This option consists of moisture bags and corrosion inhibitor vapors which typically need to be replaced upon annual preventative maintenance.

The standard GSI-2000 Transmitter comes from the factory capable of being "oil-filled". This is only recommended for severe tropical environments to prevent moisture intrusion. A GE #10, or equivalent transformer oil is recommended if the unit is planned for installation in this type of environment. The transformer oil should be checked or changed a minimum of twice per year.

NEW 10BASE-FL (Fiber Link) Ethernet Transmitter Provides direct Ethernet connectivity with fiber optic isolation from electrical surges. This is the fastest



GSI 2000-G1A8FIMQ Transmitter

transmitter on the market, thus providing faster throughput of data on larger tank farms.

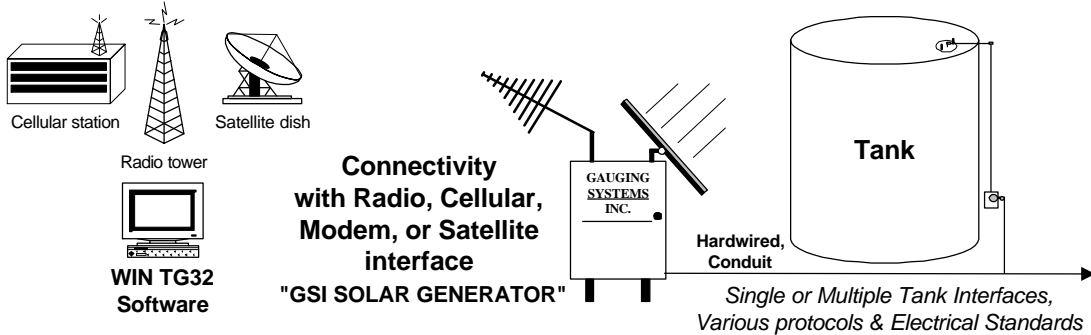
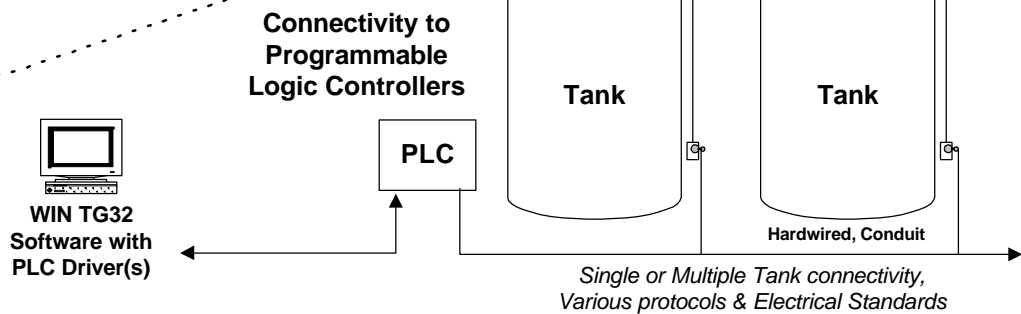
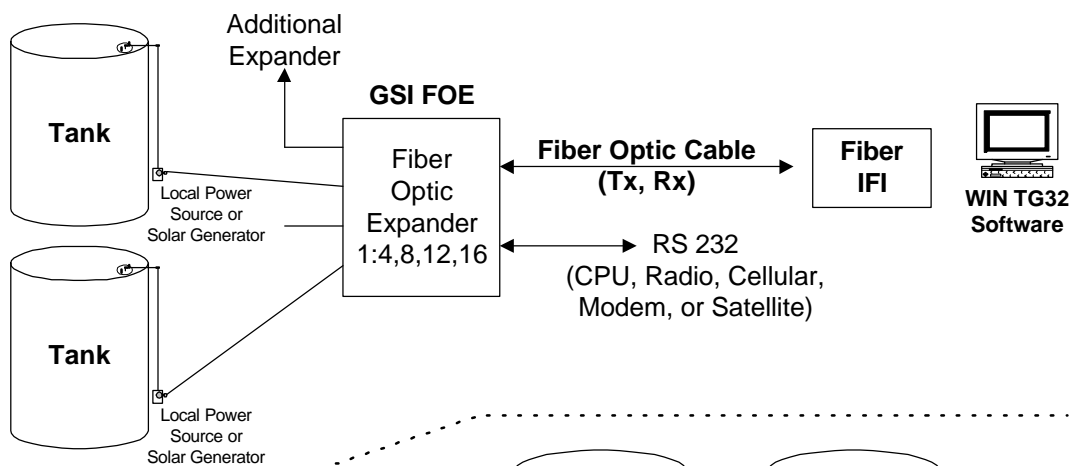
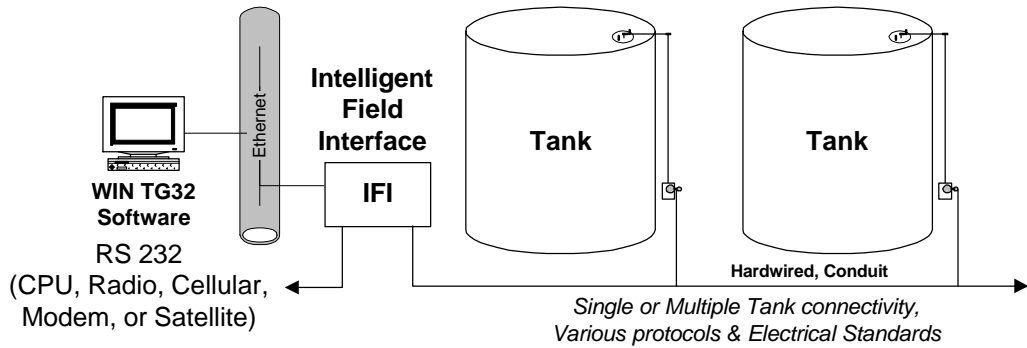
NEW BlueTooth Transmitter is electrically isolated from other tanks by use of short distance (328 ft./100M) radio transmission. The receiver is in the E/TGI Enhanced Tank Gauge Interface located the safe area. The E/TGI can then transmit back to the control room via Ethernet (10BASE-FL).

GSI-2000 Transmitter Specifications

Functional Specifications

Encoding Method:	Absolute Direct Linear Geared Brush Encoder
Code Disk:	Identical, 1/8" Thick, copper/nickel/gold plated disks
Brush Mount:	Removable, Drawer Mounted Assembly
Brush Block:	10 non-feathering, bi-directional (tracking) brushes on each side
Level Measuring Range:	0 - 96 Feet or 0 – 29.999 Meters
Output Protocols:	Transmitter cards are available for various electrical standards and protocols (most tank gauging manufacturers' and industry standards are supported)
Output Data:	Level, Temperature, Status, and Status Contacts
Discrete I/O: (Optional)	4 discrete inputs (Optical isolated) , 2 dry contact outputs
Spot Temperature Input:	3-Wire RTD, copper or platinum
Average Temperature Input:	100-ohm copper or 100-ohm DIN platinum Characterized copper elements. Variable # of elements based on tank height.

Temperature Monitoring Range:	-100F to +400F
Input Power:	12Vdc, 24Vdc, 48Vac, 48Vdc, 110Vac, 220Vac, etc. (Dependent upon the electrical standard selected)
Voltage Range:	± 10%
Current Consumption:	10mA @ idle, 35mA @ transmit
Heater/Drain: (Optional)	Requires independent conductors & power supply (1 Pair, 24 Vdc @ 6.0 Amp)
<u>Performance Specifications</u>	
Operating Temperature Range:	32F to 158F or (0C to 70C) without Heater/Drain Option
Operating Humidity Range:	0 to 98% relative, non-condensing
Signal Rate:	Mark-Space protocols: Low Speed/High Speed ASCII protocols: 300 baud to 62.5 Kilobaud
Fiber Optic transmitter:	300 baud to 76.8 Kilobaud tested
Level Accuracy:	± 1/16" (1mm)
Level Repeatability:	± 1/16" (1mm)
Temperature Accuracy:	± 0.2 degree F
Limit Switch Rating:	<u>Style A:</u> ¼ Amp 125 Vdc, ¼ Amp 250Vdc, 4 Amp 125Vac "L" or 11 Amp 1/3hp 125, 250, 277 Vac <u>Style B:</u> ½ Amp 125 Vdc, ¼ Amp 250Vdc, 20 Amp 125 & 250 Vac 1 hp 125 Vac or 2 hp 250 Vac
Surge Protection:	Clamps @ 20% "over-voltage", Type varies by Protocol & Electrical Standard (Combinations of MOV's, Gas Caps, Transorbs, & Inductors)
<u>Physical Specifications</u>	
Enclosure Material:	Cast Aluminum with Epoxy coating
Enclosure Type:	Explosion-Proof; Class I, Division 1, Group C & D UL and CSA Approvals
Power & Signal Wires:	18GA, Twisted & Shielded (0-1000FT), # of Conductors varies based on electrical standard & Protocol selected (Typically 4-Wire or Two Fibers)
Size:	7-7/8" OD x 13-1/2"
Weight:	22 LBS (with single J-Condulet and Transmitter Enclosure)



Protocol/Electrical Specifications

The following information can be used to determine the number of conductors, gauge of wire, loop configuration, speed of response, i.e., the system architecture. If you have any questions please contact Gauging Systems Inc.

IEEE RS 232

Conductors: Four
 Voltage: 12 - 24Vdc
 Current: 6 mAmps
 No. Devices: 1
 Baud Rate: 300 - 19,200 KB
 Distance: 50 Feet Maximum
 Protocol: ASCII
 Telemetry: Radio, Modem, Satellite, etc.

IEEE RS 422

Conductors: Six; 4 Com. lines, G, P
 Voltage: 24Vdc
 Current: 6 mAmps
 No. of Devices: 10
 Baud Rate: 300 - 19,200 KB
 Distance: +/- 13,000 Feet Maximum
 Protocol: ASCII
 Telemetry: PLC, RTU, IFI, etc.

IEEE RS 485

Conductors: Four; Rx, Tx, G, P
 Voltage: 9 - 24Vdc
 Current: 6 mAmps
 No. Devices: 32 I.D.'s per loop
 Baud Rate: 300 - 19,200 KB
 Distance: +/- 13,000 Feet
 Protocol: ASCII
 Telemetry: PLC, RTU, IFI, etc.

1500 Parallel

Conductors: Fifteen plus a select line
 Voltage: 24Vdc or 48Vdc
 Current: 200 mAmps
 No. Devices: 1
 Baud Rate: N/A
 Distance: +/- 10,000 Feet Maximum
 Protocol: Parallel Gray Code
 Telemetry: PLC, IFI

1600 Matrix

Conductors: Five; M, S, B+, B-, & G
 Voltage: 48Vdc
 Current: 10 mAmps
 No. Devices: Matrix dependent (16 x 16)
 Baud Rate: 280
 Distance: +/- 10,000 Feet Maximum
 Protocol: Mark - Space
 Telemetry: IFI

1700 Matrix (Metric)

Conductors: Five; M, S, B+, B-, & G
 Voltage: 48Vdc
 Current: 10 mAmps
 No. of Devices: Matrix dependent (16 x 16)
 Baud Rate: 280
 Distance: +/- 10,000 Feet Maximum
 Protocol: Mark - Space
 Telemetry: IFI

1800/1900 Four Wire

Conductors: Four; M, S, B+, B-
 Voltage: 48Vdc
 Current: 6 mAmps
 No. Devices: Limited only by power
 Baud Rate: 250 high or 70 low speed
 Distance: +/- 10,000 Feet
 Protocol: Mark - Space
 Telemetry: IFI

GPE 31422/31423

Conductors: Four
 Voltage: 48Vac
 Current: 35 mAmps
 No. Devices: Specified 32, Actual +/- 20
 Baud Rate: 300 - 1200 (300 Standard)
 Distance: +/- 5,000 Feet Maximum
 Protocol: ASCII
 Telemetry: IFI

L & J Engineering, "Tankway"

Conductors: Four
 Voltage: 30 - 70Vdc
 Current: 15 mAmps
 No. Devices: Limited only by power
 Baud Rate: 1,200
 Distance: +/- 10,000 Feet Maximum
 Protocol: Tankway
 Telemetry: IFI

Rosemount "Hart"

Conductors: Two
 Voltage: 10.5 - 55 Vdc
 Current: 22 mAmps
 No. Devices: 15
 Baud Rate: 1,200
 Distance: 5,000 Feet
 Protocol: ASCII
 Telemetry: RTU, IFI, etc.

RGL

Conductors: Two
 Voltage: 110Vac with 5Vdc Battery
 Current: Less than 1 Amp
 No. Devices: 100
 Baud Rate: 250, 500, or 1,000
 Distance: 10,000 Feet
 Protocol: Time based binary
 Telemetry: IFI, Sherrex

SAAB "FSK" - Frequency Shift Key

Conductors: Two Signal, Local Power
 Voltage: 115/230Vac or 24Vdc optional
 Current: 2/3 Amp, 80W
 No. Devices: 10
 Baud Rate: 4,800
 Distance: C/F
 Protocol: FSK
 Telemetry: IFI

Enraf - Biphase Mark

Conductors: Two Signal, Local Power
 Voltage: 110Vac
 Current: Less than 1 Amp
 No. Devices: 10 per loop
 Baud Rate: 1,200 or 2,400
 Distance: C/F
 Protocol: Bi-phase Mark
 Telemetry: IFI, TGI

"Bitbus"

Conductors: Four or Six
 Voltage: 24Vdc
 Current: 10 mAmps
 No. Devices:
 Baud Rate: 62.5 KB
 Distance: +/- 13, 000 Feet
 Protocol: ASCII
 Telemetry: IFI

**Fieldbus, Profibus, LON Works
(Development Cancelled)****GSI Fiber Optic**

Conductors: Two Fibers; Rx, Tx
 Local Power
 Voltage: 12 - 48Vdc, 110 - 220Vac
 Current: 10 mAmps
 No. Devices: 256 per loop
 Baud Rate: 300 - 76,800
 Distance: Unlimited
 Protocol: ASCII
 Telemetry: FOE (Fiber Optic Expander),
 IFI (Field Interface Board with
 Fiber Optic Personality Module),
 PLC, RTU

NEW for 2002**10BASE-FL Fiber / Ethernet
(Under Development)**

Conductors: Fiber Link
 Voltage: 12 - 48Vdc, 110 - 220Vac
 Current: 10 mAmps
 No. Devices: TCP/IP addressing, unlimited
 Baud Rate: Tested from 300 - 76,800
 Distance: 1.2 miles
 Protocol: MODBUS encapsulated TCP/IP
 Telemetry: 10BASE-FL / Ethernet

NEW for 2002**Blue Tooth Wireless Transmitter with
Solar Power Kit**

Conductors: Short distance radio (100M or
 328 ft.) to E/TGI in safe area
 Complete electrical isolation
 from communications bus
 Voltage: 9 Vdc
 Current: 6 mAmps
 No. Devices: 7 per Pico net
 Baud Rate: 5600 KB
 Distance: 100 meters (Class 1)
 Protocol: MODBUS RTU, ASCII
 Telemetry: E/TGI (10BASE-FL)

GSI-2000 Transmitter Ordering Information

A - B - C - D - E - F - G - H - I - J - K

Model: 2000 / X - X - X - X - X - X - X - X - X - X - X

A = Transmitter Electrical Standard and Protocol

(A) IEEE RS 232-Modbus RTU	(N) GPE 31422 & 31423 Transmitters
(B) IEEE RS 232-Modbus ASCII	(P) L & J Engineering "Tankway"
(C) IEEE RS 232-GSI ASCII	(Q) Rosemount "Hart" protocol
(D) IEEE RS 422-Modbus RTU	(R) Bitbus protocol
(E) IEEE RS 422-Modbus ASCII	(S) RGL protocol
(F) IEEE RS 422-GSI ASCII	(T) Frequency Shift Key – SAAB
(G) IEEE RS 485-Modbus RTU	(U) Bi-Phase Mark protocol
(H) IEEE RS 485-Modbus ASCII	¹ (V) Fieldbus protocol
(I) IEEE RS 485-GSI ASCII	¹ (W) Lon Works / GSI ASCII
(J) 1500 Parallel Transmitter	(X) BlueTooth Transmitter/ with Solar
(K) 1600 Matrix Transmitter	² (X/X) Dual Digital Transmitter
(L) 1700 (Metric) Matrix Transmitter	³ (Y/X) Dual Transmitter, Analog & Digital
(M) 1800/1900 Four Wire Transmitter	^a (Z/X) Fiber Optic / Power Requirements

Notes:

- X = Data to be specified by the customer
- ¹ = Under development
- ² = Two Transmitter Cards on one encoder assembly (select both electrical standards / protocols)
- ³ = Specify the digital output protocol required with the analog output; Y / X
- ^a = Fiber; Z / X, X = Power Required (12Vdc, 24Vdc, 48Vdc, 48Vac, 110Vac, 220Vac)

B = Enclosure / Approvals

- | | |
|---------------------------------------|------------------------------------|
| (1) UL Approved Exp.-Proof housing | (4) CENELEC IS Approval (Pending) |
| (2) CSA Approved Exp.-Proof housing | (5) Gusstandard Exp.-Proof housing |
| (3) No housing, Encoder Assembly Only | (6) Other, Specify Requirements |

C = Mounting

- (A) GSI-2550, GSI-2570, Varec 2500A, and Varec 2500B
- (B) GPE 92020 and L & J 92021
- (C) Whessoe / GPE 92006
- (D) GPE ST8000

D = Temperature Input

- (7) Temperature Averaging Probe Input
- (8) Temperature Spot Bulb Input
- (9) No Temperature Input
- (0) "G" Feature Relay for Temp. Input

E = Temperature Curve Calibration

- (E) Platinum Temp. Curve 100 ohms @ 32° Fahrenheit
- (F) Platinum Temp. Curve 100 ohms @ 0° Celsius
- (G) Copper Temp. Curve 100 ohms @ 77° Fahrenheit
- (H) Copper Temp. Curve 100 ohms @ 25° Celsius

F = Temperature Range

- (I) +/- 199° Fahrenheit
- (J) +/- 199° Celsius
- (K) - 99° F to + 299° Fahrenheit
- (L) 0° F to + 400° Fahrenheit

G = Unit of Measure

- (M) English-Fractional, FT-IN-1/16
- (N) English-Decimal, XX.XX FT
- (P) Metric

H = Options:

- (Q) Surge Protector
- (R) Heater & Drain
- (S) Desiccant (Weather Guard & Hoffman Strip)
- (T) 4 Discrete Inputs (Optically isolated)
- (U) 2 Dry Contact Outputs from MACB card
- (V) Solar cell and Battery

Limit Switches are optional and should only be specified if required:

I = Limit Switches, Select Gear Ratio:

- (0) Gear Ratio of 70:1 (Standard)
- (1) Gear Ratio of 100:1
- (8) Gear Ratio of 50:1

J = Limit Switches, Number of Switches:

- (2) Two SPDT
- (3) Three SPDT
- (4) Four SPDT

K = Limit Switches, Cam Dwell Time:

- (5) 5 Degrees
- (6) 10 Degrees
- (7) 30 Degrees

Example:

Model Number: GSI - 2000 - G - 1 - A - 8 - E - I - M - Q - 0 - 2 - 7

- (G) Transmitter Electrical Standard and Protocol: IEEE RS 485-Modbus RTU
- (1) Enclosure / Approvals: UL Approved Exp.-Proof housing
- (A) Mounting: GSI-2550, GSI-2570, Varec 2500A, and Varec 2500B
- (8) Temperature Input: Temperature Spot Bulb Input
- (E) Temperature Curve Calibration: Platinum Temp. Curve 100 ohms @ 32° F
- (I) Temperature Range: +/- 199° Fahrenheit
- (M) Unit of Measure: English-Fractional, FT-IN-1/16
- (Q) OPTIONS: Surge Protector
- (0) Limit Switches, Select Gear Ratio: Gear Ratio of 70:1 (Standard)
- (2) Limit Switches, Number of Switches: Two SPDT
- (7) Limit Switches, Cam Dwell Time of 30 Degrees

For help with specifying a transmitter, please contact Gauging Systems Inc. or your local GSI Sales Representative.